

CLIMATE AND ENERGY: RIGHT GOALS, WRONG APPROACH?

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Welcome Speech by

CHRISTIAN UDE

Lord Mayor of the City of Munich

Ladies and Gentlemen, as Mayor of Munich, it is my pleasure to greet and welcome the participants of the 8th Munich Economic Summit to the Bavarian capital city! I am pleased that you selected the subject 'Climate and Energy: Right Goals, Wrong Approach?' for this year's meeting.

Although the global finance and economic crisis is in focus these days, we should not forget that the climate change is here to stay, at best with a lower impact perhaps. Due to a lower demand for products and services there is also less demand for energy. However, the solution for a favorable development of the world climate cannot be that the economy is going down the drain. Because this would lead to very critical social problems, in particular for poorer countries and countries like Brazil, China and India which cannot be denied to be looking for a similar level as the industrialized countries.

The subject of climate change is a global problem as we know, but even the German cities can make a contribution, no doubt. I am Mayor of a city, which has committed itself to promote environmental and climate protection a long time ago and which is proud of its leading position in Germany. Being a board member of the German Association of Cities, the umbrella organization of German cities, I plead to anchor the subject of climate protection in the work of the cities even more.

As in previous years, the Munich Economic Summit has featured top-level scientists and experts from industry and politics. Climate and energy are in focus this time. Nevertheless, I would like to share with you some thoughts and expectations along these lines before the forum starts.

Meanwhile, there is no controversy in scientific and public circles that the climate change caused

by humanity is well in process. And the development is more dynamic than originally predicted. The major concern of the man-made climate change is the climate-relevant gas: carbon dioxide, in short CO₂, which is released due to the combustion of fossil energies. The next climate-killer is methane, which is largely released in agriculture and cattle breeding.

We, that means all mankind, have to take action to prevent it from getting worse! The certainly provoking theme 'Adapt, Mitigate or Die!' of the initial debates is only showing alternatives at first glance, however. As we do not want to die as a result of climate change, we cannot continue as before. Avoiding or adapting are no alternatives but must be done in addition. The Intergovernmental Panel on Climate Change is showing us the way. All of the world's countries have to make their contribution to limit the ongoing climate change to a maximum of two degrees Celsius. A higher warming of average temperatures of the earth would bring about incalculable risks. In addition, measures will have to be taken to adapt to the already unavoidable consequences of climate change.

Furthermore, many scientists are pointing out that the financial means to limit climate change are at hand and that it is even more economical than taking adaptive measures to buffer the growing consequences. I am thinking of the expert opinion by Sir Nicholas Stern or even the calculations of the German Institute of Economic Research, which will be presented to you by Professor Claudia Kemfert. Among many climate researchers and politicians there is a consensus about the goals and partly even about the instruments to be applied in climate policy. For once, the developed countries in particular are under the obligation to strongly reduce their consumption and emissions of fossil resources. This would even have to be done in the developing or threshold countries. There is a certain consensus that these countries are entitled to a 'belated development' in the reduction of their emissions and to a lower level than the industrialized countries. To make sure that the threshold or developing countries



are not forced to follow the same path as that of the industrialized countries, which would cause unnecessary emissions on the basis of out-dated technology, the industrialized countries should supply to the threshold and developing countries the latest technologies available; whether free of charge, against loans or in cash – the opinions are bound to differ here. Countries like China have considerable foreign exchange reserves and could thus be paying the bill even for the advanced technologies. At the same time, a further deforestation of the rain forest or other forests must be stopped to preserve the benefits in CO₂ reductions. There is no alternative here for two reasons at least. According to calculations by Professor Hans-Werner Sinn, for example, even under the aspect of climate protection it does not make sense to cut down jungle forests just to gain raw materials for the production of biofuels. The second reason is that the ongoing deforestation would considerably lessen the diversity of species – with enormous damage to the environment.

And, there is certainly a consensus about the fact that the Kyoto process was a step in the right direction. However, the goals were not ambitious enough, the instruments were insufficient and, above all, important carbon-emitting nations did not joined the agreement. An important cause was certainly the fact that the United States has advanced the enacting of the protocol under the former President Clinton, it is true, but then failed to ratify it. The reason was that the rising costs of the fossil energy consumption would put the local industry at a disadvantage, whereas other countries like China or India were not willing to respect corresponding regulations. These countries, however, pointed out that their per capita CO₂ emission was lower and, in addition, they claimed to be less wealthy than the United States who thought it could not afford corresponding measures. As already mentioned in the Program of this Munich Economic Summit, OPEC countries are showing only little interest to produce smaller quantities of oil and risk lower incomes from oil sales. So, it seems that we are in for a stalemate.

The situation is serious but not hopeless. For once, the European Union with its climate protection goals has taken a lead so to speak. Important instruments of the European and national climate protection policy are the trading of emission certificates and the promotion of measures to improve energy efficiency as well as the share of renewable energies. The German Act of Renewable Energies can be

assessed as a success in this respect, which can serve as an example all over the world.

Furthermore, important arguments speak for the reduction of consumption of fossil energies, the increase in energy efficiency and promotion of renewable energy quite apart from climate protection itself. Fossil energies are limited, no doubt. The peak of oil and gas production has already been reached, respectively round the corner. At the same time, it is expected that the worldwide demand for energy will go up after we will have overcome the global economic crisis. And this will lead to rising prices too, which means that the dependency of the consumer countries on oil and gas is expected to grow even further. Those countries which are the first and foremost to become independent from oil and gas will be better off. If these countries develop technologies for better energy efficiency and the use of more renewable energies, they and their citizens and companies could save a lot of money. In addition, they could make a lot of money with the worldwide sales of corresponding facilities. Environmental technologies are considered to be a real growth sector.

These two reasons have led to a reduction of the dependency on fossil fuels from instable regions of the world, or to put it differently, a higher security of supply in combination with the profitability of 'green industries' has brought about a change of thinking since the change of the US Government. However, it is far from certain, whether there will be a majority for it in Congress or in the Senate in particular, as the delegates from 'old industrialized US States' might oppose the agreement.

What would happen, if the Europeans and some other countries set a good example and then the United States, China, India and other countries would not follow? There is also the thesis that such an endeavor from Europe might not be successful at all. If the Europeans start making the use of fossil energies in Europe more expensive through a tighter commercial system of emission trading and if they improve their energy efficiency, overall consumption in Europe would drop, no doubt. If the offer is considered as a permanent factor, other consumer countries like China could use more fossil energy at lower prices – which means that the sum total on a global level would not change at all. However, this may be a schoolbook lesson. In reality, however, even countries like China are also improving their energy effi-

ciency, willing to conserve energy and be prepared to buy the latest technology, because they can foresee the end of the resources. Here substantial capital investments are needed to be able to construct corresponding facilities and to export them at a later stage, if possible.

And what is the position of OPEC now? Is it really true that in the end OPEC will suffer, if Kyoto wins – and Kyoto will suffer if OPEC wins? This may be so in the short term, but in the long run it can only be of OPEC's interest that its members' oil reserves will continue to provide their income basis for a long time: wealth of many of these countries is almost exclusively based on oil. The similar logic applies to the gas producing countries.

In my view there will be progress in Copenhagen and the Kyoto climate protection agreement will be followed by a further step in the right direction. It is absolutely necessary to focus on binding targets for the individual regions, to achieve a transfer of technologies to poorer countries and to recognize the needs of additional funds for these countries to support adaptation. In this sense, please accept my best wishes for stimulating discussions and great success for your conference. I hope you will share my optimism and identify instruments to demonstrate and implement an effective climate protection policy. To be sure the results of this conference will provide a further impetus to the delegates in Copenhagen.



Welcome Address by

JÜRGEN CHROBOĞ

Former State Secretary,
Chairman of the BMW Foundation Herbert Quandt

Ladies and Gentlemen,

On behalf of the BMW Foundation Herbert Quandt, I welcome you most cordially to the 8th Munich Economic Summit in the Bavarian capital! Once again this year, we have succeeded in bringing together experts, managers, politicians and media representatives from the EU27 and other countries for this economic conference in Munich. Today's meeting is attended by more than 160 participants from twenty countries. Together with Professor Hans-Werner Sinn, our co-organizer from the CESifo Group Munich, I thank you all for coming!

This year, our agenda focuses on a topic that increasingly runs the risk of being sidelined – energy and climate policy. The public debate is dominated by the global economic crisis that is tackled internationally with stimulus programs, rescue packages and a whirlwind of summit diplomacy. Governments around the world invest billions in systemically relevant banks and companies – but no similarly high investments are made in the future of the global climate, such as compensation payments by industrial countries to cooperative developing countries or massive funding for environmental technologies. Yet this year, on December 7 in Copenhagen, the 190 participating states will set the course for a new global climate treaty that is to replace the Kyoto Protocol.

The European Union leads the way with ambitious climate goals: by 2020, it wants to reduce both its greenhouse gas emissions and its energy consumption by 20 percent and get 20 percent of its energy from renewable energies. In view of the coming World Climate Conference in Copenhagen, the EU even urges an emissions reduction of 30 percent – provided other industrial nations go along. This is an

ambitious program to limit the dangerous rise in global temperature to 2 degrees Celsius – even if scientists actually call for emissions reduction of 80 percent to stop the climate change.

In spite of – or actually because of – the current dramatic financial and economic crisis, it would be disastrous to put climate protection on the backburner, as is demanded by some politicians, for example in Prague and Rome. This would mean that we will destroy the opportunities of future generations in order to maintain and increase our prosperity in the industrial nations today. Let me quote the founding director of the Potsdam Institute for Climate Impact Research, Hans-Joachim Schellnhuber: “politically, the post-war era ended with the fall of the wall in 1989, socio-economically it ended with the current crash. The challenge is now to completely re-program the global economy”.

There is no contradiction between economic growth on the one hand and an ambitious climate policy on the other. On the contrary, the German and European dual strategy of increasing both energy efficiency and expanding renewable energies through making the necessary investments in energy research and environmental technologies will generate sustainable economic and job growth. This way, we can get the European economy into shape for the global competition for scarce resources.

Growth and environmental sustainability do not have to be mutually exclusive. Already today, more than 220,000 people in Germany are active in the field of renewable energies. Already today, Germany enjoys a leading position when it comes to the technology and export of wind power and photovoltaic. If one adds to this the employment potential for engineers, but also skilled laborers that are required to optimize the efficiency of power plants, machines or vehicles, it further becomes clear that in order to remain competitive, Germany and Europe have to make use of the economic opportunities provided by climate protection and play a leading role in the key markets of the future – energy and resource productivity as well as renewable energies. In this way, mil-

lions of jobs could be created all over the world. I know that there will be objections to this assumption. What is needed is the close cooperation of governments, businesses and the scientific community. The World Business Summit on Climate Change in Copenhagen last weekend is the beginning of a dialogue long overdue.

The United States, too, under the new Obama administration has recognized the economic opportunities of an active climate policy and initiated a change in climate policy. This is made especially clear by the appointment of Nobel Prize winner Steven Chu as the US Secretary of Energy. With the so-called 'Green New Deal', the American president has proposed an ecologically-oriented stimulus program where the government makes high, job-creating investments in renewable technologies. One element of this program is the introduction of an emissions trading system aimed at drastically reducing carbon dioxide emissions across the country. Even though the most recent proposals to limit US car emissions by 2016 would just meet the current German average of 160 g/km and thus lag far behind the targets of the European Commission, the United States has returned with this program to the global stage as an actor in climate policy.

As for the future of the global climate, much will depend on whether Europe and the United States will be able to form a transatlantic climate alliance and together assume a leading role. Only then will it be possible to push through climate targets that go beyond merely stabilizing the *status quo*. However, given the progress of the climate negotiations so far, we should not put too high hopes on the world climate conference in Copenhagen: Even moderate emissions reduction targets such as the 5 percent proposed by the Kyoto Protocol do not find much favor with emerging economic powers such as Russia, China or India, who either want to continue their unfettered economic development or have vested interests in an increasing global consumption of their fossil energy resources.

But today's and tomorrow's Munich Economic Summit will not just deal with the question of what is the right climate and energy policy on the road to Copenhagen; it will also discuss technological developments to fight global warming, such as the capturing and storing of carbon dioxide, which so far do not (yet) offer viable solutions on a large scale. In addition, we will discuss the issue of whether a global

emissions trading system can ensure a shift of global energy consumption away from coal and oil to renewable energies.

I am particularly delighted to welcome Mr. Mohamed Bin Dhaen Al Hamli, the Minister of Energy from Abu Dhabi. The United Arab Emirates, an OPEC country, is aware that it faces the same environmental challenges we do. The planning of Masdar, the first zero carbon and zero waste city, sets standards for sustainable development. Thus the title originally entertained for one panel of this summit, 'Kyoto vs. OPEC', would have been only partially correct. This relationship, too, ought to be characterized by cooperation rather than confrontation.

I wish us all a good conference with inspiring talks and productive discussions. Together with Professor Sinn, President of the CESifo Group, I now have the pleasure of officially opening the 8th Munich Economic Summit.



Keynote Address by

MOHAMED BIN DHAEN AL HAML
Minister of Energy, United Arab Emirates

Excellencies, Ladies and Gentlemen,

It is my pleasure to be here with you today to deliver the Opening Address for this important event. I am grateful to the organisers for the honour of addressing an audience of prominent academics and policy makers. Our main themes are energy use and climate policy. These are often discussed as if they were mutually exclusive. Many people think fossil fuel use, for example, is something that simply cannot co-exist with current global climate goals. However, in reality there are commonness and mutual interests between the two, some of which I hope to highlight in the course of my presentation.

The United Arab Emirates and, indeed, OPEC firmly believe that with the right mix of technology, incentives and cooperation, continued oil production (and consumption) need not come at the expense of the environment. In the same vein, protection of the environment needs not happen at the expense of human and economic development. In the United Arab Emirates, for example, our efforts to meet the Millennium Development Goals have not been at the expense of the environment. Access to water, housing and electricity has been achieved thanks to our oil industry. At the same time, we have taken great care to produce oil and gas in an environmentally responsible manner – for example, following a zero flare policy. Thus, energy has an important role to play in sustainable efforts everywhere – efforts that respect both the environment and the development needs of people around the world.

It is important to realize in the long term that fossil fuels will continue to satisfy the bulk of the world's energy needs as long as reserves last. OPEC's current reference case scenario projected world oil demand to reach 113 million barrels a day by 2030.

Most of this growth will be in developing countries and more than half of the demand is expected in the transportation sector alone. We are confident that when the global economy eventually recovers, world energy demand will continue to grow. And demand for oil will pick up once more – just as it has occurred, in the past, after every previous economic crisis.

Now, like other OPEC member countries, the United Arab Emirates is firmly committed to ensuring a stable, secure and reasonably-priced supply of oil to the world. We also support ongoing efforts to return the world's economy to a path of sustainable economic growth. To achieve these objectives along with other OPEC members, the United Arab Emirates has committed significant investments to increase capacity. But one of the things we need is reasonable and stable prices. We certainly have not had much of that lately. As I am sure you will all agree, oil prices last summer were extreme, by any measure. The reasons for those price increases – and the later dramatic price drop – were not traditional market fundamentals but speculation. Poor regulation directly contributed to these price fluctuations.

The use of oil as an asset in future commodity markets – and the increasing disconnect between paper oil and physical oil – has led to extreme price volatility. Volatility is something that makes the business of both oil producers and consumers very difficult. In an industry with high-up-front costs and long-lead times, some predictability in prices is required in order to make appropriate investment decisions. Let me be quite clear here. Prices need to be at an appropriate level – a level that stimulates economic growth, while at the same time providing the right incentives – to both producers and consumers – and inducing further investments in the energy industry both in new production capacity as well as in renewable energy and energy efficiency. Most experts believe that this price level should be somewhere between 60 to 80 US dollars per barrel. But this is still open to debate.

It is important to stress that low oil prices are detrimental to environmental projects and ongoing

efforts at developing renewable energy. The current low-price environment provides no stimulus for continued investments in alternative energy projects. Furthermore, low prices hinder research and development of new environmentally-friendly technologies. For decades, technological innovation helped us improve oil exploration, expand production capacity and develop more efficient ways of using oil. In the same way, technological advances today will help us meet ever more stringent environmental demands and adjust to the realities of an increasingly carbon-constrained world. But all this requires continued investments – which, in turn, depend on an appropriate price level. Thus, low oil prices should be of concern not just to oil producers, but also to anyone who is concerned about climate change.

It should be clear by now that finding ways to meet the wide-ranging challenges in the world oil market is not just a task for OPEC and other oil producers alone. It is a shared responsibility, especially at this time when the world is caught in a whirl of economic turmoil. The global economy is too uncertain for anyone to navigate it alone. This is why OPEC has continually emphasized the need for openness, transparency and collaboration between producers and consumers.

This is no less true of challenges of global climate change. Today, oil producers in general and OPEC countries in particular, are playing a key role in global climate policy efforts. OPEC actively participates in global environmental discussions and it is worth noting that the first conference on the Clean Development Mechanism, for example, was hosted by Saudi Arabia in December of 2006. Other member countries have also made significant efforts to contribute to the development of environmentally-friendly projects.

The United Arab Emirates, for example, has taken a leading role in looking for ways to reduce its carbon footprint. In Abu Dhabi, work has started on Masdar City, the world's first zero-carbon emissions and zero-waste metropolis. The city will cover 6 square kilometres and is expected to be home to about 50,000 people. Among its many proposed features is a 40 to 60 megawatt solar power plant – as well as photovoltaic modules on rooftops. These are initiatives that other countries could emulate. More importantly, they are examples of how oil producers can work in collaboration with those trying to

achieve climate policy objectives. They do share common interests.

What all this demonstrates is that OPEC and its member countries do not operate on the basis of a unilateral, zero-sum game. We envisage the continued development of the oil industry taking place in tandem with the development of renewable energies and environmentally-friendly efforts worldwide. There is no reason why our mutual concerns over climate change cannot bring us together. We should not demonize fossil fuels. We should celebrate the growth of the global energy mix – while recognizing the fact that fossil fuels will remain an important element in this mix for many, many more years to come.

Many of you may be aware that Germany has taken a leading role in the recent establishment of the International Renewable Energy Agency (IRENA) of which the United Arab Emirates is a founding member. Today, IRENA has 82 members and in a few weeks, the second meeting of IRENA's Preparatory Commission will meet in Egypt to elect its Secretary General and to choose a location for the Secretariat. Highlighting its commitment to the environment, the United Arab Emirates has tabled a proposal to host the Secretariat in Abu Dhabi. With support from fellow IRENA members, we look forward to hosting this important new organisation.



THE GREEN PARADOX

HANS-WERNER SINN

Professor of Economics and Public Finance,
University of Munich;
President of the Ifo Institute for Economic Research

Environmental policy must be turned on its head: instead of mulling over for the thousandth time about which technical measures can be applied to reduce carbon dioxide emissions, we should turn to the core question of how to induce the resource owners to leave more carbon underground, as that is the sole possible way to solve the climate problem.

The simple but usually overlooked fact is: other than the useful but limited afforestation efforts, there are only two ways to curb the accumulation of carbon dioxide in the atmosphere and, with it, slow down global warming. We either temporarily refrain from extracting carbon from the ground, or we stuff it back into the ground after having extracted its energy. All the technical endeavours to develop alternative technologies and all economic incentive systems to curb the greenhouse effect must subordinate themselves to this fundamental fact.

Bringing carbon dioxide back underground is easier said than done. One third of the primary energy in the original fuel will be consumed by scrubbing CO₂ from the exhaust and subsequently compressing it into a liquid. On top of that, the amount of storage volume required is gargantuan, as each carbon atom has been joined by two oxygen atoms upon combustion – and they all need to be stored. Thus, in the case of anthracite coal more than five times as much volume is required as the original fuel occupied underground, while in the case of crude oil the proportion is more than three-fold. According to estimates by the IPCC (Intergovernmental Panel on Climate Change), the Earth's depleted coal mines and oil and gas deposits will offer room for only some 600 gigatons of carbon, barely one tenth of the recoverable carbon resources (6,500 gigatons). For that reason, if we are to curb climate change, carbon extraction

rates must be slowed down. The resource owners must be prompted to temporarily leave more carbon underground.

Those convinced that with the brave new technologies proudly displayed in many newspapers' special sections we can avert climate change should specify how they would move resource owners to extract less fossil fuel. And that is precisely the sticking point. Politics so far exhibits not the slightest glimmer of thinking in this direction. From the Environmental Agency through the Greens to the relevant European Commission there is not a thing on the matter. Even science itself overlooks the issue. Energy models depicting the long-term extraction path of fossil fuel resources do not concern themselves with the climate. Climate-theoretical models, in turn, do not concern themselves with the extraction of such resources; they are in fact atemporal models that, by their very nature, are not in a position to analyse decision issues that have an intertemporal dimension. Only now, thanks to the influence of the current German debate, a bit of movement is becoming apparent in the model front.

This silence goes hand in hand with the acknowledged difficulty of being able to do something in this regard at all. What we in Europe and Germany have set in motion with untold billions invested is geared at gradually reducing demand for fossil fuels by developing alternative energy sources and strategies. The range of initiatives goes from biofuels through wind power to better insulating homes and capping vehicles' CO₂ emissions. The measures to reduce consumption exert an increasingly stronger downward pressure upon the world's fossil fuel market price and dampen the rate of increase in such prices.

Resource owners regard this development with concern. They rightly fear the erosion of the rate of capital gains on the resources still *in situ*, moving them to react by bringing forward their extraction plans and converting a larger portion of their wealth into cash and securing it as financial capital. They thus

increase their fossil fuel supply when demand for them decreases. This is the green paradox: environmental policies that turn increasingly greener over time operate like announced expropriations. They prompt resource owners to try to escape this by accelerating extraction of their fossil fuels, which in turn speeds up the warming of the planet.

Small wonder then that the massive efforts of Europeans have delayed the peaking of the world's carbon dioxide emissions curve to the future. In fact, they have not been able to cause even the tiniest dip in this curve.

By saving ever more energy we are raising fears of the future among resource owners and leading them to increase the extraction rate. This has been music in the ears of Americans, Chinese and all other environmental sinners. They have enjoyed the resulting lower energy prices and raised their consumption by *even more* than we have reduced ours.

Some observers pin their hopes on a different effect: that the green policies push the price of fossil fuels in the world market so far down that they fall below the extraction costs, making extraction unprofitable. Demand would then drop, as green policies intend. This hope is baseless, however, because, like old Rembrandts, resource prices are not driven by cost but by scarcity, and these hover always far above the extraction costs. That is even now the case, in the midst of the dramatic fall in prices triggered by the current economic crisis. With oil prices slightly below 60 dollars per barrel, the extraction costs including exploration in the Gulf (but not mining rights, which are part of the profit) amount to around one to one-and-a-half dollars, and even the extraction of the Canadian tar sands costs, including exploration, no more than 15 dollars. In due course, fossil fuel prices will steadily increase as the resources become scarcer. At the same time, extraction will progress in the direction of increasing extraction costs, as resource owners save interest costs by beginning with the sites that are more easily accessible. Presumably, however, there will never be a point when extraction costs overtake product prices – or even come near them. An environmental policy based upon pushing prices below production costs would need a big hammer. Marginal measures as those currently in force are plainly insufficient for that purpose.

This is just as well so, as the argument for permanently sealing off part of the resources still *in situ* to

the detriment of generations far in the future finds neither economic nor ethical justification. What we need is a measured green policy that slows down resource extraction and, with it, global warming, but the green paradox shows that this goal cannot be achieved with the policies currently in place in Europe. The question is then, what brings us truly closer to the goal?

If a steadily greener policy accelerates resource extraction, it may be worth thinking about a green policy that turns to pale green as time goes by. Such a policy would exert much higher pressure on prices at the beginning but let up gradually over time, with the effect that world market prices would drop quickly to a fairly low level only to rise afterwards at a steadily increasing rate. Climate change would be slowed down, as intended.

But that is unfortunately only a theoretical solution that is well nigh impossible to attain, as a steadily less green policy would have difficulty gaining credibility among the resource owners. The many proposals concerning the long-term goals of climate policy made by politicians all go in the opposite direction. Energy consumption is to be reduced a little at the beginning but with increasing zeal as time progresses. From the G8 Summit at Toyako in July 2008, in which the participating countries committed to a 50 percent reduction goal up to 2050, to the ludicrous proclamations of the German Left Party, who want to reduce emissions by 90 percent by 2050, policies follow the same pattern. The largest reduction efforts are to be made in the far future, while the current generations are largely spared. Politicians cannot do otherwise, alas, as they do not want to inflict the pain of immediate reductions upon their voters. The year 2050 is so far in the future that the boldest policy proposals can be made now without scaring voters off. After all, the onus will fall later on other citizens and other politicians who will have to tighten their belts. The consequence of this delaying policy is that the resource owners will move forward the extraction of their resources. The quantities that the politicians announce for future restriction spring from the ground all the more copiously today.

An environmental policy subjected to the constraints of democratic discussion and that limits itself to influencing the demand for fossil fuels cannot persuade resource owners that the price of their products will be less affected in the far future than now or in the near future. On the contrary, the resource

owners will be plagued by the fear that, as the planet becomes warmer and the resulting climate damage more apparent, this policy will be tightened up even further. As a result, it can hardly be expected that a demand policy that attempts to influence supply through price signals will ever make a contribution towards curbing climate change.

A possibility to overcome this problem is to make it unattractive for resource owners to convert their fossil fuel wealth into financial investments. A global shift from the residence to the source-country principle in taxing interest income could achieve this goal. This would not alter the tax on interest income for the residents of consumer nations but would levy higher taxes on interest income for the resource owners, giving rise to an incentive to leave more of the resource *in situ*, slowing down extraction and, with it, climate change.

Another possibility is the formation of a seamless consumer cartel in which all consumer countries take part. Demand policies are ineffective if they only encompass some of the countries, as they will then only operate through price signals and are likely to cause the green paradox. The non-participating countries will then, at lower prices, not only gobble up the fossil fuel quantities that are set free thanks to the efforts of the Kyoto countries, but also the additional quantities the resource suppliers bring to the market out of fear of a deteriorating business environment for their products.

The situation is different if all consumer countries accept a cap on consumption, as then the suppliers will find no takers for their products and will have to reduce extraction whether they want it or not. Expectations regarding the future will no longer play any role. With consumption caps valid for all consumer nations the playing field will be tilted in a direction that does something for the climate.

These consumption caps could come about through a global certificate trading system, extending the one introduced by the UN for a number of countries in 2008. Granted, it would still be a market system that allocates carbon volumes to the individual countries, but now it would not be the resource owners who set the extraction path, but the United Nations. The resource owners could not wriggle free of the power of the UN.

During the forthcoming world climate summit in Copenhagen later this year the EU will try to create

such a Super-Kyoto system, given that it has been working intensively towards such a goal for several years. But it will probably fail again, as the road to an all-encompassing consumption cap is still far away. Thus far only the 27 EU nations, Canada, Australia, Iceland, Japan, New Zealand, Norway, Russia and Ukraine have accepted a cap on CO₂ emissions. The rest of the world, including the United States, South America, Africa and Asia from Turkey to China, responsible for 70 percent of CO₂ emissions, have kept well clear of such a commitment.

The circumstances could change, however, if it appears that the United States under the Obama Administration sets off on a new course. In any case, the new Director of the White House's National Economic Council, Lawrence Summers, has announced that the United States, after having overcome the crisis, will introduce its own emissions trading system in 2011. After this, the step towards a globe-spanning Super-Kyoto system should become easier.

In principle a Super-Kyoto system would be similar to the rationing that was practised after the war in many European countries, when in order to buy food one needed ration coupons or stamps that were issued by governmental agencies according to social criteria. To buy a pound of butter, a person had to pay the proprietor the regulated price of the product and at the same time give him a butter coupon. If one did not have enough coupons, it was necessary to trade coupons with other coupon recipients. The mechanism would be very similar if trade in UN certificates were extended to all countries of the world. The total amount of carbon that is available to the countries could be rationed this way, and the distribution of the certificates via the UN trading system and subordinate, regional trading systems, such as that of the EU, would determine where carbon is burnt.

The result would be attractive for the consumer countries in two ways. Fossil carbon would not be extracted so quickly, which would slow down climate change. Secondly, the consumer countries would no longer have to pay so much for their fuel. To be sure, the energy costs for individual consumers would be higher because they would also have to buy the certificates, but the state treasury of every country would have more revenue and citizens would benefit by the additional provision of public goods or from lower taxes. The consumer countries as a whole, both

citizens and the state treasury, would pay less for fossil resources because they would reduce their demand, thus driving down world market prices.

From an economic viewpoint this Super-Kyoto system basically amounts to a partial expropriation of the resource owners and a partial substitute of the market mechanism by a centrally planned control of quantities. Since one is only allowed to use the resources if one can produce the UN rationing coupons, the UN will become, in economic terms albeit not legally, the joint owner of the fossil fuel. If it gives the national governments the right to sell these rationing coupons, as will be the case at least within the EU for the third trading period as of 2013, then it will of course transfer its ownership rights to the national governments. The revenue that these governments achieve from the sale of the certificates comes at the expense of the resource owning countries and would lower the market value of the stocks *in situ*.

Whether we should set out along this path, in light of the negative experience we have had with centrally planned strategies, is a highly complex issue that is difficult to decide. In the final analysis we will probably have no choice but to let the UN take over the central planning.

This will certainly produce various negative behavioural effects, as we know from central planning systems. A power centre will grow up around the UN that will try to extricate itself from democratic controls. The countries will begin to struggle with each other over who is to be favoured in the allotment of the certificates and will seek to obtain exceptions from the necessity to purchase certificates. This in turn will further strengthen the power of the UN bureaucracy. Possibly a worldwide black market for carbon will arise with a Mafia-style counter force arising that escapes democratic controls.

The resource countries will do all they can to resist such a solution. They will try to prevent the UN from forming a worldwide demand cartel, and by granting special deliveries of carbon fuel they will try to keep as many countries as possible out of the cartel. They will also try to form a counter cartel. The fact that the OPEC is flirting with the idea of admitting Russia is not surprising in light of these developments. Moreover, the countries with the resources will attempt to develop their own economies such that they will be able to exploit their own fossil fuels

without limitations from the UN. Bearing these considerations in mind, Dubai's breathtaking economic development can surely be understood as a rational counter-strategy of a significant resource supply country.

However, these avoidance manoeuvres will in turn induce the demand countries to develop their own counter strategies. The countries participating in the cartel will not allow individual countries to acquire fossil carbon without the proof of certificates, and they will build up trade barriers to punish those who deviate. All this will create a considerable conflict potential that could lead to outbreaks of military force.

Only the horror of a further warming of the atmosphere combined with the fact that the consumer countries will have to keep on spending considerable parts of their real income for the acquisition of constantly dwindling amounts of carbon makes the worldwide demand cartel that the UN is planning attractive. Policy-makers have the choice between Scylla and Charybdis.

If we wish to pursue the path to a Super-Kyoto system, it is important that we do it quickly. Any delay is poison for the climate, not only because in the meantime emissions will continue unabated but especially because a piecemeal inclusion of more and more countries would have the ironic effect of stoking the green paradox even further. If the number of countries accepting caps on their emissions increases only bit by bit, this will give rise to an increasingly larger price pressure over time that will induce the resource owners to anticipate the worsening of their profit margins by speeding up extraction. Paradoxically, the more successful the world climate summit is in gaining members to the worldwide demand cartel over the coming decades, the more rapidly will the world's climate warm up in the initial stages. Only taking the resource owners by surprise, with an immediate completion of the cartel that proceeds so rapidly that the resource owners no longer have the time to react by accelerating the extraction of their resources, can bring about the desired effects.



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 prac-

tices 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 CO₂ 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

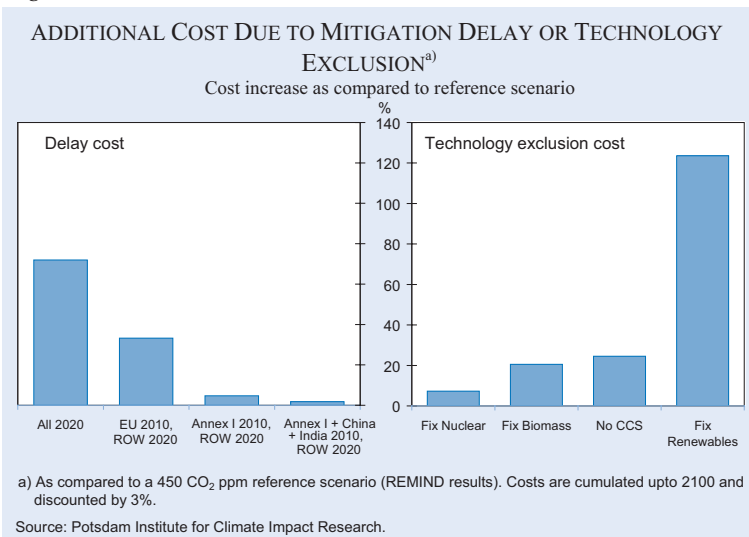
¹ RECIPE is an in-depth international comparison of energy-economy models carried out at the Potsdam Institute for Climate Impact Research (Germany) together with Centro Euro-Mediterraneo per i Cambiamenti Climatici (Italy) and Centre International pour l’Environnement et le Développement (France). The 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.

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 CO₂ 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



A Global Contract³

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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Panel 1

THE BLIND ALLEYS OF CLIMATE POLICY

Fossil fuels warm up the planet? Then let us turn to biofuels. But doing so has caused food prices to soar around the world, provoking riots and hunger in several countries. On top of that, biofuels appear not to be as carbon-neutral as advertised. So, are our climate policies doing the right thing? What other blind alleys are there?

Daniel Hertzberg, of *The Wall Street Journal*, as panel chairman, provided a glimpse of how policies can turn into blind alleys. After having no climate-change policy at all, the United States is now mulling over one in which 85 percent of the pollution permits would be given away free to the utilities for the next 20 years, with the idea that they keep costs down for their consumers. *“I wonder how that is going to work: if consumers do not pay more for energy, they will not consume less. If utilities do not pay for the permits, they will not emit less”*.

The first speaker, **Lady Barbara Judge**, Chairwoman of the UK Atomic Energy Authority, quipped that *“coming to Germany and talk about nuclear power is taking your life in your hands”*. Germany, after all, is the only country that considers it proper and appropriate to close down nuclear plants that are actually working to produce energy. Even if the EU goal of drawing 20 percent of its energy from renewable resources in 2020 is attained, she pointed out, 80 percent would still need to be obtained from fossil fuels. *“But I think the issues here are not renewables, but clean energy. Nuclear is neither fossil nor renewable, but it is clean. It is not the answer, but it is one answer”*.

There are several hurdles to be overcome in order to stick to nuclear or expand it. One of them is *politics*: is it on the agenda? Does this administration want to do it? Will the next one stick to it? Another one is *planning*, i.e. where new plants should be built. In Britain, when one plant is decommissioned,

it is the local people who are bidding to have the new plants, even the waste disposal, built on the same location. Next is *price*. Nuclear power projects are expensive. The government, she said, has to help, as is the case in Britain, France, Italy and so on. But once the plant is built, it is relatively cheap to run, with low, stable energy prices. The fuel, uranium, is abundant. And then *people*: do we have the people to build and run those power plants? It used to be sexy to be a nuclear engineer. Today, we need to build a new cadre of people to design, build and run such plants.

A further issue is *parts*: there is only one producer in the world for the containment mechanism of nuclear reactors, for instance. There is going to be a queue for parts. Then there is the waste issue, often cited as the reason not to build new nuclear plants. But, she pointed out, only 10 percent of the nuclear waste in the world comes from old nuclear plants. The rest, 90 percent, comes from nuclear weapons. Furthermore, the new power plants only emit about ten percent as much waste as the old ones. And, lastly, the *press*: *“you have to engage the press, explain to them, talk to them, to see what the benefits are, to look at the cost of renewables, to see what people think”*. In Britain, for instance, there has been a reversal in public opinion regarding nuclear power, with more people now for than against. People care about the climate, and nuclear is a good bridge to keep carbon emissions in check until renewables reach maturity.

Karl Falkenberg, Director-General Environment, European Commission, defended the political thrust in climate issues. *“What we have done so far is no blind alley”*. We need competition among different technologies, he stressed, and must use our energy more efficiently, emit substantially less CO₂. That means having to use renewable energy sources. Moreover an international negotiation requires leadership, with countries that begin to show the road, investor mounting pilot projects. All of this has started with Kyoto. There is a general understanding that we are moving to a huge crisis for this planet that is going to dwarf the current economic crisis –

and this economic crisis is probably the greatest any one of us will see in our lifetimes.

It requires difficult choices. Kyoto, with all its failures, has led to a real understanding in many countries. Witness the about-faces in Australia and the United States. Europe is going to the climate conference saying, we have already committed to a 20 percent reduction. While the United States is not yet quite there, it is heartening to hear that John Holdren, chief science advisor to President Barack Obama, acknowledges that anything that goes beyond 2°C requires not mere adaptation, but is the beginning of suffering.

In real negotiations among countries, he said, someone has to demonstrate that things work. We do need wind energy, we do need feed-in systems: they allow other energy technologies to compete. *“Show me one energy technology that is not in one way or another subsidised”*. What we need, he added, is a framework providing an opening for technologies to be tested and deployed if we want to have different forms of energy creation than using fossil fuels. We need to be open-minded. We have to demonstrate that economic growth does not equate more use of fossil fuels.

Carl Christian von Weizsäcker, Max Planck Institute for Research on Collective Goods, reflecting on Hans-Werner Sinn’s analysis of the green paradox, started out by posing the question of whether economic logic is sufficient to solve the climate problem. Given the prevalence of short-termism in politics, industry, financial markets and so on, he asked, how likely is it that fossil fuel producers will apply economic logic when considering how much of their products to extract? Venezuela, Nigeria and Iran, to name but a few, will not think in such long-term horizons. They simply need to extract as much as possible now because they need every dollar just to remain liquid, not necessarily because they are afraid of future increases in green taxes. Saudi Arabia, in turn, as market-maker, has usually increased production when oil prices rise too steeply in order to stabilise the price. So it is unlikely that they will try to pump as much and as quickly as possible out of fear of an increasingly greening global policy.

On the other hand, he added, the reduction in oil and gas prices resulting from subsidising renewables could mean that we will eventually have one

less hurdle for economic growth. When the world economy picks up again, and with it demand for fossil fuels, by the middle of the coming decade the producers will be unable to meet demand, even at very high prices, because of a lack of investment in expanding production. But because we will have already invested in wind power, nuclear power and subsidised renewable alternatives, the coming energy bottleneck may be alleviated, enabling economic growth to go on.

“While I have been opposed to the feed-in system, because it is a tax that lies outside the budget and constitutionally subsidies should be channelled through the budget, when one considers the shortage in fossil fuels likely to occur in the next seven years”, he concluded, “it is not so clear whether Sinn’s green paradox analysis is the correct one for the medium term”.

Renate Künast, Chairwoman of the Alliance 90/The Greens Parliamentary Group at the German Bundestag, opened up by referring to this panel’s title, *The Blind Alleys of Climate Policy*. John F. Kennedy, she said, would have never talked about blind alleys: when the Russians beat them to space, he said: ‘we decided to go to the Moon in this decade’. And what happened? Americans reached the Moon in that decade. Sixteen years ago, she added, a big German utility asserted that even in the long run, renewable energy will never be able to cover more than four percent of our electricity needs. But the German Parliament, using various tools and measures and laws, said that Germany will reach 12 percent of renewable electricity by 2010. We are still in 2009, and we have already reached a share just shy of 16 percent. Can you imagine what would have happened 16 years ago if we had said, we have decided we want to go to 20 percent or even to 100 percent renewable energy?

Talking about blind alleys will not get us anywhere, she stressed. To those saying it costs too much money, in these times of crisis, to subsidise renewables, she would like to retort, *“how can it be that we are spending billions, sometimes just throwing them out the window, to rescue the finance industry and yet ask whether we should spend money to push a new technology?”* Quoting Roosevelt (‘Never let a good crisis go to waste’), she pointed out that a crisis is both a threat and an opportunity: *“I think we now need something like the New Deal, a New Green Deal. Let’s change the way we live, we produce, we*

transport. We should not live at the expense of our children. Let us say: we have decided that we want to have a carbon-free Europe”.

Martin Wittig, of Roland Berger Strategy Consultants, said that we often find ourselves in blind alleys because we confuse strategic and tactical problems. A common mistake is to apply a tactical remedy before you have a clear strategy of what you want to accomplish. *“I think Germany’s decision to exit nuclear energy is exactly that kind of problem”,* he asserted. *“Climate change is a strategic problem. It needs immediate action. So we decide to strive for as much renewable energy as possible to reduce CO₂ emissions. I fully agree. But I am not certain that can reach that goal quickly, even if we were John F. Kennedy”.*

Nuclear power, in contrast, is a tactical problem. There is the problem of final disposal of radioactive waste, but, as Lady Judge said, we will only marginally increase that problem by continuing to use nuclear power. Still, we have to solve it. *“I see it as an engineering problem: what is going to be more difficult for our children and their children: to reposition a climate we once changed, or to treat nuclear waste? I think the latter is the less complicated challenge”.* There is also the terrorist threat problem. *“That is exactly the case in which we treat tactical problems as strategic ones. If Saddam Hussein was able to withstand the attacks of waves of F/A-18 bombers with simple bunker technology, I am sure that German engineering will easily be able to build power plants that can withstand the impact of even the largest passenger plane in the world, the Airbus 380. It is a manageable tactical problem that can help to considerably reduce the strategic problem”.*

If you look at France, he added, it produces around the same amount of electricity as Germany but at only about ten percent as much CO₂ emissions as Germany’s. Furthermore, with all the talk about clean energy for transportation, using electric cars, hybrids, hydrogen-powered vehicles, nobody mentions that the primary energy – electricity or hydrogen – must come from somewhere, and at the moment that can only be done in combination with nuclear power. He thinks that Germany has to play a leading role in this kind of energy, become a technological leader and help the other countries build their nuclear plants. Plants that, by the way, they will build anyway.

During the ensuing discussion, Renate Künast countered the above by focusing on what principle is moving us to act. *“I think it has to be the precautionary principle: if there is a technology that could be very dangerous and an alternative to it, I would say let’s go for the alternative. Let’s restructure the way we live, using energy more efficiency, conserving energy, and turning to renewables. For me, nuclear power is not the way”.*

Carl Christian von Weizsäcker, in turn, pointed out that Chinese investment in renewables follows their need to satisfy their energy requirements to fuel their ten-percent-per-year growth rate. They are pushing fossil fuels even more heavily. So, their and our investment in renewables, as Hans-Werner Sinn said, in the end does not reduce demand for fossil fuels but increases overall energy demand.

Karl Falkenberg complemented that by stating that the one thing we cannot do is say to developing countries: we have our wealth but unfortunately, because of the climate, you have to stay poor. What we have to do is help those countries grow economically with a lower carbon footprint. We have to help them develop clean energy, whether it be nuclear or solar or any other kind. We also have to invest in ourselves, he warned. Americans are investing 100 billion US dollars in research and development of green energy and, given how they excel in bringing the resulting products to market, the hundred billion are going to come to us in no time. If we do not match that, we will have lost the future.

Olaf Storbeck, Handelsblatt, wanted to know whether when we say nuclear fuel is safe, do we just mean that it is impossible, or merely highly unlikely, that a high-impact event will occur? *“I think rather the latter. And if we look at the financial markets, which two-and-a-half years ago were being touted as safe from such low probability events, so-called ‘tail risks’, we can see that such events, though rare, can have quite a large impact indeed”.* Lady Judge replied that nothing is totally safe. Some 3 to 5 thousand people died at Chernobyl, she said, while around 3,000 people are killed on the roads in Britain every year. *“How many nuclear accidents have occurred in the more than twenty years since then? None”.* In the end, she emphasized, it is a question of risk and reward. *“And, when it comes to climate change, I think we should fight it with all the weapons we have at our disposal”.* Around the world, including China, added Martin Wittig to make the

point doubly clear, between ten and fifteen thousand people die every year in mine accidents, extracting fossil fuels. *“And nobody talks about that”*.

Dennis Mueller, of the University of Vienna, said that the problem with nuclear energy in Europe is that it is decided at the national level, where politicians put their re-election at risk by supporting it against negative public perceptions of it. Conversely, he asked, why is the European Union such a leader in the world in environmental policy? Because the European Commission decides it, and there is no political cost. They can decree that we are going to get rid of inefficient light bulbs, and the light bulbs are gone. It is a different thing in the United States, where congressmen are accountable to the voters. And that, he said, makes the passing of such laws that much more difficult.

Panel 2

OPEC VERSUS KYOTO?

Introduction

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The Kyoto Protocol²

The Kyoto Protocol (KP) is an international agreement on the reduction of anthropogenic emissions of Greenhouse Gases (GHGs)³ concluded at the third Conference of the Parties (COP 3) to the United Nations Framework Convention on Climate Change (UNFCCC) in Kyoto, December 1997.⁴ The KP was the first step to mitigate the impacts of global climate change. It expires in 2012. In December 2009 COP 15 will be held in Copenhagen where a long-term agreement on drastic further reductions is on the agenda.

At the Kyoto Conference industrialized countries agreed to reduce GHG emissions by an average of 5.2 percent in CO₂ equivalents from 1990 levels by the commitment period 2008-2012. The KP reduction targets were differentiated by country and ranged from an increase of 8 percent for Australia, to decreases ranging from 0 for the Russian Federation, 6 percent for Japan and Canada, 7 percent for the United States and 8 percent for the EU. The rationale for differentiated reductions was that the burden of limiting GHG emissions should be equally shared (Fisher et al. 1998).

Under the principle of common but differentiated responsibilities and recognizing that industrialized

countries are responsible for the current levels of GHGs in the atmosphere in the first place (see http://unfccc.int/kyoto_protocol/items/2830.php), Non-Annex I Parties (i.e. developing country members of the UNFCCC) were only obliged to periodically update their national inventories of GHG emissions and of removals by sinks – i.e. natural or man-made systems that absorb and store more GHG than they emit, for example, forests (see van Kooten and Sohngen (2009) for details). However, developing countries were not obliged to reduce emissions during the commitment period.

In 2005 the KP was ratified by the Russian Federation, whose emissions accounted for 17.4 percent of 1990 CO₂ emissions. The Russian Federation's ratification implied that the KP came into effect as all requirements were thus met.⁵ Specifically, effectuation required that the KP should be ratified by at least 55 states and that the industrialized countries which had ratified should account for at least 55 percent of CO₂ emitted by themselves in 1990.

To reduce the overall abatement costs, the KP contains the following cost mitigation mechanisms:

- The Bubble, which allows groups of countries to jointly meet their obligations. This mechanism was especially created for the EU so that it could negotiate as a single party, while providing possibilities to differentiate the targets among its member states.
- Joint Implementation (JI) and the Clean Development Mechanism (CDM). Both mechanisms are project-based. Particularly, they open the possibility that a country meets treaty obligations via an abatement project in another country (i.e. the project brings in credits for the donor country). JI is the mechanism for projects in Annex I countries while CDM is the mechanism for projects in Non-Annex I countries.
- International Emissions Trading (IET), which is a transfer of GHG quotas among Annex I countries.



¹ I am deeply indebted to Rudiger Pethig for his comments on an earlier draft of this paper. The usual disclaimer applies.

² This section is based on Larson et al. (2008) and van Kooten and Folmer (2004).

³ The main GHGs that the KP seeks to control are carbon dioxide, methane, nitrogen oxide, hydrofluoro-carbons, perfluorocarbons and sulphur hexafluoride (van Kooten and Sohngen 2007).

⁴ The IPCC was established in 1988 by the World Meteorological Organization (WMO) and the United Nations Environment Program in response to the concerns about GHG emissions.

⁵ Up to February 2009, 181 countries had signed the KP. The United States withdrew its support in 2006. The United States considered JI and CDM insufficiently flexible and the role of its terrestrial carbon sinks inadequate in meeting its KP targets.

JI, CDM and IET allow countries to meet their obligations via reductions abroad. Although these mechanisms make it possible to increase efficiency, several NGOs amongst others saw them as escapes for those countries who do not wish to reduce emissions domestically (Ringius 1998). Another objection was that abatement abroad might slow down technological innovation in Annex I countries because of less domestic pressure. In order to meet this criticism Annex I countries were obliged to meet at least 50 percent of their abatement obligations domestically.

In addition to these objections, the KP and its flexible mechanisms suffer from several other weaknesses and pitfalls:

- The KP is not legally binding, while the penalty for non-compliance is basically ineffectual.⁶
- JI and CDM credits emanate from reductions relative to a hypothetical baseline of emissions that would have occurred absent the JI or CDM investment. Estimating a counter-factual implies economic and engineering problems.
- CDM projects can be substituted for development aid.
- For some countries, particularly the Russian Federation and Ukraine, their quotas were higher than their expected emissions in the commitment period, which would make it possible for them to sell quotas without the need to reduce emissions.⁷

In spite of all the above-mentioned weaknesses and pitfalls as well as the fact that most countries will not meet their reduction targets during Phase I of the KP, substantial experience has been made with respect to GHG abatement and emission trading which serves as input to post-KP negotiations.

EU emissions trading

The EU emissions trading mechanism is a two-stage system. At the first stage, the EU negotiates as a sin-

gle party at the KP level; at the second stage the EU differentiates its total obligation among the member states in a burden sharing agreement resulting in a National Allocation Plan (NAP). The domestic EU trading scheme for CO₂ emissions has been thus far restricted to the sectors electric power generation (installations greater than 20 megawatts only), iron and steel, pulp, paper and board and minerals (cement, glass, ceramics, oil refineries) in the EU27 plus, as of 2008, Norway, Iceland and Liechtenstein. The total number of emitters subject to the trading scheme is approximately 11,000; they account for about 40 percent of the EU's GHG emissions. In 2008 the European Commission (EC) proposed extending emissions trading to other sectors including the airline industry, and to other GHGs including nitrous oxide and perfluorocarbons.

At the national level, emitters obtain an initial endowment of permits via grandfathering (i.e. for free). The endowment is based on expected emissions, which in their turn are based on historical performance. A small proportion of the permits can be auctioned off by the national governments. The scheme is a cap on emissions. At the end of each year regulated emitters must surrender allowances equivalent to their emissions. Short-falls of actual emissions relative to grandfathered permits need to be matched through purchases. NAPs are subject to EC oversight. Particularly, the EC oversees whether or not the NAPs are consistent with KP and national abatement obligations.

The EU trading scheme suffers from several weaknesses. Particularly, the two-stage design of regulation (member state level implementation and EC oversight), have created inefficiencies, regulatory uncertainties and delays. To overcome these weaknesses the EC launched a proposal in 2008 which replaces the NAPs by an EU-wide cap based on harmonized rules under an EU authority. Moreover, in response to the price collapse in April 2006, which was due to an over-allocation of permits in Phase I as a consequence of, amongst others, allocation of permits on the basis of emission projections instead of verified emission data (Alberola et al. 2008) and grandfathering (see e.g. Neuhoff et al. 2006), the EC in January 2008 launched a proposal to auction at least 60 percent of the permits.

In 2007 the European Council agreed on a unilateral cut of 20 percent in GHG emissions by 2020 relative to 1990 levels. Moreover, it endorsed a 30 per-

⁶ This is a typical feature of any international (environmental) problem. It is a consequence of the absence of an institution with the jurisdiction to enforce environmental policy internationally. It implies that international (environmental) cooperation must be based on consent. Consequently, there is a risk of free-riding. Moreover, a policy that has been agreed upon may be foiled. Several mechanisms have been developed to induce countries to cooperate and to comply to concluded agreements – see Folmer et al. (1993) and Folmer and van Mouche (2000).

⁷ This has become known as trade in "hot air". Woerdman (2002) discusses various options to limiting trading in hot air such as renegotiating targets, transaction taxes and quantitative restrictions.

cent cut if other developed countries committed to comparable reductions, and India, China, Brazil and other more advanced developing countries contributed adequately according to their responsibilities and capabilities. Although these intentions are vague and contingent upon the responses of other countries, they are major initiatives that are likely to have a positive impact on post-Kyoto negotiations. Another major EU initiative was launched in January 2008. It amounts to the proposal to develop a world-wide emissions trading scheme. Such a system would eliminate several weaknesses of the present flexible mechanisms and contribute to a more effective and efficient global warming policy.

OPEC versus Kyoto?

Is OPEC going to suffer when Kyoto wins, or vice versa? To answer this question I start by briefly describing OPEC, its mission and market power. The Organization of the Petroleum Exporting Countries (OPEC) is an intergovernmental organization of twelve oil producing and oil exporting countries. Its mission is to coordinate and unify the petroleum policies of its member states so as to ensure them a steady income but also to secure an efficient, economic and regular supply of petroleum to consumers (<http://www.opec.org>).

In 2007 world oil production was 73.27 million barrels per day of which approximately 45 percent was produced by OPEC, 25 percent by OECD countries (particularly the United States, Mexico, Canada and Norway) and 10 percent by Russia (IEA 2008). More than 75 percent of world oil reserves are located in the OPEC countries. Saudi Arabia currently is the largest oil producer in the world. Moreover, it possesses approximately 20 percent of the world's proven oil reserves (EIA 2007b). Its relatively low production costs and accessibility has enabled Saudi Arabia to boost output quickly and to operate as the swing producer of the world (EIA 2007a). Kaul and Subramanian (2005) show that when oil prices tend to fall Saudi Arabia reduces output, while it increases output to prevent substantial price hikes, as during the Gulf War.

By means of a multi-equation dynamic econometric model based on monthly data, Hansen and Lindholt (2008) show that for the period 1973–2001 producers outside OPEC can be characterised as competitive producers but that OPEC members cannot be con-

sidered as price-takers. Kingma and Suyker (2007) stress OPEC's institutional instability suggesting that its member countries often produce more than agreed upon. The excess production has frequently been compensated by Saudi Arabia by lowering production.

OPEC's position relative to the KP is ambiguous. On the one hand, all major OPEC countries, except Iraq, are signatories and thus formally support the KP. However, the KP also implies partial expropriation for OPEC countries because taxes on oil levied by oil consuming countries raise the consumer price above the OPEC supply price. The expropriation likely explains OPEC's opposition to plans to reduce oil consumption and its criticisms of the subsidies that industrial countries offer to stimulate renewable energy resources. It may also have induced OPEC Secretary General's comments on the sidelines of the International Oil Summit in Paris⁸ that oil is not responsible for climate change but that it is the industrialized countries that are responsible and his plea that the revenues from high taxes on oil products should be invested in environmental projects, particularly adaptation to climate change. On the basis of a review of the literature Barnett et al. (2003) provide evidence that OPEC will indeed incur losses from the working of the KP. However, the losses will not affect OPEC countries equally nor will the losses be as large as some models predict.

The possible losses that OPEC countries may incur have triggered a debate on the *green paradox* (Sinn 2008). This paradox is based on the assumption that suppliers of oil feel threatened by a decline of future prices due to gradual reduction of oil consumption in abating countries. If this reduction reduces the discounted value of the oil price in the future more than at present, the oil producing countries will expand production in the short run which will increase oil consumption and thus accelerate global warming.

Eichner and Pethig (2009) analyze the green paradox in a two-period, three-country general equilibrium model with profit maximizing suppliers of oil. One country supplies oil and the other two consume it. One of the oil consuming countries tightens its emissions cap in the first or in the second period. They find that tightening the second period cap does

⁸ Reuters, 02.04.2009.

not necessarily lead to the green paradox. It may occur if it does not result from tightening the cap in the first period.

Even in the case oil producers do not increase production there may be a perverse effect in the form of *carbon leakage*. The basic idea is that a CO₂ reduction policy in the home country will raise domestic energy costs which will bring a comparative advantage to firms in non-abating countries. Moreover, it may induce firms to migrate from the home country to non-abating countries (*environmental capital flight*). Both carbon leakage and environmental capital flight will lead to an expansion of production in non-abating countries and thus offset some of the abatement in the home country.

Eichner and Pethig (2009) show in their two-period three-country general equilibrium model that carbon leakage does not necessarily occur and that if it occurs the extent depends on the interaction of various parameters and elasticities. Regarding environmental capital flight, Jeppesen and Folmer (2001) argue that a firm's response to the introduction or tightening of an environmental policy handle, such as the introduction of a cap on CO₂ emissions, needs to be evaluated in the context of the entire set of location factors including the quality of the labour market, public policy, access to suppliers and consumers, and cultural and social aspects. Particularly relocation is a rational response to environmental policy if the difference between discounted costs associated with compliance with the environmental policy outweighs the discounted sum of the difference in costs and benefits of all other location factors at both locations, plus relocation costs. In a meta-analysis Jeppesen et al. (2002) find that methodological considerations play a critical role in shaping the body of received estimates. Finally, van der Veen et al. (2001) finds no support for environmental capital flight in the Netherlands.⁹

One of the basic assumptions underlying the green paradox is that oil producing countries fear a decline of future prices due to gradual reduction of oil consumption in abating countries. Support for this assumption can be derived from the decreasing oil intensity of production (i.e. total primary use of oil per unit of output). OECD (2004) shows that due to the more efficient use of oil, increasing utilisation of alternative energy sources and a shift in the compo-

sition of output towards less oil intensive sectors, oil intensity of production has steadily declined in OECD countries by slightly less than 50 percent over the period 1970–2003. In developing countries it increased by slightly less than 30 percent until 2000 when it started marginally declining. However, the decrease in oil intensity of production has been nullified by the increase in volume of output, as reflected by, amongst others, the development of the spot price of crude oil. The spot price increased by approximately 257 percent from a S&P GSCI Crude Oil Spot Price Index of 147.4 in the first quarter of 2000 to an unprecedented level of 526.0 in the last quarter of 2007. Moreover, although global crude oil production has increased from 68,490 barrels per day in 2000 to approximately 73,270 in 2007 (7 percent), the contribution of oil to the world's energy supply has decreased. Particularly, IEA (2007) shows that due to shrinking oil reserves in politically stable and easily accessible regions and limited investments in production capacity, the share of oil in the world's total energy supply has declined from 46.2 percent of 6,128 million tons of oil equivalents (Mtoe) in 1973 to 35 percent of 11,435 Mtoe in 2005. A third factor that runs contrary to the green paradox is the increased demand in developing countries, particularly India and China, which compensates or exceeds the possible gradual reduction of oil consumption in abating countries.

The increases in oil prices to unprecedented levels have triggered the substitution away from oil. Specifically, it has encouraged the use of alternative energy sources and further stimulated research and development of fuel efficiency and of utilisation of more ecologically-friendly alternatives, particular wind, solar and bio-fuels. However, the substitution away from oil need not necessarily be beneficial to the environment nor lead to net social benefits. First, not only ecologically-friendly alternatives have been substituted for oil; the use of nuclear and coal-based energy has also increased lately, especially in coal abundant China. Secondly, several alternatives may be ecologically friendly in terms of CO₂ emissions but nevertheless have other negative (environmental) impacts. For instance, first generation biomass production (e.g. ethanol and bio-diesel) may lead to, amongst others, reductions in soil fertility, leave less water for food crop production, aggravate soil erosion, negatively affect biodiversity and compete with food production resulting in higher food prices (Lundgren et al. 2008). Moreover, it is not clear whether the use of bio-fuels really results in lower

⁹ It should be noted that this study is dated and relates to environmental policy in general rather than climate policy.

GHG emissions because of the increased use of N-fertilizer which can contribute as much or more to global warming than the reduction achieved via fossil fuel saving (Crutzen et al. 2008). Overall, Lundgren et al. (2008) concludes that converting from non-renewable fossil fuels to bio-fuels does not necessarily lead to net positive welfare effects. Thirdly, several ecologically-friendly alternatives, particularly solar, are still at an early stage of development and unable to compensate large scale reductions in the use of fossil fuels in the short run.

Kyoto is also influenced by the business cycle. During the present recession the consumption of fossil fuels has substantially decreased, as reflected by the price fall of a barrel of oil from its peak of 146.08 US dollars in the first half of 2008 to approximately 50 US dollars early 2009.¹⁰ The price drop reduces the incentives to substitute away from oil. Moreover, together with increasing public deficits and declining profits in the private sector it may discourage development and large scale introduction of alternative types of energy including low-carbon. For instance, the Australian government recently decided to postpone the introduction of CO₂ emission trading for at least one year, although it announced that it is still committed to the long-term CO₂ emission reduction.¹¹ The upshot is that both high and low prices of fossil fuels should be supported by accompanying policies, e.g. subsidies on research and development, to foster energy transition.

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PANEL

The European Editor of *The Economist*, **John Peet**, panel chairman, expressed the hope that the role of coal could be discussed, especially since one of the panel members comes from a coal-rich country, Poland.

¹⁰ In response to expectations that the recession has reached its peak, it has slightly started increasing (Reuters, 04.05.2009).

¹¹ Reuters, 07.05.2009.

Energy expert **Claudia Kemfert**, German Institute for Economic Research (DIW), pointed to the problem of oil supply scarcity if investment in production is postponed because of the economic crisis. Since global oil demand will increase, we will need this investment to develop new oil fields. “The oil demand increase by fast growing countries will overcompensate the demand decline by the OECD countries leading to increasing, not falling prices”. The growing scarcity of oil makes substitution necessary and at the same time we need to substitute coal because of climate change. To prevent environmental capital flight, we need a global climate agreement on an emissions trading system. But we also need technological breakthroughs to achieve CO₂-free, safe and affordable energy, and implementing new technologies requires time and money.

Janusz Reiter is the Polish ambassador-at-large for climate change, whose expertise lies in reconciling diverging interests. “Although we are united in our vision of a low-carbon economy, we are not agreed on how this can be achieved”. Some oil producing countries fear that they may be marginalised in the climate change debate and these concerns must be addressed. “In Copenhagen, we must strive to achieve a deal that is considered to be fair by all countries”. But the Middle Eastern countries are also very influential in the G27 and in China, which is why it is important that they back a Copenhagen agreement. With regard to coal, it is democratically distributed throughout the world, and abandoning coal is not an option for all the countries that depend on it. He believes that carbon capture and sequestering (CCS) will be a viable process, as businesses are already investing in this technology. In Poland, for example, 94 percent of power generation comes from coal, a reality that cannot be denied but that must be shaped. Nevertheless, Poland should be able to reach the EU’s 20/20 target by 2020. The EU can be proud of its Climate Control Package because it accommodates the needs of its diverse members. Now it is important for the EU and the United States to reach out to the Chinese and get them involved in a Copenhagen agreement. Russia, as an oil producing and coal burning country, has taken a status-quo position on climate change, although Putin has recently addressed the problem. We need Russia’s support, otherwise a deal in Copenhagen could be blocked.

The last speaker was **Tom Burke**, an adviser to the British government on climate change. The shared

dilemma of all countries today is that to prosper we need a growing amount of energy but if we continue to use energy the way we do today we “will compromise the very prosperity we are using the energy to achieve”. How can we deliver both energy security and climate security? Although technologies for achieving a low carbon economy are available or within reach, we are lagging in deploying these technologies. To achieve a low carbon economy we need to emphasise not the pain this will involve but “the opportunities for innovation and efficiency that improve productivity and competitiveness”. The needed political action is hindered by the question of the costs, and these will be of the same order as required for the bank rescue packages. But the cost of failing to resolve the dilemma will be even higher, and since all will benefit, all must pay, either in the form of emissions trading or a carbon tax. It is essential that governments use this additional revenue to promote low-carbon technologies and not to consolidate the public finances after the bank rescues.

The ensuing discussion looked at the role of OPEC in the climate change discussion. Will OPEC lose out in the transition to a low carbon economy? **Mohamed Bin Dhaen Al Hamli** stressed that oil, as part of the energy mix, will still be needed 50 years from now. The oil producers in his region have signed the Kyoto Protocol and should not be discriminated against; they need the income from oil to catch up with the rest of the world.

The discussion then turned to the price of oil and how it is determined. Tom Burke observed that the failure to invest in the oil industry contributed to a spike in prices. Oil production is not going to exceed 80 to 90 million barrels a day no matter what happens to demand. This implies rapidly rising prices. According to Claudia Kemfert, a price of oil above 80 to 90 dollars a barrel is needed to finance exploration, which has grown increasingly more expensive. Because of the scarcity factor, the oil price will not fall to a large extent. **Henk Folmer** agreed and argued that the expectation of lower future oil prices is false because oil production cannot keep up with demand. **Frederick van der Ploeg** mentioned an overlooked statistic: an increase in known oil reserves. Folmer cautioned, however, that the growth of new finds is slowing and that these finds are often difficult to access or are in politically instable regions.

Does OPEC set the price of oil? Al Hamli argued that the price is set by market forces. The oil produc-

ers, in dialogue with consumers, try to determine how much oil is needed so that their expensive production capacities can be adjusted accordingly. Oil production has not been cut in the current crisis, on the optimistic assumption that the world economies will soon recover. **Ali Obaid Al Yabhouni** added that the price of oil, like other commodities, is influenced by the flow of supply, which can vary for technical reasons; by market fundamentals such as demand and inventories; by natural causes that can interrupt supply; by taxation, regulation and policies; and also by statements of politicians. OPEC's role should be seen as that of a central bank, intervening to regulate and balance the market and implementing policies that contribute to economic growth.

Ottmar Edenhofer agreed with Hans-Werner Sinn that the supply side has been underestimated, but in taking this into account we must look at the interdependency of the oil, gas and coal markets. A high oil price makes coal attractive as a substitute, which leads to higher CO₂ emissions. **Michael Hoel** stressed that coal is the key issue in climate change because of its great supply. **Lady Barbara Judge** added that coal is cheap, democratic and widely distributed. We need the same efforts for developing renewables applied to cleaning up coal. Tom Burke questioned whether coal can be made "clean" but at least we should strive to make its use carbon neutral. This can be achieved by CCS, for which huge investments will be needed. Claudia Kemfert added that public acceptance of CCS technology must also be worked for. Janusz Reiter stressed that coal has a future and that since coal reserves are distributed throughout the world, we can expect to have scale effects from the new CCS technology. The advancement of this technology is all the more urgent, in Claudia Kemfert's opinion, since coal may be subject to a green paradox: producers fearing a fall in future prices may extract more today, leading to higher carbon emissions.



Panel 3

THE ROAD TO COPENHAGEN: WHAT AGREEMENT CAN ACTUALLY BE EFFECTIVE AND STABLE?

Introduction

CARLO CARRARO

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Preparatory talks to the next round of negotiations seem to indicate that a comprehensive agreement to mitigate climate change will not be easily attainable, despite the intentions of the US administration and the high expectations surrounding the Copenhagen meeting. One key issue is to what extent fast growing economies, and especially China, should take actions to reduce their growth of emissions. And whether fast growing economies are actually willing to take such actions. What are then the prospects for an agreement in Copenhagen? Can the world live with a few opt-outs, in particular from large developing countries? Are there policy measures to enhance the participation incentives of developing countries? The purpose of this paper is to address these questions by analyzing: (i) the incentives for the major greenhouse gas (GHG) emitting countries to participate in an international climate policy agreement, i.e. in a 'climate coalition'; (ii) the effectiveness of such climate coalitions in actually reducing GHG emissions, even when some countries opt-out; and (iii) the size of transfers that could actually enhance the incentives to participate in a large climate coalition.¹

The analysis is carried out using the World Induced Technological Change Hybrid (WITCH) model

¹ Most results presented in this paper are extensively discussed in Bosetti et al. (2009). The author is grateful to Valentina Bosetti, Enrica Decian, Romain Duval, Emanuele Massetti and Massimo Tavoni for insightful discussions and excellent collaborations. Financial support from the OECD is gratefully acknowledged. The author is also grateful to participants at the 8th Munich Economic Summit for many helpful comments.

(Bosetti et al. 2007 and 2009). WITCH has two major strengths in this specific context. First, it belongs to the class of so-called integrated assessment models (IAMs), i.e. it incorporates explicitly the gains from emission reductions in terms of avoided climate change through regional damage functions that feed climate change back into the economy. Also, WITCH has a game-theoretic structure, i.e. the 12 model regions and/or coalitions of regions behave strategically with respect to all major economic decision variables – not least emission abatement levels – by playing a non-cooperative Nash game. Therefore, when deciding whether or not to cooperate on GHG emission control, countries take into account how their decisions affect all other countries, and whether these countries will cooperate or remain outside the coalition.

Let us underline that incentives to sign a climate agreement will ultimately depend on a wide range of economic and political factors, not all of which can be captured by a climate-economy model. Nevertheless, useful insights can still be gained by focusing on economic incentives, which in the WITCH model include the avoided damages and the abatement costs incurred both within and outside a coalition.

Assessing the incentives for the major regions of the world to participate in an international climate policy agreement

The assessment of the incentives for the major regions to participate in an international climate policy agreement crucially depends upon the estimates of climate damages. Two different assumptions on climate damages ('low', following Nordhaus' estimates of climate damages; and 'high', following the estimates in the IPCC FAR) and two assumptions of the pure rate of time preferences (0.1 percent as in the Stern Review and 3 percent declining as in Nordhaus' work) are considered in our analysis. Damage functions are also specified to reflect the following major features of climate change:

- Damages from climate change are unequally distributed across world regions. Some countries may benefit from climate change (e.g. Transition Economies (TE) or Canada) at least for limited increases of temperature. Other countries, e.g. some developing countries, are more vulnerable and may suffer large losses. Sub-Saharan Africa (SSA), South Asia and Western Europe are likely to suffer the greater losses from climate change.
- Marginal abatement costs are also unequally distributed across world regions. Abatement costs are likely to be lower in India, South East Asia (SEASIA), SSA and China. They are much higher in Japan, Western Europe and TE.
- Taking into account both damages and abatement costs, Russia, the Middle East countries and China appear to have lower incentives to participate in a coalition than most other countries, *ceteris paribus*. In particular, a robust positive correlation is found between abatement costs and the magnitude of free-riding incentives, as measured by the welfare gain from withdrawing from a 'grand coalition' consisting of all countries.

These preliminary conclusions are useful to proceed with the identification of coalitions which are both effective, i.e. large enough to achieve a significant climate objective, and stable, i.e. not undermined by free-riding incentives.

As a result – and considering that what matters for participation incentives is the balance between abatement costs and benefits from avoided damages – countries with the highest incentives to free-ride are likely to be China, TE and the Middle East countries. *Ceteris paribus*, regions with flatter (steeper) marginal abatement cost curves and/or flatter (steeper) marginal damage curves have larger (smaller) participation disincentives, because they contribute more (less) to the coalition's abatement effort and/or benefit less (more). This is confirmed by the results contained in Bosetti et al. (2009). Their main findings are:

- As a general rule, developing countries incur larger damages from climate change than their developed counterparts. Within the group of developing countries, African countries appear to be more exposed than India and, to an even greater extent, China. Within the group of developed countries, Western Europe would suffer greater damage than the United States, which in turn would be more vulnerable than the OECD Asia-Pacific countries and Canada. Russia would be least affected by climate change.
- Abatement costs under a single world carbon price scenario are also larger in developing countries than in their developed counterparts, due to their higher energy/carbon intensity. Fossil fuel producers such as the Middle East countries and Russia incur the largest costs, reflecting their very high energy/carbon intensity and the fall in world fossil fuel prices. Within the group of developed regions, Western Europe and Japan-Korea would face smaller costs than the United States, also due to lower energy/carbon intensity.

Analyzing the size and stability of possible climate coalitions without international financial transfers

Let us introduce the concept of 'potentially effective coalitions (PECs)'. A set of n countries is a potentially effective coalition (PEC) if the sum of their technical lower bound emission levels (zero), added to baseline (BAU) emissions of non-participating countries (singletons), results in a concentration level which is below or equal to the target by 2100. The existence of at least one PEC is a necessary (but not sufficient) condition for the 550ppm CO₂eq target to be attainable. It is only necessary because a PEC is defined by an emission profile which is lower than the actual emission profile of the coalition. Therefore, if the target is not achieved by the lower emission profile, it cannot be achieved by the equilibrium emissions of the coalitions.

Results in Bosetti et al. (2009) show that only seven politically relevant coalitions (out of 4,095 when the world is divided into 12 regions) are PECs with respect to the 550ppm concentration target in 2100. This means that only few coalitions could meet the 550ppm CO₂eq target by 2100, even if they were able to reduce their own emissions to zero, while the emissions of non-participating regions continued along their BAU path. These few PECs include both China and India, along with most other world regions. Even by 2050, all PECs need to include both China and India, unless all other developing regions offset the non-participation of one of these two countries. Summing up, in all PECs:

- The participation of both China AND India is needed to attain the 2100 target.

- When the goal is GHG stabilization at 550ppm in 2100, PEC are subsets of the 12 regions in which at most three regions are not included (SSA, TE and SEASIA).
- Generally, only SSA or SSA plus another region (SEASIA, TE, Middle East and North Africa, and Latin America) can be singletons. All the other countries/regions should sign the climate agreement for the 550ppm target to be attainable.
- When emissions of countries belonging to a PEC and the related emissions of singletons are the equilibrium ones, i.e. emissions are the outcome of a cost benefit strategic decision analysis, then only the grand coalition (all countries) achieves the 550ppm target in 2100. The grand coalition less SSA gets close to the target. All the other coalitions cannot achieve the target.
- However, no PEC, not even the grand coalition, is *stable*, i.e. there is always at least one country/region that gains from free-riding on the other countries' abatement efforts.

Given that PECs are necessary but not sufficient conditions for meeting the target in our analysis, in practice coalitions will need to include virtually all world regions in the course of this century. In fact, when account is made for the economic unfeasibility of zero emissions, and for the free-riding incentives of non-participating regions, only a very broad international coalition excluding no region other than Africa can achieve the target by 2100.

The cost-benefit analysis in Bosetti et al. (2009) suggests that only a grand coalition finds it optimal *as a whole* to stabilise overall GHG concentration below 550ppm CO₂eq, and only at the high climate damage and low discount rate. Smaller PECs, including a grand coalition excluding Africa, achieve less ambitious targets. This is because they do not fully internalise the global environmental externality, and allow a larger number of (non-participating) countries to free-ride (thus increasing their own emissions).

Unfortunately, although this grand coalition can, and *as a whole* has an incentive to achieve the target, it does not appear to be internally stable. Most regions gain more from non-participation than from participation in a grand coalition. The same conclusion holds for all other, smaller PECs. In addition, neither the grand coalition nor any other PEC is *potentially* internally stable either, i.e. no set of international financial transfers can be found that would offset the free-riding incentives of *all* participating countries *simultaneously*. This is because the overall welfare gain from any PEC relative to the non-cooperative outcome is not large enough to give each country/region its free-riding payoff. After compensating all losers in the coalition, the remaining coalition surplus is too small to offset free-riding incentives.

Summing up, two additional important policy messages emerge from the analysis:

These conclusions apply in particular to the following six 'politically important' coalitions: (i) 'the grand coalition' to which all countries belong; (ii) the coalition formed by industrialised countries and by China, India, Russia and Latin America; (iii) the coalition with industrialised countries, China, India and Russia; (iv) the coalition with industrialised countries, China and India; (v) the coalition with industrialised countries and China only; (vi) and, finally, industrialised countries only. Only (i), the grand coalition, can actually achieve the 550ppm target by 2100.

Analyzing the size and stability of possible climate coalitions with international financial transfers

It is therefore relevant to analyse whether there are transfer schemes that can stabilise the grand coalition or other climate coalitions. First, the coalition surplus could be used to transfer resources to countries with the largest incentives to free-ride. If the coalition surplus is large enough to offset all coalition members' incentives to free-ride, then the coalition is Potentially Internally Stable (PIS). Unfortunately, as shown in Bosetti et al. (2009), there exist no transfer scheme and no coalition that can be shown to be PIS.

Although no set of transfers is found to address the free-riding incentives of *all* countries *simultaneously*, there is little doubt that transfers can improve the prospects for broad-based participation in international mitigation action. In practice, one powerful way to implement such transfers is through the allocation of emission reduction commitments across countries. For instance, allocation rules could be designed to shift some of the costs of action away from developing countries, which in general have larger free-riding incentives than their

developed counterparts. Illustrative allocation rules² under a global emission trading scheme (ETS) are explored in Bosetti et al. (2009), with the following results:

- The cross-country distribution of mitigation costs varies drastically across alternative allocation rules, reflecting the wide variance in the sign and magnitude of each region's net permit imports. By 2050, developing regions are projected to gain significantly (relative to BAU) from rules that would grant allowances in inverse proportion to each region's contribution to past cumulative emissions, or from rules that would cover their projected BAU emissions. To a lesser extent, and with greater variance across countries, they would also benefit from allocation of allowances in inverse proportion to emissions per capita, or emissions per unit of output.
- By contrast, developing regions incur sizeable losses during the first half of this century under grandfathering or full auctioning of international allowances. Russia loses under all rules except grandfathering. Overall, given the heterogeneity of outcomes across alternative rules, these could in principle be combined to achieve any particular distribution of mitigation costs.

These negative conclusions are partially offset by the following consideration. Let us quantify the amount of resources that developed countries could transfer to developing countries for the grand coalition to be stable. The sum that the industrialised countries should be ready to transfer is about 10 percent of their global welfare (about 3 percent of their discounted sum of future GDPs). With these transfers, which are net losses for developed countries, developing countries can be induced to sign a global deal and to adhere to a long-term climate agreement.

Sensitivity analysis

The PECs previously described are the union of all PECs identified in the four scenarios considered in this report: (a) high damage, low discount rate; (b) high damage, high discount rate; (c) low damage, low discount rate; and (d) low damage, high discount rate. Therefore, our analysis of potential effectiveness is robust to different crucial parameter specifications. Results on profitability also hold for the four scenarios.

However, the conclusion about the environmental effectiveness of the grand coalition, the only coalition that attains the 550ppm target in 2100, is limited to the scenario with high damage and low discount rate. In all other cases, no coalition attains the 550ppm target at the equilibrium. Therefore, only if the discount rate is low and future damages, in particular risks of future catastrophic events, are adequately taken into account, can the grand coalition yield an equilibrium emission profile consistent with the 550ppm target in 2100.

Finally, the conclusion that no coalition is stable and cannot be stabilised by a self-financed transfer scheme (no PIS) holds for the four scenarios and is therefore robust. However, it should be acknowledged that the main findings on coalition stability are subject to a number of limitations. Although the results are reasonably robust to the alternative damage and discounting assumptions, there are also wide uncertainties surrounding more distant climate impacts (beyond the 2100 horizon considered here), future emission trends, and the cross-country distribution of damages and risks. Also, the analysis focuses on immediate, irreversible and self-enforcing participation to mitigation action, thereby abstracting from other possible bargaining options including, for example, delayed participation, renegotiation, sanctions or joint negotiation in multiple areas (e.g. linking climate and international trade negotiations).³ Furthermore, the co-benefits from mitigation action such as in terms of human health, energy security or biodiversity, are not taken into account. Previous OECD analysis indeed suggests that such co-benefits are large, although the participation incentives they provide are not straightforward (Bollen et al. 2009; Burniaux et al. 2008). Finally, removal of fossil fuel subsidies is also omitted from the analysis. Insofar as phasing out subsidies would bring an economic gain and lower the carbon intensity of a num-

² Five rules have been analysed: (i) a grandfathering rule (permits are allocated according to each region's share of world emissions in 2005); (ii) a per-capita rule (each human being receives the same amount of emission permits); (iii) an 'ability-to-pay' rule (permits are allocated every year to each individual worldwide in inverse proportion to the gap between this individual's GDP per capita and average world GDP per capita in PPP terms); (iv) a 'historical responsibility' rule that grants allowances to each region in inverse proportion to its contribution to cumulative world CO₂ emissions over the period 1900–2004; (v) 'no-lose' rule under which the amount of allowances given to Non-Annex 1 regions covers their projected baseline emissions, while Annex 1 regions set their cap – then allocated across them on a per-capita basis – at whatever level is required to meet the 550ppm CO₂eq target. For all the five allocation rules just described, the same conclusion holds: no coalition is stable and no coalition is PIS.

³ However, these limitations have little impact on the analysis of PECs, which is the main cornerstone of the paper's analysis of feasible and effective coalitions. Therefore, most conclusions are quite robust to changes in bargaining options.

ber of (mainly developing) countries, incentives to participate in international mitigation action could improve (for an analysis of the economic gains and world emission impacts of fossil fuel subsidy removal, see Burniaux et al. 2009) .

Another important feature of the analysis is the assumption that even if a country benefits from an international coalition relative to a BAU scenario, it will always prefer to free-ride if that option is even more profitable. While this merely reflects the underlying assumption that each individual country maximises its own welfare, current international redistributive policies, such as official development aid, point instead to some degree of altruism. For instance, with a loss of a few percent in the discounted value of their consumption levels, it is estimated that industrialised countries would stabilise the grand coalition in the high-damage/low-discounting case, i.e. market-based transfers of such magnitude would be large enough to fully compensate other (mainly developing) regions for their free-riding incentives.

Conclusions

The main conclusions reached in this paper can be summarized as follows. Only coalitions including all large emitting regions are found to be technically able to meet a concentration stabilisation target below 550ppm CO₂eq by 2100. Once the free-riding incentives of non-participants are taken into account, only a grand coalition including virtually all regions can be successful. This grand coalition is profitable as a whole, implying that all countries can gain from participation, provided appropriate transfers are made across them. However, neither the grand coalition, nor smaller but still environmentally significant coalitions, appear to be stable. This is because the collective welfare surplus from cooperation is not found to be large enough for transfers to offset the free-riding incentives of all countries *simultaneously*.

If only the grand coalition is effective and profitable, and only in the high damage and low discount rate case, what's next? The attainment of an ambitious target (550ppm, above 2 degrees increase anyway) therefore seems unlikely: it requires immediate global cooperation, perfect foresight and full availability of all technologies. Would it not then be wiser to reduce mitigation ambitions (say from 550ppm to

650ppm, leading to about a 3 degree temperature increase), which is feasible at very low cost if all countries participate but is feasible also without all countries participating from the beginning?

This change in strategy would require additional investments in adaptation, but much later (which is an additional benefit given the economic crisis and development needs in China, India, and the other developing countries). Quite by chance the strategy just described seems to be very close to what is implicitly occurring in international negotiations. Indeed, the goals set by the United States, Japan, and some developing countries seem to lead to a 650ppm path more than to a 550ppm one.

The standard approach to climate policy, i.e. to start with very ambitious mitigation measures in developed countries and wait for developing countries to join the climate coalition, is likely to be very costly and largely ineffective. The approach suggested by this paper, i.e. to focus on less ambitious mitigation measures and develop a long term adaptation strategy in particular in developing countries, seems to be less costly and more effective in controlling damages from climate change.⁴

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⁴ A detailed analysis of the optimal intertemporal and geographical mix of mitigation and adaptation measures is contained in Bosello et al. (2009).

PANEL

Panel 3 was chaired by **Anatole Kaletsky** of *The Times*, London, who pointed out that agreement prevailed at the conference as to the goals but not as to which of the many suggested approaches to follow. He hoped his panel could contribute to “some convergence into a coherent approach that could be considered in a Copenhagen agreement”.

The first short panel statement came from **Karen Harbert** of the Institute for 21st Century Energy at the US Chamber of Commerce, who spoke, from a private-sector perspective, of the need for balancing energy, the environment, economic growth and national security. The United States has been reducing its greenhouse gas emissions since 2001 with the help of several mandatory programs, she observed. The goals of the Obama Administration are even more ambitious, involving very dramatic change, and the policies are needed today to reach these goals. So far US public opinion has not been sensitised to the scale of the changes that are needed, as demonstrated by the extreme difficulties facing the approval of new energy projects. Clean coal projects will make the price of electricity in the United States higher, and this has met with strong public opposition. To reach a 50 percent reduction in global CO₂ emissions by 2050, the developing nations will have to participate, since they will be responsible 80 percent of the expected increase in emissions up to 2050. The principles of climate change policy that the business community can support include the following: equal competition for all countries, realistic goals that do not undermine economic growth, binding global commitments also from the large developing countries, verifiable mitigation actions, protection of intellectual property rights and removing trade barriers to environmental goods and services. It is only on the back of the free enterprise system that success will be possible.

Angelika Niebler, who chairs the European Parliament’s Committee on Industry, Research and Energy, pointed to the EU’s ambitious goals, set in 2007, of increasing the share of renewables in the energy mix by 20 percent, reducing CO₂ emissions by 20 percent and improving energy efficiency by 20 percent – all by 2020. To implement these goals the EU has introduced a cap and trade system, the first emissions trading system in the world. This system still needs improvements to ensure that companies are given the necessary planning security and

that a level playing field in the EU is assured. Nevertheless, with its ambitious goals the EU is well-positioned to take a leading role in the Copenhagen negotiations. Without a successful agreement in Copenhagen among the industrial and developing countries, the EU’s ambitious climate protection plan cannot be further developed.

The perspective of the power generation industry was presented by **Tuomo Hatakka**, Chairman of the Management Board at Vattenfall Europe AG. He stressed that the post-Copenhagen situation will be even more challenging than the Copenhagen negotiations themselves. Since renewable energy is not a silver bullet, an environmentally friendly energy mix must be found. Here, industry must lead by example. The Vattenfall strategy is a 50 percent CO₂ reduction by 2030 in its electricity generation and carbon neutrality by 2050. This goal is realistic, in his opinion, especially because of the positive effects of the learning curve. The technology for carbon capture and sequestering (CCS) already works, and his company will have a pilot plant up by 2015, with commercial use planned for 2020. The primary challenge will be the legal framework and public acceptance, especially with regard to the further development of nuclear energy. Decisions at a national and supra-national level are needed to implement an emissions trading system and to place a price on carbon. This will provide market-based incentives to promote technological development, also for conventional energy, to achieve a balanced energy mix.

Johannes Teysen, representing both E.ON and the World Energy Council, observed that the world’s poor cannot be denied access to clean and accessible energy and they too must be involved in a climate change solution. His company wants to be a part of the solution, but to do this stable political support regimes and the help of the markets are needed. Attracting private capital for energy solutions is crucial since the financing capacity of the state will not be sufficient. Regardless of the political framework agreed in Copenhagen, all will depend on technology and investment. The “Third Industrial Revolution” that many call for cannot be planned by the state. It can only come about through intellectual openness, by providing room for creativity and from the willingness to accept risk as well as failure. Making projections to the end of the century is also fruitless since we are sure to have a totally different situation then. Important now is technological openness and an atmosphere where things happen. In

Finland, for example, the political class has created an atmosphere for free discussion; in Germany, unfortunately, the public discussion on future energy sources is much less realistic.

Henning Wuester, United Nations Framework Convention on Climate Change (UNFCCC), stressed that success in Copenhagen is possible if the focus is placed on the right issues. Firstly, the industrialised countries must set ambitious mid-term targets, as they are the highest emitters and can also foster the necessary technologies. "Overall, the level of ambition is not yet high enough". Secondly, the developing countries, many of whom are already doing a lot, must enhance their mitigation efforts, applying the concept of nationally appropriate mitigation action (NAMA). These actions must be "measurable, reportable and verifiable". Thirdly, the resources for adaptation and mitigation must be increased. Since most of the funding for mitigation will come from private sources, incentive mechanisms such as a functioning carbon market must be put in place. Lastly, effective institutional structures are needed, perhaps built on existing financial institutions, to manage global cooperation and "leverage action by the private sector". Here, it is important that developing countries also "have their say on how funds are used". The EU is leading in setting emissions targets, and the United States is slowly moving in this direction, but the necessary decisions on the financial side have not yet been taken.

In the discussion that followed, **Efraim Sadka**, Tel Aviv University, mentioned how incentives could be used to reward good and penalize bad behaviour, such as non-participation in a climate control treaty. **Larry Karp**, University of California Berkeley, agreed and suggested that trade policy be used to encourage compliance. **Carlo Carraro** cautioned that trade officials would be reluctant to use this instrument as it could harm negotiations on free trade. Henning Wuester warned against using trade threats at the present stage of negotiations "where we are striving for a grand coalition". Karen Harbert pointed out that a tax on trade assumes failure in Copenhagen and would only pass on the costs to the consumer: "we should open up trade, which will bring down compliance costs for all countries". Anatole Kaletsky also mentioned the need to address deforestation, "one of the largest contributors to climate change". Henning Wuester pointed out that this issue is on the Copenhagen agenda and

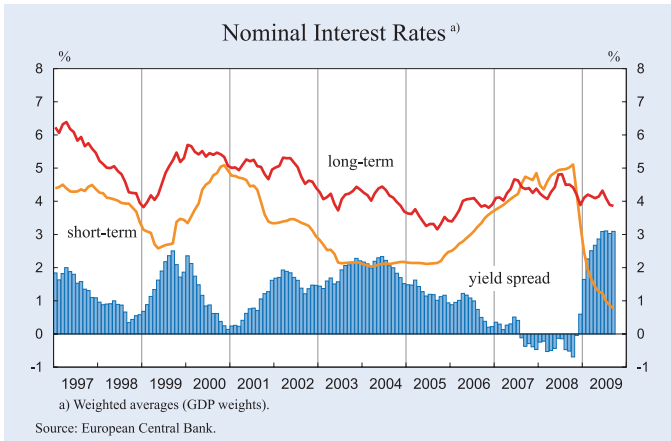
that a system with verifiable compliance could indeed be part of a final agreement.

The problem of population growth was also brought up. A one percent increase in population means a 0.8 increase in emissions, as Carraro pointed out. If we can bribe people to cut down fewer trees, why not bribe them to have fewer children, **Dennis Mueller** of the University of Vienna suggested. This would be cheaper than all other solutions. Henning Wuester pointed out that China is using its population control policies in the Copenhagen negotiations as proof of having lower emissions than otherwise. However, "for obvious reasons we cannot ask the developing world to reduce its population".

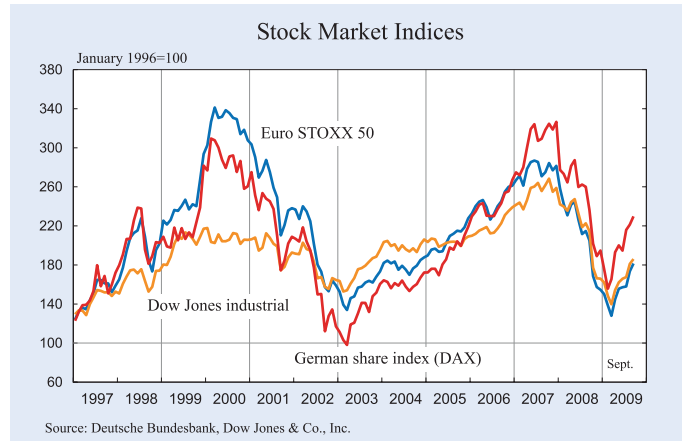
Maximising efficiency is a tremendous opportunity, according to Karen Harbert. We need policies that reward efficiency although this is actually counter-productive to the bottom line of energy producers. Energy must become part of the solution to the climate problem and must not be seen as the enemy, since "more prosperous countries are more respectful of the environment". Henning Wuester added that "industry needs some direction that has to be put in place by policy". Long-term direction underpinned by short-term measures is needed.

Several discussants urged governments to invest more in education and research, especially for future technologies. Angelika Niebler, however, defended policy-makers' accomplishments thus far. The transition to renewables has only been possible with the help of politicians, who have also effected a rethinking on energy saving. Political decisions have also created reimbursement systems for feeding into the power grid. The EU emissions trading system will produce the revenue needed to tackle the climate change problem. Henning Wuester was also optimistic that political leadership and support at the highest levels from various countries will increase the chances for success in Copenhagen. He was sceptical, however, about economic models that look far into the future: "goals must allow for corrections, as we see what is possible and not possible". Or as Kaletsky added, quoting Voltaire: "the best is the enemy of the good".

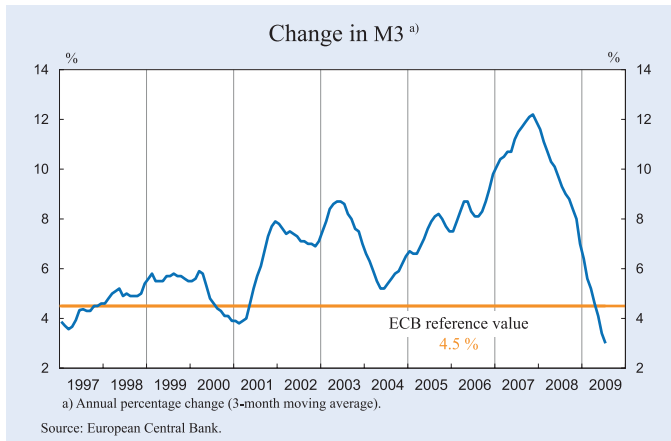
FINANCIAL CONDITIONS IN THE EURO AREA



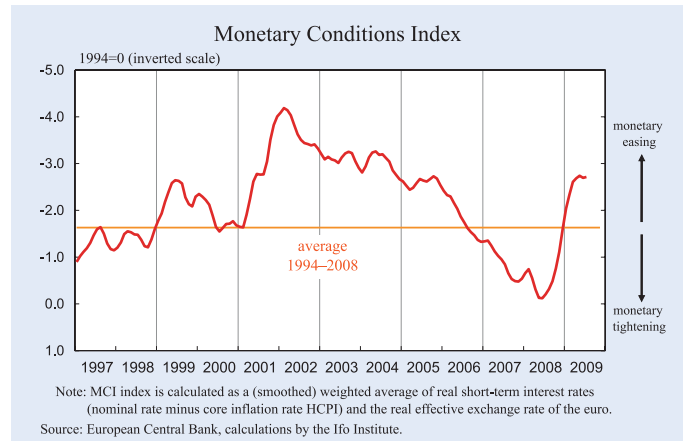
In the three-month period from July to September 2009 short-term interest rates declined. The three-month EURIBOR rate decreased from an average 0.98% in July to 0.77% in September. The ten-year bond yields also declined from 4.09% in July to 3.86% in September. In the same period of time the yield spread reduced from 3.11% (July) to 3.09% (September).



The German stock index DAX grew in September 2009, averaging 5,675 points compared to 5,332 points in July. The Euro STOXX also increased from 2,462 in July to 2,828 in September. The Dow Jones International also grew, averaging 9,635 points in September compared to 8,680 points in July.

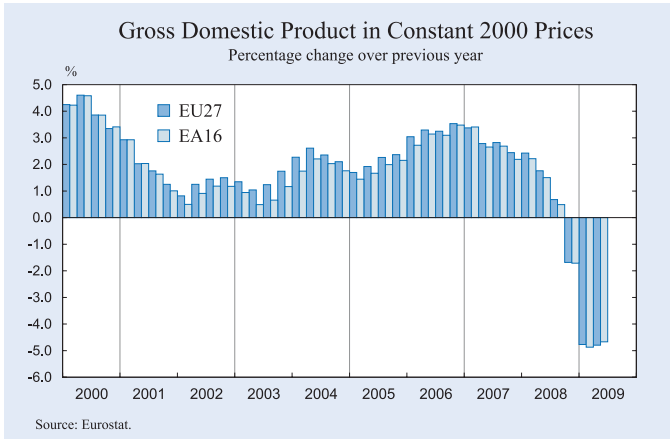


The annual rate of growth of M3 decreased to 2.5% in August 2009, compared to 3.0% in July. The three-month average of the annual growth rate of M3 over the period from June 2009 to August 2009 declined to 3.0%, from 3.4% in the period May 2009 to July 2009.

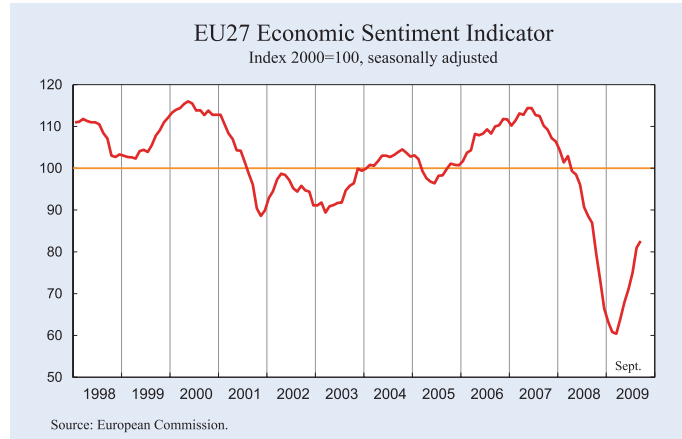


In April 2009 the monetary conditions index continued its rapid growth that had started in mid-2008, signalling greater monetary easing. In particular, this is the result of decreasing real short-term interest rates.

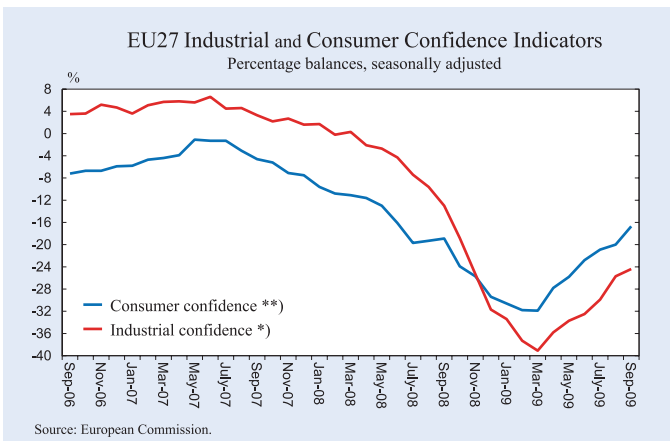
EU SURVEY RESULTS



According to the first Eurostat estimates, GDP fell by 0.1% in the euro area (EU16) and by 0.2% in the EU27 during the second quarter of 2009, compared to the previous quarter. In the first quarter of 2009 the growth rate had amounted to -2.5% for the euro area and -2.4% for the EU27. Compared to the second quarter of 2008, i.e. year over year, seasonally adjusted GDP declined by 4.7% in the euro area and by 4.8% in the EU27.

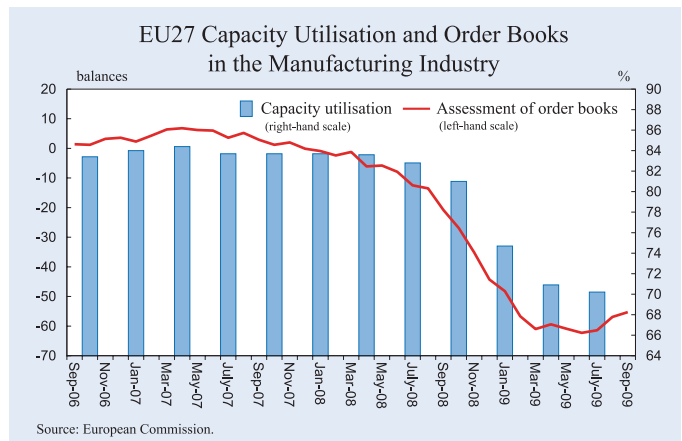


In September 2009, the Economic Sentiment Indicator (ESI) for the EU27 and the euro area continued to improve for the third month in a row. In this month the ESI increased by 1.6 points in the EU27 and by 2.0 points in the euro area, to 82.6 and 82.8 respectively. Yet, in both areas, the ESI level is still below the long-term averages.



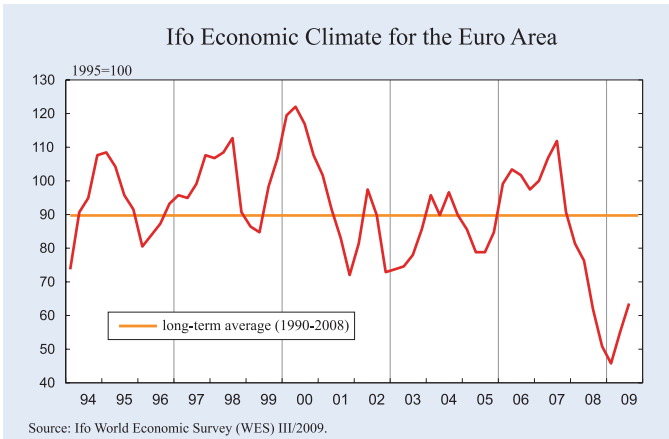
* The industrial confidence indicator is an average of responses (balances) to the questions on production expectations, order-books and stocks (the latter with inverted sign).
** New consumer confidence indicators, calculated as an arithmetic average of the following questions: financial and general economic situation (over the next 12 months), unemployment expectations (over the next 12 months) and savings (over the next 12 months). Seasonally adjusted data.

In September 2009, the *industrial confidence indicator* slightly increased by 2 points in the EU27 and by 1 point in the euro area, while the *consumer confidence indicator* increased by 3 points in the both areas. However, these indicators stood below the long-term average in both areas in September.

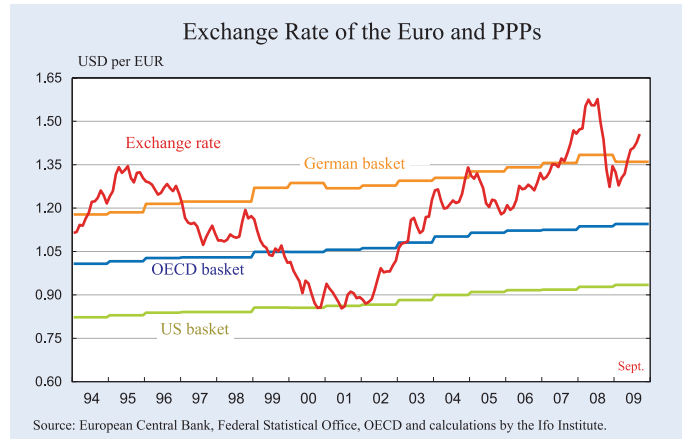


Managers' assessment of *order books* improved from - 61.4 in July to - 55.3 in September 2009. In June 2009 the indicator had reached - 62.3. *Capacity utilisation* declined to 70.2 in the third quarter of 2009 from 70.9 in the previous quarter.

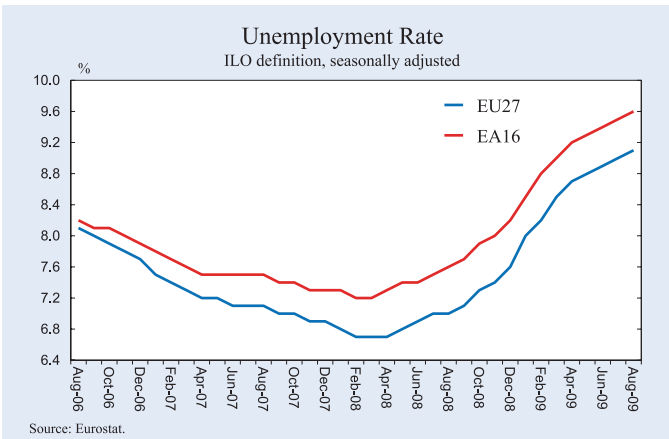
EURO AREA INDICATORS



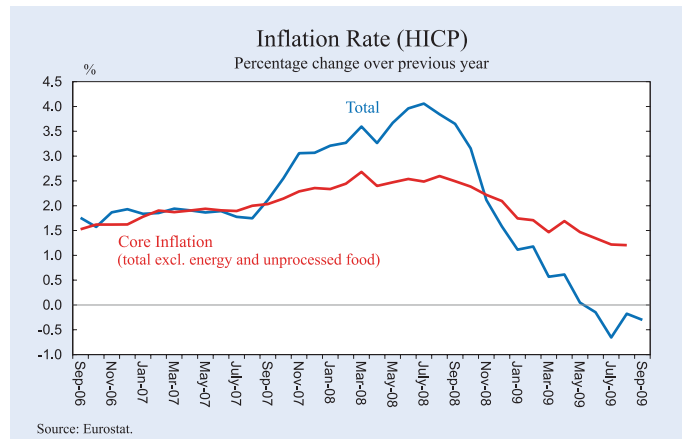
The Ifo indicator of the economic climate in the euro area (EU16) improved in the third quarter of 2009 for the second time in succession. Its rise is solely the result of more favourable expectations for the coming six months; the assessments of the current economic situation, in contrast, still remain at an historical low.



The exchange rate of the euro against the US dollar averaged 1.46 \$/€ in September 2009, an increase from 1.41 \$/€ in July. (In June 2009 the rate had amounted to 1.40 \$/€.)



Euro area (EU16) unemployment (seasonally adjusted) amounted to 9.6% in August 2009, compared to 9.5% in July. It was 7.6% in August 2008. EU27 unemployment stood at 9.1% in August 2009, compared to 9.0% in July. The rate was 7.0% in August 2008. In July 2009 the lowest rate was registered in the Netherlands (3.4%) and Austria (4.4%). Unemployment rates were highest in Spain (18.5%), Latvia (17.4%) and Lithuania (16.7%) in July 2009.



Euro area annual inflation (HICP) was -0.2% in August 2009, compared to -0.7% in July. This is an evident decrease from a year earlier, when the rate had been 3.8%. The EU27 annual inflation rate reached 0.6% in August, up from 0.2% in July. A year earlier the rate had amounted to 4.3%. An EU-wide HICP comparison shows that in August 2009 the lowest annual rates were observed in Ireland (-2.4%) and Portugal (-1.2%), and the highest rates in Hungary (5.0%), Romania (4.9%) and Poland (4.3%). Year-on-year EU16 core inflation (excluding energy and unprocessed foods) fell to 1.2% in August from 1.4% in June.

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