The Kyoto Protocol and its Implications for Energy

*By Richard Baron and Lee Solsbery**

By now, most readers of this newsletter are probably familiar with the phrase "Kyoto Protocol", and perceive very well that it is bound to be associated with many energy policy decisions to be made in the near and long-term future. In December 1997, Parties to the United Nations Framework Convention on Climate Change agreed to legally-binding commitments on the future greenhouse gas emissions of developed countries. For most of these countries, the brunt of the effort will necessarily fall on the energy sector, from primary supply through end-use. Climate change concerns will need to be reflected in many policy decisions, and virtually all economic activities will be affected. Governments, along with most concerned private actors, are now struggling to elaborate cost-effective and practical policies and measures to meet this challenge. Along with the issue of energy market liberalisation, climate change seems to have become a pillar of energy policy making: energy policy analysts and economists have a lot to contribute to assure that environmental goals are met effectively in the future, while preserving other energy goals.

What Was Agreed at Kyoto

Net Reductions in Annex I Parties

Overall reduction commitments for greenhouse gas emissions accepted by the industrialised countries amount to 5.2 per cent compared to 1990 levels. They are to be reached over a first "commitment period" from 2008 to 2012. All six greenhouse gases are covered, not only carbon dioxide, which accounts for the greater part of emissions, but also methane, nitrous oxide, perfluocarbons, hydrofluocarbons and sulphur hexafluoride. Net reductions or increases in emissions from changes in land use and forestry activities undertaken since 1990 count against national emission commitments.

Despite initial resistance from some Parties, the Annex I Parties (essentially the industrialised world) agreed to differentiated reductions – 8 per cent for most of them, 7 per cent for the United States, 6 percent for Canada, Japan, Hungary and Poland, and 5 percent for Croatia. New Zealand, Russia and Ukraine are to stabilise their emissions at 1990 levels, while Norway, Australia and Iceland were allowed increases of 1, 8 and 10 per cent, respectively.[1] Specific national circumstances and difficult negotiations resulted in this diverse set of commitments. Most striking is the situation of some countries with economies in transition to a market economy (Russia, Ukraine and others), whose current emissions are much lower than the emission level they have been allocated in the Protocol, to reflect their dire economic circumstances and the prospects for recovery.

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See footnotes at end of text.

Policies and Measures

A core issue of the Kyoto negotiations was related to the adoption of mandatory common policies and measures. The rationale for such an approach could be twofold: alleviate competitiveness concerns from certain segments of industry, and generate possible economies of scale for technologies such as renewables, by sending a broad-based signal to the market. Mandatory policies and measures were not agreed at Kyoto, as the weight of specific national circumstances won over the need for harmonisation. But the Protocol does include a list of priority policy areas, covering energy efficiency, renewable energy sources, market imperfections running counter to the objective of the Convention, and market instruments. Non-CO_2 greenhouse gas emissions such as methane from the production, transport and use of fossil fuels are also stressed.

International policy cooperation is addressed through the need to enhance the effectiveness of policies and measures, and to share related information and experience. Parties to the Convention are encouraged to implement R&D and increase the use of CO_2 sequestration technologies, as well as new and renewable forms of energy, greater energy efficiency and other advanced and innovative, environmentally sound, technologies. The door is still open to further coordination of policies and measures, if Parties decide it could be beneficial to the objectives of the Protocol.

Flexibility Mechanisms

Flexibility and provisions for international cooperation in meeting emission reduction commitments are a novel and critical feature of the Protocol. Four articles contain the main elements of geographic flexibility, with different levels of detail and need for more elaboration by Parties. Still, at the end, they all deal with the same matter: reductions towards the quantified emission objectives of developed countries. For this reason, further negotiations on one article are likely to influence negotiations on others, in order to maintain their overall consistency.

Under Article 4, any group of participating countries can agree to reallocate their emission commitments among themselves, so long as the resulting overall reduction meets their combined commitments. This new agreement must be completed prior to the ratification of the Protocol by the involved Parties, and is valid for the duration of the commitment period. This approach commonly known as "bubbling" would allow the European Union, for example, to share the burden among its Member states. If the group of Parties fails to meet its common target, each individual Party will be held responsible against its new objective under the agreement. Such agreement is akin to a form of emission trading, where all transactions occur at government level, and take place before the beginning of the first budget period. Also, no price signal emerges from such transactions, as they represent a political agreement based on elements such as the primary energy mix, emissions per capita, economic development, mutual economic assistance, etc.

Under Article 6, an Annex I Party may transfer verifiable emission reductions achieved through specific projects to another such Party. The Party receiving the reduction would see its allowable emissions increased, while those of the other Party would be reduced accordingly. This is referred to as joint implementation, and only applies to

emission reductions realised over the 2008-2012 period. It is open to the participation of legal entities, based on approval by their government. A central issue here is in the quantification of additional emission reductions compared to what would have happened otherwise (known as the "additionality" issue). The protocol specifies that the contribution of joint implementation projects to the achievement of emission commitments should be supplemental to domestic actions, without defining this notion any further.

Under Article 17, countries may "trade emissions". A Party which over fulfils its Protocol commitment may sell the "surplus" to any other Party. Here again, emissions trading should be supplemental to domestic actions. Other principles and rules for emissions trading have yet to be defined and adopted, however. This issue is on the agenda of the next Conference of the Parties, which will constitute an opportunity for all Parties to have an open discussion on an instrument that was unknown to many at Kyoto. Lack of understanding was the apparent cause of last-minute reluctance on the side of developing countries to accept a tool that seemed to grant emission rights to the developed world. Although Article 17 does not specify whether private companies would be allowed to trade, they are authorised to do so among Annex I Parties under Article 6 on joint implementation. It is therefore highly probable that Parties will allow private entities to participate in emission trading when they come back to this question in Buenos Aires in November 1998, or in subsequent negotiations.

Under Article 12, developing countries may transfer certified emission reductions from sustainable development projects to Annex I Parties. Any such reductions achieved from 2000 onwards may be transferred to, and used by, the industrialised country which acquires them to meet its commitments in the first budget period, from 2008 to 2012. The private sector is explicitly allowed to initiate projects of this type. The device has been dubbed the "Clean Development Mechanism". As with emissions trading, it still lacks a specific code of procedures, the role of its executive board, and the notion of certification. It will be under close scrutiny regarding the assessment of how many reductions are indeed additional; unlike joint implementation projects within Annex I, where one Party's allowed emissions are increased and the other's are decreased, developing countries do not have such overall emission goals against which to assess the real nature of reductions. In spite of these methodological difficulties, the Clean Development Mechanism is a clear and welcome step to a more global approach to climate change.

For many people inside the negotiations, the definition of the Clean Development Mechanism was very much a surprise. It emerged from an original proposal tabled by Brazil, which included a clean development "fund", to be financed by penalties paid by those developed countries who would not fulfil their assigned emission commitments. The fund was to finance sustainable development projects and generate emission reductions. Many elements of the Brazilian proposal were dropped, including, most importantly, the international financial penalty for non-compliance, and the clean development fund evolved into a clean development mechanism, introducing the possibility to generate credits in the developing world, for use by the developed countries. This is a goal many had been pursuing since 1995 under another instrument (so-called activities implemented jointly), the results of which were to be assessed by 1999.

A final important element of flexibility in the Protocol lies in the adoption of a five-year commitment period, rather than a target set for a single year (e.g., a 5 per cent reduction in 2010). Under the actual provision, countries may take actions throughout the five years, when it is most convenient and cost effective to do so. They also have the possibility to save reductions beyond their objective and use them in a future period, an option referred to as "banking". The possibility to borrow future emissions for the current period has been ruled out for now, due to concerns about the inability to ever assess compliance from Parties who would permanently resort to emission "borrowing".

A clear achievement of the Kyoto negotiations was to include mechanisms that can help minimise the overall economic cost of this new carbon constraint. But more work is needed to transform this potential into cost-effective emission reductions.

Where Do Negotiators Go From Here?

The Kyoto Protocol leaves a number of questions hanging and issues unresolved. First and most obvious is the prospect for ratification. The Protocol will enter into force only 90 days after it is ratified by 55 Parties which together accounted for 55 per cent of the industrialised world's greenhouse gas emissions in 1990.[2] Many countries are expected to ratify quickly. But in others, the Protocol is politically controversial and legislative approval is by no means guaranteed. In the United States, for example, a large majority of the Senate has served notice that it would refuse to ratify any agreement unless major developing countries actively participate. In the European Union, a Council of Environment Ministers will decide, at the end of June, the new burden-sharing agreement among EU Member states. There are indications that this new agreement would not depart significantly from the one agreed in March 1997. Still, countries like Germany and the UK, who had agreed to more stringent reductions to offset other Members' growth in emissions, would now be held accountable against these ambitious objectives if the EU "bubble" fails to meet its 8 per cent reduction objective.

What the developing world will do is the second great uncertainty after Kyoto. The UNFCCC process has advanced with this Protocol, there is no question of that. So far, however, it binds only the richer countries – the countries which produced and still produce the lion's share of greenhouse gas emissions. But the developing world is catching up rapidly, through economic development and demographic pressure. Several proposals for developing countries to adopt voluntarily emissions limitation commitments were advanced at Kyoto. The developing countries, also known as the Group of 77 and China, rejected them all, reminding other Parties that the Mandate agreed at Berlin in 1995 was to negotiate towards a Protocol that would not introduce any new commitment for developing countries.

The Clean Development Mechanism is based on projects and as such, is unlikely to significantly alter the growth of developing countries' greenhouse gas emissions. Article 10 of the Protocol does contain recommendations on policies and measures that apply to all Parties, including developing countries, but it remains fairly general at this stage. There

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is no question that a core issue for upcoming negotiations will be the engagement of most advanced and major developing countries towards the adoption of limits to the growth of their emissions.

As for the Annex I countries which will assume commitments under the ratified Protocol, the unanswered question is just how "binding" the document will be. So far, Article 18 on non-compliance has no real teeth, so the Protocol relies mostly on moral suasion. This raises some concerns about the success of instruments like emissions trading, where compliance with the emission cap is critical to the participants's confidence in the system.

Energy Implications: Markets and Policies

Even a superficial reading of the Protocol yields evidence that energy is at the heart of the Kyoto programme. Energy contributes decisively to the problem. Energy will have to bear the brunt of the emission reductions burden.

What Constraint on Energy?

Quantifying the exact level of required reductions in energy-related emissions is difficult at this point. The task is complicated by the wide range of natural and anthropogenic sources of greenhouse gas, as well as by the varying costs and political implications of abating emissions in various sectors. What is incontestable is that carbon dioxide emissions from fossil fuel combustion represent about four-fifths of all greenhouse gas emissions in the industrialised world. Energy production and use is also a source of methane and nitrous oxide. By comparison, the contribution of perfluorocarbons, hydrofluorocarbons and sulphur hexachloride – three other greenhouse gases covered by the Protocol, which are not energy-related – are reported to vary from negligible to 6 per cent of the total.

Because of the absence of any commitments by developing countries, the Kyoto negotiators have not set constraints on worldwide greenhouse gas emissions. As a logical consequence, there is no current prospect of a cap on world consumption of fossil fuels. Yet, what they did achieve was far from inconsiderable. Virtually the entire developed world will take part in the treaty, once it is ratified. Had there been no Protocol, studies by the International Energy Agency (IEA) indicate that energy-related emissions would have risen steeply above 1990 levels in the next decade, and national energy projections confirm this information. The curbs that are now planned will affect both supply and demand; they may well alter energy markets worldwide. As for the developing world, although it has made no commitments of its own, one effect of the Protocol is likely to be a speed-up in the diffusion to them of cleaner, more efficient energy technologies. Their energy demand will most probably go on increasing, but at a slower rate than if there were no Protocol. That is, unless there is major "leakage" of industrial activities from the developed countries to the developing countries, as a result of the greenhouse gas constraint applied on the former.

For the past decade, low energy prices have undercut the motivation to achieve energy savings. In future, the price of energy services is likely to reflect increasingly the social cost of the damage they do to the environment by exacerbating climate change and other local externalities. Such increases would foster efficient market responses. To be coherent and economically efficient, direct and hidden subsidies to fossil fuel production and use should be eliminated.

Carbon constraints will affect coal, oil and gas unequally. Coal releases more CO_2 per unit of energy than does oil; oil releases more than natural gas. Several countries have already introduced, or are considering, carbon taxes that would fall most heavily on coal. So far, these efforts have been limited by lack of political momentum; they now have a better chance of being realised. With or without such taxes, the Kyoto accord provides a clear signal to investors in expensive and long-lived energy-using equipment: unless it is used much more efficiently, coal will be more and more disadvantaged compared to oil and gas. While multiple unpredictable factors will affect future oil markets, nothing in the Protocol is likely to diminish worldwide demand for petroleum or undermine prices. In the medium run, natural gas is likely to gain an increased market share, if infrastructure keeps up with growth in demand.

Sectoral analysis provides additional clues to the Protocol's impact on energy. Emissions from stationary end-uses of fossil fuels in the industrial, commercial and residential sectors (including heating) have remained stable for about a decade and could well decline if new climate policies are enacted, given their relative sensitivity to price changes. Power generation and transport have been the fastest-growing sources of carbon dioxide emissions in IEA countries, both driven by final consumers' growth of income, and relatively stable or decreasing end-use energy prices. Fossil fuels are a major cost component in electricity generation and so utilities will be fully engaged in efforts to meet Protocol emission objectives.

Transport tells a different story. Two-thirds of transport emissions come from personal cars, and fuel costs are a relatively small component of overall transport costs (sometimes declining), even in countries with very high gasoline taxes. At the same time, car ownership and per capita car use in IEA countries appear to be far from saturation point. So the current trend is for CO_2 emissions from transport to continue rising, unless very vigorous new measures are taken; some such measures may be driven by climate change considerations while others may be taken to fight congestion or air pollution. Governments need to encourage further fuel economy, alternative fuels and new modes of transport, which warrants government-industry cooperation on research and development, and probably performance standards to orient markets. But such actions will take time to produce real results, as new technologies will come into play only as vehicle fleets are renewed and consumer psychology shifts. In this context, one can only welcome the agreement reached by European car manufacturers and the European Commission to arrive at an average of 140 grammes of CO_2 per km by 2008 for their marketed fleets (roughly 5.8 litres/100 km or 40 mpg for gasoline cars).

For all energy-related activities, the slow pace of capital stock renewal (half a century for buildings and some industries) will inevitably delay effects of measures to reduce CO_2 emissions. Unlike stop-and-go macro-economic policies, energy policies have considerable lead-time. This is a key reason why the industrialised nations must begin acting now to achieve the Kyoto goals, and further goals that may be negotiated in the future.

The Role of Domestic Actions

As economists, we prefer the use of market instruments to control emissions of greenhouse gas. The introduction of international emission trading should be welcome in that respect. If efficient, this new market will provide some crucial information for the negotiations of future commitments: the market price, i.e., the marginal cost of reductions, will indicate how far our economies can go to reduce our emissions in subsequent commitment periods. But we must make no mistake: the existence of mechanisms for cost-effective reductions at the international level does not guarantee that the ambitious emission goals set at Kyoto will be met. Emission reductions will be achieved through domestic actions; in some cases, these domestic actions and other economic developments will result into more reductions that can eventually be traded internationally. But how many countries are likely to be in that situation, and will they choose to sell or bank these reductions? Under all possible scenarios, no country can afford to rely entirely on others to achieve its Kyoto target.

As policy-makers, we must take a number of other factors into account, as climate change is not the only item on the agenda of energy policy, and energy policy is only one of several major policy questions that governments must tackle, both in the developed and the developing world. Competitiveness, unemployment, poverty in some segments of our societies are pressing issues, and energy responses to the Kyoto Protocol should not play against them, otherwise their political sustainability will soon be at stake. To be successful, climate change policy will have to set an unprecedented case of policy integration across different parts of national administrations, and involve a wide range of different stakeholders, from large industrial energy-users to citizens.

When thinking about potential policy options, it is useful to go back to the signals sent by energy markets over the past few years. In IEA countries, energy prices have generally been going down in real terms, except where countries have introduced new carbon/energy taxes. In parallel, the major policy thrust is towards market de-regulation which, in most cases, will deliver further end-use price reductions; this is a welcome outcome for consumers and our economies. Clearly, we should not count on energy market deregulation to deliver the environmental goals set at Kyoto. What this wave of deregulation does brings about, however, is a more level playing field for energy suppliers, definitely a good basis for a market approach to reduce greenhouse gas emissions. In that respect, some players have already demonstrated that emission trading is feasible, once both parties have an incentive to reduce emissions, e.g., through voluntary agreements set prior to the Kyoto commitments.

Because of the flexibility they offer, domestic emission trading systems appeal more to industrial sources than carbon taxes do, especially if the allocations are based on grandfathered emissions, as opposed to an auction. They also open a door to the possibility of international emission trading, provided governments have reasonable confidence that their domestic entities meet the emission objectives they have been given. Let us not forget that the Protocol will be signed by Parties, not by companies, even though reductions will come from private entities and citizens. This will have clear implications on the conditions under which domestic entities will be allowed to participate in the international system; in that respect, the so-far successful example of the United States SO_2 allowances trading programme[3] does not provide an entirely valid precedent for international greenhouse gas emission trading, as far as the organisation of such a system is concerned. Of course, the insights on the economic efficiency delivered by trading systems are relevant.

The most challenging sectors are probably those for which there are no ready-made policy instruments, or where economic instruments cannot be used as stand-alone policy tools for practical and political questions. For instance, emission trading systems are unlikely to cover all individual sources of CO_2, let alone all greenhouse gases in a country. The economist's alternative is carbon taxation to reflect the external cost of climate change and orient energy choices towards less carbon-intensive uses through competitive market responses. But the political implications of taxation are, in some cases, as complex as the design issues of emission trading systems...

We, at the IEA, observe in our day-to-day activities how energy markets depart often from full competition, from supply to final energy use. Given these inefficiencies, it is difficult to argue that market instruments like taxation alone can deliver reductions at cheapest cost. A pragmatic and rational approach would be to establish fully competitive and transparent energy markets, and send a signal that will then be best transmitted throughout the economy, when necessary. In many cases, governments will have to resort to regulatory approaches to supplement economic instruments. In other cases, regulatory approaches (such as energy efficiency standards) may be sufficient in the medium run, or they may be the only socially acceptable way to move forward.

From Climate Change to Other Global Energy Questions

The magnitude of the Kyoto challenge calls for a close look at all policy options, alone and in combination, to try and assess their cost-effectiveness, and provide practical recommendations to policy-makers on how to tackle the Kyoto commitments from the energy side. Energy economists have tremendous expertise to contribute to solve this problem, especially in a period when energy market uncertainties introduced by the wave of deregulation makes it necessary to master both the deregulation and environmental issues related to energy.

This expertise would also have considerable value added if it helped regions of the developing world in their attempt to address their growing energy needs and alleviate poverty. Instruments like the Clean Development Mechanism have a role to play, but projects, however numerous, cannot substitute for more structural changes that are necessary to meet broader development goals, and remove well-identified barriers to the penetration of cleaner energy technologies. A recent OECD study on fifty years' experience in international aid highlights that real scarcities may be in the domain of governance. In other words, the technology is available, what is required is the enabling environment and institutions for it to be adopted. Development agencies are trying new approaches along those lines: the European Bank for Reconstruction and Development is financing energy service companies (ESCOs), rather than specific energy efficiency projects; these ESCOs then implement cost-saving efficiency projects and pay themselves on the benefits. Investing in

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Italian Association of Energy Economists: First Quarter Activities

In the first quarter of 1998, the Italian Affiliate organised two important conferences in Rome to debate some relevant themes of the energy sector.

The first one organised in cooperation with Price Waterhouse at Banca Nazionale del Lavoro on 26 February 1998 analysed the EU Gas Directive and the related effects on the Italian market. This one-day Conference, in which more than 150 participated, ended with a round-table chaired by AIEE's President, Edgardo Curcio.

Fabio Fontana (British Gas Italia) outlined the possible scenarios that introduction of the new directive might have on the Italian gas market, among which new pipelines built and financed by various operators, the availability of gas releases for third operators that would start selling natural gas in Italy as well as the network access for big users to import and distribute gas.

Massimo Orlandi (Edison Gas) showed the present structure and future development of the Italian gas market, highlighting the growth of some sectors, among which the electric cogeneration is considered the most dynamic.

Philip Nutman (Price Waterhouse) focused on the effects of gas liberalisation, stressing the various steps of this process in other countries and assuming the possible process that will take place in Italy, a scenario characterised by uncertainty, e.g., the role of the main operator, the importance of eligible customers and most important, the problem connected to the role of strategic storage.

Pippo Ranci, President of the Italian Authority for Electricity and Gas gave his contribution, which was followed by a representative of Federgasacqua, Fabio Fantini, who suggested as eligible customers, the Italian public utilities, although they do not present high levels of gas consumption, they nevertheless have homogenous features and provide the country with public services.

Distinguished representatives took part in the Round Table, among whom, Giulio Paini, Managing Director of Edison Gas, Angelo Ferrari, President of SNAM, Giuseppe Gatti, President of UNAPACE and Fabio Fontana, Vice President of British Gas Italia.

Paini stressed the importance of liberalisation after the adoption of the EU directive and he reiterated the need for opening the market and allowing enlarged flows of supply.

Ferrari confirmed SNAM's attitude to use the directive as an opportunity to boost efficiency, to make gas processes much clearer and, therefore, to optimise the role and participation in the domestic market.

Gatti underlined the importance of defining the market of eligible customers that could presumably reach a more than 30 percent share of the overall market. He also reiterated the need for splitting the various phases of SNAM production and distribution processes and enabling network access to third parties.

The second Conference - held in Rome on 26 March - dealt with the theme *The Energy System After Kyoto: Analyses and Perspectives*. Some 140 participants attended the meeting in the XVIIIth century Halls of Palazzo de Carolis, seat of Banca di Roma. The conference addressed all topics relating to the resolutions adopted in Kyoto in occasion of the IInd Communication on climate changes.

As for the oil sector, P. De Simone stated that, provided steadiness of overall fuels consumption, fuels are likely to be involved in the eventual reduction of emissions (also following the further penetration of gas vs. heating gas oil and fuel oil), without leaving out that policies should be coordinated on a European level and be referred to the market.

As for the electrical sector F. De Luca assumed that half of all new plants are more efficient than the existing ones. This goal can be reached only under some circumstances: first of all, the national electric market has to be clearly defined, and secondly renewable and similar sources should be rather competitive with respect to other sources.

The Italian Minister of the Environment, Edo Ronchi, ended the conference declaring that by April 30, the Italian Government will propose a first series of measures to implement the requested CO_2 reduction as set forth by Kyoto. These measures include the incentives for electric cars, the development of the photovoltaic sector and a series of agreements with the motorcar, household appliances and chemical industries.

The Italian Minister also confirmed the objective of a 7 percent reduction of CO_2 emissions in Italy by 2010 compared to 1990, although the Government is still waiting for the EU directives on the distribution of the various engagements taken in Kyoto.

Edgardo Curcio

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these companies provides more leverage, lower transaction costs for the lending agency, and develops valuable capacity in countries.

If Parties are to address seriously the issue of global climate change, the Kyoto Protocol is only a first and small step towards a more sustainable energy future, however ambitious it is when compared to ongoing trends in fossil energy demand. More nations will eventually need to come onboard to limit emissions, as their level of economic development allows them. In the meantime, effective policy cooperation between governments and experts can help set the environment right for more efficient energy systems, whether or not climate change is considered an energy priority: price distortions, subsidies, market access and consumer information should be examined and reformed, when necessary. In time, this more efficient energy framework will form the basis for effective responses to climate change and other environmental concerns.

Footnotes

[1] The full list of countries with their respective commitments is contained in Annex B of the Protocol.

[2] For instance, this rule means that the Protocol could theoretically enter into force without the participation of the United States, whose emissions amounted to less than 45 per cent of Annex I Parties total emissions. The environmental effectiveness of the Protocol would, however, be greatly reduced.

[3] See Ellerman, Denny, R. Schmalensee, P.L. Joskow, J.P. Montero and E.M. Bailey (1997), *Emissions trading under the U.S. Acid Rain Program - Evaluation of compliance costs and allowance market performance,* Report, MIT Center for Energy and Environmental Research, Cambridge, Mass.