Panel 2

OPEC versus Kyoto?

Introduction

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The Kyoto Protocol[2]

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 CO_2 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 CO_2 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 CO_2 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 Sohngren 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 for 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 single 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 CO_2 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. It's 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 considered 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 Paris[8] 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 CO_2 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 CO_2 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 composition 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 CO_2 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 CO_2 emission trading for at least one year, although it announced that it is still committed to the long-term CO_2 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 CO_2-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 CO_2 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.