Climates of Change: Sustainability Challenges for Enterprise

Smith School Working Paper Series

3 September 2009

Working Paper 09-01

EU climate-change policy— a critique

Professor Dieter Helm

Author: Professor Dieter Helm

Climates of Change: Sustainability Challenges for Enterprise

Smith School Working Paper Series

EU climate-change policy—a critique

Professor Dieter Helm

From The Economics and Politics of Climate Change, edited by Dieter Helm and Cameron Hepburn, OUP, October 2009.

I Introduction

Environmental issues in general, and climate change in particular, lend themselves to EU rather than national policy: many of the effects (such as acid rain and water pollution) are regional, and climate change is global. To date, the EU has had some notable successes, of which addressing the problem of acid rain is perhaps the most significant in both scale and impact. But when it comes to climate change, there has been much action but little effect. Even though the EU comprises over 20 per cent of world GDP, and despite its historical responsibility for a considerable amount of the carbon dioxide (CO_2) in the atmosphere, its efforts in the last two decades have probably not made as much as one part per million difference. Indeed, it is arguable that, even in comparison with the USA, the EU has not made much progress. The rhetoric, the plethora of initiatives, directives, and interventions has not been matched by outcomes.

It might be argued that to date this is not surprising: much of the policy has been largely a 'trial'—a process of learning by intervention, potentially leading to a significant future advance both within the EU and at the international level. The January 2008 Climate Change Package (CEC, 2008*a*) and the negotiated agreement at the December 2008 Summit (CEC, 2008*b*) argue that the new 2020-20-20 targets will deliver the desired effects.[1]

This critique focuses on the 2008 package of measures. The starting point is the measures taken so far, notably in respect of Kyoto, and its production-based measurement of emissions (section II). This sets up the context for the 20-20-20 package (section III) and the subsequent analysis of each of the main components: the EU Emissions Trading Scheme (EU ETS) (section IV), the renewables targets (section V), and the energy efficiency measures (section VI). Critiquing a particular package necessitates an analysis of the alternatives—what the EU has not done, but

[1] The EU is committed to reducing its overall emissions to at least 20 per cent below 1990 levels and increasing the share of renewables in energy use to 20 per cent by 2020.

could have done. The notable components are nuclear, significant carbon capture and storage (CCS), and a serious R&D programme, as well as a carbon tax with a carbon import component (section VII). The critique and the alternatives come together in an overall assessment of the EU's climate-change policy and provide the conclusions (section VIII).

II. The starting point

The EU has from its foundation been primarily focused on trade and economic integration. Beginning with the Coal and Steel Community, it moved to a customs union. The political 'deal' at the heart of its foundation was the integration of Germany into the European economy after the Second World War, and the 'price' Germany paid was to support French agriculture.

Unsurprisingly, therefore, the Common Agricultural Policy absorbed much of the EU's budget for decades. After the Gaullist stalling of further integration in the 1960s, the EU in the 1970s began to move towards a currency reform, eventually resulting in a currency union for the main economies. Liberalization played a part in completing the internal market—first through the 1992 programme and then with the Lisbon agenda. New members were added, as the southern dictatorships of Greece, Portugal, and Spain embraced democracy, and the Soviet Union imploded.

Along this path and with its preoccupations, the environment played at best a peripheral part. The EU was never until recently an environmental project. That does not mean that there were no attempts at EU-wide environmental policy. Rather they were focused on specific issues. Acid rain was one such example, and it was an EU matter because it was regional rather than national. The Large Combustion Plants Directive (LCPD) (CEC, 2001) proved to be a core measure, with the effects still playing out.

Similarly, energy has been primarily a national undertaking, with national champions playing a key role—notwithstanding the early Treaty Establishing the European Coal and Steel Community in 1951. As the 1992 programme to complete the internal market got under way and as privatization and liberalization were tried in the UK, the competition elements of energy policy became more important, though, as the Commission reported in January 2007 (CEC, 2007), attempts to create a competitive European-wide energy market have been largely a failure. Integration through network development has also been largely unsuccessful.

Climate change came very late to the EU, and its importance has transformed environmental issues from the periphery to the core. In 2008, the EU effectively made it its central policy focus. This centrality was partly a matter of expediency—the failure quickly to ratify the Lisbon Treaty left the EU short of initiatives in 2008, and, more importantly, climate change provided a way in which it could demonstrate relevance to the wider public, faced with widespread scepticism about the EU's performance. The impotence of the Commission in the face of the global economic downturn

reinforced this.

Climate change provided not only an opportunity to demonstrate the Commission's relevance, but also a foreign policy role for the Commission. Indeed, the climate-change policy issues started off with the global negotiations following the Rio Summit in 1992, and then the Kyoto follow-up. In a crowded international space—with, notably, first Thatcher and then Blair championing the cause of abating emissions—the EU had to compete with the G8 and other international forums. Yet the decisive advantage the EU had was that it actually wanted to commit to Kyoto targets in a context in which others—notably China, India, and the USA—did not.

Why did the EU lead on Kyoto? A combination of factors contributed to the strategy. The wider political attractions were compounded by the fact that Kyoto targets were seen as achievable with little or no pain. The collapse of the Eastern European and Russian economies at the end of the 1980s played helpfully against the 1990 baseline. The targets were defined in terms of carbon production, rather than consumption, and that neatly avoided the need to make substantial north–south financial transfers. Finally, more narrowly, European governments entered the 1990s in the context of declining support for the major parties and hence coalitions were increasingly required to form governments, putting green votes in a powerful position, able to exercise political leverage beyond their voting base. In this they were supported by lobby groups backing particular technologies. In response, major parties scrambled to incorporate this green vote.

In playing this leadership role, the EU was isolated. The USA stood aside, as did most of the other major powers. Only by persuading Russia to join Kyoto could it be implemented, to meet the hurdle for participation. The EU therefore turned to Russia, and there followed a series of diplomatic initiatives which eventually brought Russian on board. These included support for World Trade Organization (WTO) membership. For Russia, the calculation was simple: the scale of its economic collapse in the early 1990s meant that it would be unlikely to bear significant costs, and there was also the calculation that Kyoto might be better than more effective action to tackle global warming, which, for a predominantly carbon economy, may have represented a significant threat.

The EU went much further than supporting Kyoto; it pursued two parallel policies which would eventually figure as central to the 2008 package: the EU ETS and the promotion of renewables. The EU ETS came about as a combination of the growing enthusiasm for market mechanisms, the recognition that there needed to be a carbon price, and the strong lobbying by polluters for a permits scheme rather than a tax. EU attempts to go down the carbon tax route in the early 1990s had failed to get off the ground, and the UK-only ETS experiment provided an example to draw upon. There was also the evidence from permit trading in the USA for sulphur, and a recognition not only of its success but also that it might be better than the regulation-driven LCPD in Europe.The EU ETS started in 2005 for an initial trial period running until 2008. Permits were

grandfathered (as industry had hoped), incumbents gained a strategic advantage, and there was an intense debate about whether the result was windfall profits.

The carbon price proved volatile over the period, with a noticeable collapse, and this period coincided with rising oil and gas prices, too. There can be little doubt that lessons were learned—indeed, these have formed an important component of the proposals for the post-2012 period. The other main component of early EU climate-change policy focused on renewables. Here, the EU was largely confined to exhortation, encouraging the spate of national initiatives, targets, and instruments. The result was a mishmash of support mechanisms, from feed-in tariffs to traded permits for renewables, and widely varying levels of penetration. Targets, such as the EU's 1997 target of generating 12 per cent gross domestic energy consumption from renewable sources by 2010 (CEC, 1997), made little initial progress, and the January 2007 'Renewable Energy Road Map' (CEC, 2006) listed the long history of initiatives on renewables. Until the 2008 package proposals, renewable remained in practice a national affair.

Perhaps of more importance in this early period was not what was done, but rather what was not done. Outside France, and some countries bordering on Russia (such as Finland), nuclear power was regarded with, at best, indifference and in many countries with outright hostility. Germany had a phase-out plan (as Sweden had had), the Netherlands showed no enthusiasm, and the UK effectively closed off the option in 2003. The memories of the Chernobyl nuclear accident in 1986 remained fresh, the oil price stayed low until 2000, and the green groups had a long anti-nuclear pedigree carried over from the Cold War. Renewable energy lobbyists also feared that a revival of nuclear would crowd their preferred technology out, and put the spotlight on its costs relative to nuclear.

The EU was also very slow off the mark on CCS technologies, and whereas the USA had, through the FutureGen initiative,[2] put the emphasis on R&D, in Europe the steps were tentative, and the European Institute of Technology concept—to rival the Massachusetts Institute of Technology (MIT)—came later, facing much national opposition. Finally agreed in November 2007, the Institute is only now getting set up (European Parliament and Council of the European Union, 2008). Thus key aspects of climate-change policy—base-load technologies and R&D—were not prioritized, and it remained for gas to fill the vacuum created. This comparative neglect carries over into the current context, as we see in section VII below.

The EU's attention to security of supply was negligible throughout much of the period from 1990 to 2006, while the contribution of the LCPD (which squeezed coal) and the impact of the renewables programme (which needed back-up for its intermittence) led to a further dash-for-gas. The fact that

[2] FutureGen, launched in 2003, was one of the outcomes of the US National Energy Plan 2001. Another was the Nuclear Power 2010 programme. See the US Department of Energy website for details.

this gas increasingly came from less reliable sources did not seem to register on the EU's radar and, as we shall see, by 2008 the consequences were beginning to be felt, with inevitable implications for the generation mix, the future of coal, and, therefore, for future CO_2 emissions.

Finally, while security of supply was neglected, the liberalization agenda was being pursued with enthusiasm. The Commission took it for granted that increasing competition and unbundling the networks would enhance both security of supply and carbon abatement—yet neither was necessarily true. Driving down the price of electricity and gas in the absence of an appropriate price of carbon may well have exacerbated distortions and increased emissions, while the unbundling process did not obviously improve Europe's bargaining power with Russia. At no point did those in charge of the liberalization of energy agenda appear seriously to consider the security and environmental consequences as they pursued the 'British model' of liberalization and competition. It was *asserted* that liberalization would increase security, but quite *how* remained unclear.

In 2006, the EU was still focused primarily on the liberalization agenda. The Commission carried out a study of competition and liberalization in the electricity and gas sectors, and concluded with a damning report in January 2007 (CEC, 2007), recommending the ownership unbundling of networks. Resistance from Germany and France was fierce, and by the end of the year it was evident that there would have to be significant compromises if directives were to be agreed.
A better way to reconnect with voters was through the climate-change agenda. Whereas the big three EU members could not agree on unbundling, they could on climate change. France had nuclear, Germany had its powerful Green Party and coalition formation issues, and the UK had its claim to international leadership. With the post-Kyoto negotiations gathering momentum through the various conferences and meetings of the parties to the Framework Convention, the EU turned its attention to its self-proclaimed leadership role in international negotiations at Bali. So was born the 20-20-20 programme, as the climate-change package in January 2008 was termed.

III. The 20-20-20 programme

Any package with a title of matching '20' numbers has got to be primarily political. The probability that the correct answer to the question of what to do about climate change is even approximately 20 per cent overall reductions, with 20 per cent from renewables—and then 20 per cent from energy efficiency—is close to zero. Its political resonance is matched by its economic inefficiency. Below, the renewables target and the role of the EU ETS are considered in greater detail. Here we concentrate on two aspects of the package: the 20 per cent overarching target and the extent to which the various elements fit together.

The overarching target of 20 per cent is a deceptively simple number. In practice, it is not at all

clear what achieving it requires and, indeed, whether, if it were achieved, it would make much difference to global warming. The 20 per cent relates to the production of greenhouse-gas emissions within the EU as a minimum target. But why would this be a good number? Why not 10 or 30 or 50 per cent? What is the link to the stabilization objective of 550 parts per million (ppm) CO_2e by 2050?

The Commission itself does not think the 20 per cent target is adequate. It states that in order to limit global average temperatures to not more than 2°C above pre-industrial levels, developed countries as a group should reduce their emissions to 30 per cent below 1990 levels in 2020 (CEC, 2009, p. 2). Climate change is a global phenomenon, and it is far from obvious that the EU is the best location to make these reductions on this timescale. There may be much cheaper ways, for example by preserving tropical rainforests or decarbonizing China and India's rapid coal-based economic growth. But here the Commission sets the baseline for the contribution of the developing countries to 15–20 per cent below business-as-usual (BAU)—in China's case, presumably BAU represents the pre-recession 10 per cent + GDP growth per annum. The EU target does permit reductions from outside the EU to be counted towards the target—through the Clean Development Mechanism (CDM)—but, as we see below, it is far from clear that CDM reductions are equivalent to internal EU reductions.

This international dimension raises perhaps the most important aspect of the 20 per cent overall target: it is based on production of carbon within the EU, and not on consumption. Thus the EU can achieve its targets if it switches carbon production that would have taken place within the EU to overseas, and then imports back the goods and services which would have caused the emissions internally. And, to the extent that energy-intensive industrial production is shifting globally from developed to developing countries (which it is), the 20 per cent target can be achieved without reducing carbon concentrations globally by the implied amount. Indeed, if the production techniques in developing countries are less carbon-efficient than in developing countries, and if we add the emissions from shipping, aviation, and other transport, it could even increase emissions. There appears to be no clear analysis by the Commission along these lines, so it cannot assess what contribution a cut in carbon production of 20 per cent in the EU would make to mitigating global warming.

Worse still, by presenting the EU as taking a leadership role with its 20 per cent target, it sidesteps the substantial question at the heart of climate-change policy. This was set out in the Brundtland report (WCED, 1987) on sustainable development and the North–South divide. The key challenge for climate-change policy is how the developing world can raise its standards of living towards those of the developed countries and at the same time global carbon emissions and other environmental damage can be reduced. Brundtland understood that at the heart of this sustainable development problem is the transfer of resources from the North to the South—in money and

technology. China can argue that its *per capita* emissions are much lower than those in Europe and the USA, and hence the developed countries should take the brunt of emissions reductions. Furthermore, since the developed countries are responsible for most of the stock of carbon in the atmosphere as a result of their industrialization, it is the developed countries which should pay China not to follow the same path. China can also argue that much of its emissions are caused by demand in developed countries—in effect, emissions have been outsourced.

The 20 per cent target is not just internally focused, it is designed with the explicit aim of facilitating an international post-Kyoto policy framework. The EU proposes that if the USA and others come on board, then the target will be increased to 30 per cent. Even more so than for the 20 per cent target, the Commission provides no serious analysis as to how it imagines that in just 10 years this might be achieved—since the USA and others will not agree before at least the Copenhagen Conference at the end of 2009, and possibly not until the 2012 deadline for Kyoto expires. To propose a further 10 per cent reduction in carbon emissions in less than a decade is not credible and, that being so, the EU is unlikely to achieve its objective of incentivizing other countries to take aggressive targets, too. Only a major long-term global recession for much of the period would make this sort of target plausible—and in such dire economic circumstances, it is far from obvious that the politics of global warming will be benign, given the costs of the interventions.

The 2020 date itself is a further serious flaw in the EU package: 2020 is so close that it is unlikely that there will be much technical change by then. In other words, the target is to be met by existing technologies. As a result, there are only two major candidates to meet the target on the energy side (in addition to outsourcing energy-intensive industries): renewables and demand reductions. In the renewables category, wind is likely to be the main technology. Energy efficiency might help to reduce demand, but not necessarily. If income rises sharply over the period, overall demand might also rise, even if energy efficiency goes down. And energy efficiency itself creates an income effect.[3] There is not much room for nuclear before 2020, or for CCS. Tidal power is not likely to make a significant contribution until post-2020, and the target itself provides no incentive towards the sorts of R&D required. For transport, the focus is on biofuels, since hydrogen and electric-based cars are unlikely to be significant pre-2020 technologies. The contribution of biofuels to reducing global warming is at best controversial and could even be adverse. Thus choosing a short-term target date induces a very powerful technology bias—with both short- and long-term consequences.

The package approach (take it or leave it), which the 20-20-20 programme measures represent, follows on from experience with monetary union and with the earlier completion of the internal market in the 1992 package. At the European Summit in December 2008, the components were brought together in this form. But packages tend to be created with political rather than economic

[3] Sorrell (2009).

requirements in mind, and the results in terms of the interaction between the component parts depend critically on the conceptual coherence. In both the internal market and monetary union cases, the overarching rationale was clear. Here, it is much less obvious how the various aspects cohere. At one level, there is a target and a price instrument—the EU ETS. The idea is that the high-level target is disaggregated into a stream of permits, so that the price of carbon emerges as a result of achieving the target. In theory, there is one target, and one instrument, with the market determining the most efficient ways on the supply and demand sides to meet the overall objective.

However, the package has multiple instruments. Not only is there the EU ETS, but also the renewables target and a host of ancillary policies. If the EU picks winning technologies, and legally enforces their deployment, the remaining target to be achieved by the EU ETS will be the residual of the combination of energy (and transport) demand and the emissions after renewables have been taken into account. The permits should add up to this residual, but they do not, and no attempt has been made to add up the parts. On the demand side, this is partly macroeconomic, and partly driven by policy.

Just to confuse the picture further, there is ambiguity both about the CDM contribution to the target, and about changes which might result from the international negotiations after 2012. Then there is the possibility that the renewables target might not be met. Finally, as no consideration has been given to the serious security-of-supply problems facing Europe in the next decade, it remains possible that the constraints on coal (notably the LCPD) might have to be relaxed to keep the lights on.

Thus the 2008 package targets an arbitrary number (20 per cent), and then for primarily political reasons applies this arbitrary number to renewables and energy efficiency as well. It is based on carbon production, not consumption, thereby sidestepping Europe's responsibilities towards the developing world. It has multiple instruments, the overlaps between which have not been adequately considered. It is short term (and shorter than the R&D horizon), and little account has been taken of security of supply. As a result, the package is very unlikely to have the intended effects, and it will be high cost. And, of greatest concern, it is not at all clear what impact, if any, it will have on the concentration of carbon in the atmosphere. Though politicians may legislate for the future, if the package lacks credibility it will almost certainly be revised *ex post*. To these criticisms of the overarching target and the coherence of the package we then need to add the problems with the main components—the EU ETS, renewables, and energy efficiency.

IV. The EU ETS phase three

As with the overarching target, we need to ask: what is the question or questions to which the EU ETS is supposed to be an answer? The conventional response is that the global public bad—

carbon emissions—should be priced to reflect its social marginal costs, and hence facilitate their internalization in decision-making.

It is immediately apparent that there are several alternative ways of achieving the internalization of the social marginal cost: in particular, that the carbon price could be fixed directly via a carbon tax rather than through a permits scheme, and that command-and-control regulation provides a third option.

The choice of instruments is a topic which has been exhaustively researched in the literature, and two broad conclusions have been reached: that market-based mechanisms (tradable permits and carbon taxes) are generally better than command-and-control regulation; and between tradable permits and carbon taxes, the ranking depends upon the shapes of the costs and damages functions.[4] Put simply, under uncertainty, it depends whether the policy-maker is more worried about getting the damage or the costs wrong. In the climate-change case, a marginal increase in emissions is unlikely to make much difference to global warming, but a marginal increase in costs in the short run, above the expected level, might have big economic effects on competitiveness and economic output. Thus there is a strong case for arguing that taxes are better than permits for carbon emissions—a point which Nordhaus has made forcibly (Nordhaus, 2008).

Why, then, has the EU gone down the EU ETS rather than the carbon-tax route? The answer is almost entirely political. Following the tentative suggestion in the early 1990s that the tax route be followed, the policy process focused on the income effect—who gets the money. Under taxes, it goes to the governments; under permits, *if they are grandfathered*, the companies keep it. It is hardly surprising that for as long as the polluters expected grandfathering, they lobbied hard for this approach.

The politics has some twists, however, which affect the various interest groups. *Ex ante* auctions of permits give governments the capitalized value of what a carbon tax would have approximated. So if it is feasible to move from grandfathering to auctions, suddenly the income effect from the polluters' perspective is even worse under tradable permits than under taxes. However, if the revenues are ring-fenced—for example, for spending on particular technologies, such as CCS, renewables, and energy efficiency—a new set of vested interests has an incentive to argue for tradable permits since they now have a 'carbon pork barrel' to compete for.[5]

Rent-seeking is not confined to the technologies. A tradable permits regime creates new markets, which in turn create rents for participants. There is now a rapidly growing set of vested financial interests with every incentive to lobby for the retention and development of the EU ETS.

[4] Hepburn (2009)

[5] Helm (2009)

A further political argument relates to the role of the EU ETS in international negotiations. It is claimed that a tradable-permits scheme helps to achieve two additional objectives: to provide a way of integrating different countries' efforts to mitigate climate change; and to provide a mechanism for income transfer to developing countries. On the former, the argument is that other countries will be subject to the same political incentives, and hence will in any event construct their own tradable-permits schemes. The USA is the most significant case in point. Then fungibility between the EU and US schemes will lead to significant further efficiency gains. On the latter, the CDM has the considerable advantage that, in theory, it allows for cheaper ways of meeting carbon targets by bringing on board low-cost developing-country projects, and in the process facilitates some North–South transfers. The fact that these have very low visibility has the political advantage that voters will not see the consequences of the EU and particularly the USA transferring sums to the authoritarian regimes, such as China, and thereby increasing their competitiveness as decarbonization takes place.

As the EU prepared for the next phase of EU ETS, it argued strongly for a relatively simple 2012–20 phase-three regime with two principal innovations: many of the permits would be auctioned; and the domain of the permit scheme would be widened. Inevitably, this kicked off a political scramble for rents. The polluters lobbied again for grandfathering—especially in countries that are heavily coal-dependent (in a context where the alternative up to 2020 is largely gas), and for sectors facing international competition from countries such as China with no such permit requirements. Then, in addition to grandfathering, a number of EU members argued that the EU ETS should have a cap and a floor. The argument had much to recommend it,[6] in that were the carbon price to rise sharply there would inevitably be considerable *ex post* difficulties which might trigger intervention. Furthermore, a very high price of carbon would lead to significant carbon leakage—to countries with lower pollution standards, such as China. And if the price of carbon were to fall sharply—for example, in a severe recession—then investors in low-carbon technologies would be out of the market.

Although there are practical difficulties with implementation, the caps-and-floors approach would have mitigated many of the economic and political problems with the EU ETS. The ceiling would be clear and transparent, whereas in practice what may now happen is that, if the price rises, the Commission will be under strong political pressures to add in more permits under the CDM, change the timing of permit release into the market, and at the limit suspend the EU ETS.[7] Indeed, in the negotiations for a post-Kyoto framework, the Commission may well offer such an enhanced CDM to induce developing countries to take on more demanding targets, and if countries join the

[6] Helm (2008); Philbert and IEA (2008).

[7] The final compromise on the package permitted external offsetting of around 8 per cent of a country's overall emissions reduction target. See Kérébel (2009) for a summary of the negotiation process.

trading regime after 2012, they will probably come with the inducement of a significant quantity of free permits or 'hot air'.

In respect of the floor, many EU countries face the problem of supporting low-carbon technologies post-2020, and to do this they will need a long-term price of carbon. A floor in the EU ETS as a carbon tax in addition to and separate from the EU ETS permit price would achieve this, if there were also agreement that it would never fall from its initial (low) level. In practice, many EU members are likely to introduce such a tax anyway, in part for reasons of raising general revenues to address their budget deficits. The difference between an EU ETS floor price and a series of national carbon taxes is that the former is uniform across the EU, while the latter is not—with the inefficiencies that will be created as a result. In addition, in the absence of the floor, governments will increasingly be under pressure to subsidize low-carbon technologies which would otherwise have been supported by the floor price.

Having got the EU ETS up and running, there are now very powerful vested interests in not only perpetuating it, but also weighing in on its evolution. At the December 2008 EU Summit, these pressures were revealed, and the result has been at best very messy. The auctioning has been significantly reduced, the scope for *ex post* manipulation increased, and the resulting price expectation damaged. When combined with a sharp economic downturn and the associated demand destruction on the one hand, and with major security-of-supply problems in respect of Russian gas on the other, the EU ETS now looks a very shaky foundation on which to base the policy of decarbonization of the EU economy. The carbon price may even collapse, and very considerable volatility is already apparent. All of this will be accompanied by high transaction and administrative costs.

As time goes on towards 2012, the relative attractions of a carbon tax are likely to grow. A carbon tax provides a predictable and stable price of carbon, and it is not limited to 2020. It will enable some of the costs of the renewables programme to be absorbed through the tax base, and underpin the economics of new nuclear investments. It also has the merit of being able to take account of the price of oil: at $147 a barrel, the case for a carbon tax on top was weak; at $30 a barrel it is rather different. It might even be possible to make the tax broadly inverse to the oil price—thereby not only improving the efficiency of the tax itself, but also addressing some of the political constraints.[8]

The EU has therefore landed itself with a complex and relatively inefficient tradable permits system which maximizes the scope for vested interests to pursue the resulting economic rents. It provides no long-term price of carbon, and the short-term price that emerges is likely to remain highly volatile. It creates considerable problems for competitiveness which can only be met either by

[8] Coal would have to be considered, too, however, as a high price of oil might encourage a switch to coal.

effectively reducing the impact on the exporting sectors, or by introducing a border carbon tariff or tax. Over time, it is possible that the EU ETS will move from centre stage towards the margins, though the vested interests will likely keep it going. A carbon tax as a floor price, extending to imports, is a plausible way in which the carbon price may be supported. This is especially likely if China and India, at Copenhagen and beyond, do not take on binding carbon constraints themselves.

V. Renewables 20 per cent

For many, this rather gloomy assessment of the EU ETS is not of central importance. The main action, many argue, is with renewables (and, for some, nuclear). Neither technology is currently driven predominantly by the carbon price—both are very much the result of direct government

intervention in the market. Indeed, in the renewables case, the 20 per cent target sits rather oddly with the EU ETS—the former prescribes the share of a particular technology, while the latter leaves it to the market to sort out the relative shares of renewables, nuclear, energy efficiency, and switching from dirty to cleaner coal, and from coal to gas. The case for a market mechanism is precisely that policy-makers do not know the relative costs; the case for a renewables target is that they do, and, in particular, are able to calculate that it should be precisely 20 per cent. The consequence of having both appeals to those who argue that every mechanism available should be used, but it has significant efficiency costs.

As with the EU ETS, the starting point is to work out what is the question to which renewables are supposed to be the answer. It is far from obvious, and even less obvious why the answer is 20 per cent. Curiously, the very notion of a renewable is ambiguous: there is no clear definition—indeed, the concept itself is at best a relative one. It is not just a matter of semantics: the precise definition determines what is inside the protected domain and what is outside. And, of course, by varying (expanding) the definition over time, not only can the target be more easily met, but the returns to those projects well inside the domain are lowered as the supply of an increasing number of technologies goes up.

There are two approaches to this definitional question. The first is to try to find something intrinsic—that, in some way, the source of energy ‘renews’ itself. Wind and tides might fit into this category—the extraction of energy from them is argued not to reduce their future availability. The trouble with this sort of definition is that, on the one hand, it excludes a whole host of energy sources which policy-makers clearly want to include, such as biomass and biogas, and, on the other, fast-breeder nuclear reactors might almost qualify. The second approach is to define renewables as low carbon, but here again there are serious problems. For example, is the switch from coal to gas—which clearly *lowers* carbon emissions—‘low carbon’? Or, more obviously, does nuclear qualify?

This ambiguity creates flexibility, which is politically very convenient, but also creates uncertainty for investors. If, however, the overarching question is about reducing carbon emissions—the justification for the high-level target—the only practical definition is the low-carbon one, and therefore one that includes at least nuclear. This result is one that most in the renewables camp wish to avoid, either because nuclear might turn out to be more economic than wind and tidal power, or for more ideological reasons and concerns about waste.

The next question is why renewables need a special reserved quota. If the EU ETS provides the price of carbon, as the Commission argues, then why is this not sufficient? Here a host of arguments are advanced. First and foremost is the 'infant industry' argument. The claim is that renewables are *new* technologies, subject to R&D, and as deployment expands the costs will fall. As a defence of the renewables targets across Europe by 2020, it is nonsense.

Between now and the target date—less than 11 years—there is little scope for R&D resulting in deployed and operational assets. It is *after* 2020 that this argument would have traction. And in the next 11 years, much of the renewables will come from wind plus some biogas and biomass. In the wind case, the technology is well developed. There can be few who think that the renewables targets are necessary to incentivize a technical revolution in wind turbines in the next 11 years. A second argument is that renewables need special protection because there are other (non-carbon) problems with their deployment, and they bring other advantages not reflected in the carbon price. These include the absence of transmission and distribution networks designed with decentralized generation in mind, and the claimed benefits to security of supply from local and national sources. On the former, these issues are best addressed through the regulated networks, which are charged additionally to customers. And, indeed, the Commission has made the additional requirement (on top of the 20 per cent target) that wind should be given priority access to networks. On the latter, there is much evidence to suggest that a dash-for-wind will, in the next 11 years, induce an associated dash-for-gas (reducing security). Or, if gas is deemed too insecure a fuel source, the result could be a dash-for-coal (increasing emissions).

These considerations indicate that the renewables target is less about addressing climate change in the most efficient and cost-effective way, and much more to do with politics, lobbying, and vested interests. In comparison, the case for a broader low-carbon obligation is a strong one, but this might lead to more nuclear, less wind, and a greater focus on alternatives such as coal-based methane and incinerated landfill.

Developing wind power is a coordination problem between networks, wind turbines, and customers. It is inherently intermittent, and especially vulnerable to high-pressure weather systems which tend to be associated with static, cold, continental air in winter. Not only does it require networks that take power from decentralized sources to customers, but it requires significant back-

up generation capacity, and customers willing to absorb fluctuations in supply. In due course, battery storage and smart meters may help to solve these issues, but neither will have a noticeable effect before 2020.

Building the wind turbines before these technologies are widely available (and in the case of battery storage, even invented) is not only costly, but almost certainly more expensive than alternative ways of reducing emissions now. At the extreme, if all the extra subsidy that will go to wind in the next 11 years were instead to be invested in energy efficiency, the carbon reductions would be almost certainly significantly cheaper and greater. At the margin, although resources are being devoted to energy efficiency, there remains a trade-off. Furthermore, while the R&D on batteries and smart metering will take time to reach a deployable stage, the technologies for energy efficiency are largely mature.

The costs of the wind programme have been variously estimated. Looking back over the forecasts made by wind lobbyists is a revealing exercise. For those with an economic interest in capturing as much of the climate-change pork barrel as possible, there are two ways of presenting the costs in a favourable light: first, define the cost base as narrowly as possible; and, second, assume that the costs will fall over time with R&D and large-scale deployment. And, for good measure, when considering the alternatives, go for a wider cost base (for example, focusing on the full fuel-cycle costs of nuclear and coal-mining for coal generation) and assume that these technologies are mature, and even that costs might rise (for example, invoking the highly questionable ‘peak oil hypothesis’).

The correct way to do the analysis is to take the full-cost approach, and in the renewables case to include the full network costs and the back-up generation requirements. On this basis, most studies show wind power to be expensive relative to other fuels and, indeed, in many cases to achieve the dubious position of making nuclear power look cheap. On the back-up requirements, these can come through additional non-renewable generation (except where there is abundant hydro) and transmission interconnections over significant distances. In a national-only market, at the limit, if wind were 100 per cent of capacity when the wind was blowing, there would need to be another complete non-wind system in still periods. To put this in a more realistic context, whereas the UK’s expected energy demand is met with a current installed capacity of around 70 GW, by 2020 with the wind power required to meet the 20 per cent energy from renewables target, and with a lower demand (assuming the energy efficiency measures actually reduce demand, rather than reduce only costs), National Grid predicts that at least 100 GW capacity will be needed (National Grid, 2008).

On the costs side, advocates of renewables have an incentive to claim that costs will fall over time for their preferred technologies, but not for others. This has turned out not to be the case so far:

there is no evidence that wind costs have been falling—indeed, arguably they have risen significantly in recent years. The evidence to support the peak-oil hypothesis is highly questionable and, indeed, the predictions of oil at $200 a barrel (in current prices) not only did not materialize when made confidently at the end of the 1970s, but also today remain suspect. There is much conventional oil to be discovered, much discovered but not brought to market, very significant gas reserves, lots of non-conventional sources, and, of course, several hundred years of coal reserves. It is less the concern about running out of fossil fuels that should trouble policy-makers, and more the possibility that these reserves might actually be burned.

These considerations do not apply equally across all EU member states. Where there is abundant and developed hydro (little new hydro could be built by 2020), there is scope for balancing the system without fossil fuels. In some countries, too, the nature of transmission and distribution systems lends itself more easily to decentralized and intermittent wind, and as climate (and wind patterns) vary, so, too, do the costs of intermittency. There is then a case for considerable variance across member countries, and the Commission has tried to capture these in the varying national targets. Yet, in calculating these, inevitably politics plays a role, too. Because there are only 11 years to meet the target, the starting point matters. So, for example, the UK has a target of only 15 per cent because its own national targets for 2010 are being missed.

In such circumstances, it might be expected that the Commission would want to replicate the EU ETS by a system of EU-wide tradable renewables certificates, to allow the market to find the cheapest European locations for a very rapid deployment. This, however, has not been pursued and, as a result, the allocation of national targets has been a political process which will almost certainly raise the costs of reaching the EU-wide 20 per cent.

The final issue to consider is whether the targets are *credible*. The EU has a history of setting targets well into the future for future politicians to address. Investors, however, have to evaluate the risks that the policy might be weakened, abandoned, or delayed, since this affects the economics of renewables projects. Why should any investor believe that these targets will be met? In the design of this sort of regime, the key issues are: milestones, leakage, and penalties. It suits politicians to back-end load the renewables programmes and, indeed, that is inevitable given that there are only 11 years to go. Countries are required to lodge national energy action plans with the Commission by June 2010. This at least provides a basis for judging performance. Yet it is also reasonable to expect the EU to set precise milestones along the way to assess progress. These are, in practice, at best vague.

Second, credibility depends upon leakage, by broadening the definition of renewable through the inclusion of extra technologies, and including renewables investments from outside the EU. If, as the 2020 date approaches, the targets look like being missed, there will be a strong political

temptation to broaden the definition, since it is possible to expand the definition of renewables to include just enough technologies to meet the target. Allowing greater scope for counting renewables from outside the EU will also be a way of meeting the target. Declaring success by changing the measuring stick is one way of dealing with the possibility that the wind investments are not made to time.

Third, there is the issue of penalties: what happens if members fail to hit the targets? The uncertainty here is considerable: what if only one country misses? What if those missing have plans to catch up? What happens if lots of countries miss the targets? The Commission will be hard pushed to punish credibly those who fail, unless most succeed. Since success is already in considerable doubt, so, too, is the credibility of enforcement.

To these standard questions of the design of the renewables regime, there is a further one: will the scheme as a whole be changed or even abandoned? By the middle years of the next decade, there may be major security-of-supply problems. As old capacity is retired, and as the EU LCPD and the EU ETS bear down on the existing old coal power stations, the EU may confront an ugly situation of a major (and increasing) reliance on gas in the context of a politically uncertain relationship with Russia. Wind makes this worse: it requires a high total capacity to address its intermittency. The possibility of an energy crunch by the mid-2010s has been widely suggested. Faced with quantity restrictions or very high and volatile prices, there will be political pressure to moderate the targets.

Then there is the economic recession. Suppose it lasts for years—as in Japan. Are European consumers willing to pay the much higher costs of wind generation as it becomes a significant part of total capacity (and bills), rather than making its present marginal contribution? The politics of energy prices will continue to play its part.

Finally, there is the issue of other technologies. By, say, 2015, it will probably be clear whether Europe is to see a major nuclear expansion in the years after 2020. The potential contribution of CCS will also be clearer. Suppose by then a combination of nuclear plus coal with CCS looks a viable long-term way forward. In such circumstances, would the Europeans carry on regardless with the back-end-loaded wind programme?

For these reasons, the national renewables targets themselves remain uncertain, and this will affect investor sentiments. The renewables target is not only an expensive way of reducing emissions in the short term, but it lacks credibility, too. Renewables have an important part to play, but a crash programme in wind is not obviously the best way to address global warming.

VI. Energy efficiency

Alongside the 20 per cent renewables target, the EU has a similar one for energy efficiency. The rationale for an energy-efficiency policy is well known: there are significant market failures which inhibit the take-up of energy-efficiency investments. As a result, it is argued that a host of projects with positive net present values are forgone. One of these market failures is carbon emissions, but, as we have seen, the EU ETS is designed to solve this particular failure by virtue of creating a price of carbon to be internalized. Thus, intervention might be justified to deal with other market failures, but in the climate-change arena it is only justified if the EU ETS price of carbon does not accurately represent the social marginal cost.

This overlap of policy instruments is typically ignored by the advocates of energy-efficiency measures. Indeed, many argue that energy efficiency is the main mechanism for reducing carbon emissions. No serious attempt has been made by the Commission to estimate how far the EU ETS fails to internalise these marginal costs, and hence how large a contribution the additional measures are required to make.

In the context of these other market failures, there is an extensive literature on the scale and magnitude of the net present values forgone. Much of this literature has been written from the perspective of advancing the case for further intervention. Little research has explored the possibilities that these positive net present values might be the consequence of ignoring costs—in other words, of policy appraisal optimism. If the net present values are so high, why do apparently rational consumers and firms ignore them, and why have not new economic agents appeared as intermediaries? Unless the rationality assumption is relaxed, the working hypothesis should be that some costs have been omitted.

To the extent that there are barriers to efficient take-up, it is far from clear why the appropriate domain of policy is the EU. Indeed, there are strong arguments to the contrary. The temperature varies greatly from Greece to Sweden, as does the rainfall between Spain and Ireland. Building designs are not optimally set on an EU-wide basis, and the information base for setting policy instruments is typically national or even local. Planning regimes differ widely. The degree of public housing varies not only in respect of the private sector, but also between national and local authorities. Even the housing finance markets vary considerably. For these reasons, the Commission is in a poor position to set optimal policy, and to adjudicate across countries. Given, too, that countries start with very different housing and building stocks, a common target has little economic rationale.

Reducing energy demand will, *ceteris paribus*, reduce emissions. The economic recession which began in 2008 is, indeed, having a notable impact—it is probably the single most important method of abatement in 2009. However, the Commission jumps from this observation to the much more

contentious claim that increasing energy efficiency necessarily reduces emissions because it reduces demand. This is open to both theoretical and empirical objections.

If energy efficiency increases, then the amount of energy required to produce a given output goes down. However, as a result, the level of income goes up, since it now costs less to achieve the same output. It may also increase competitiveness if others improve energy efficiency less quickly. So, there is an income effect as well as a substitution effect. What then matters is what that income is spent on. It has been argued that, as energy efficiency goes up, consumers may spend some of the gains in income on energy-consuming activities.[9]

To these direct income effects, it is important to add in the effects of economic growth. Since the oil-price shocks of the 1970s (and particularly after the Iranian Revolution), the energy ratio has declined for many industrialized countries. Less energy is needed for incremental increases in GDP as economic growth continues. It is tempting to extrapolate this forward and, indeed, to use this extrapolation to set overarching targets. But this depends upon the composition of demand for final goods: for example, air-conditioning could pass a threshold cost against rising incomes and lead to an increase in energy intensity. As the price of energy falls relative to income, the demand may go up.

The above considerations suggest that energy efficiency may be important, but that demand reduction may be more so, as a policy to address climate change *in the short run* while the energy supply is dominated by fossil fuels. Demand reduction requires a higher price of carbon than energy efficiency because not only is the substitution from energy-intensive to less energy-intensive methods required, but there is also a requirement to offset the rebound effect and the broader impact of economic growth on energy demand. Energy-efficiency measures may be necessary, but they are not sufficient to address climate change.

VII. What is left out?

To sum up so far, the EU climate-change package is best regarded as a politically neat but economically inefficient set of targets. The '20' in all the targets is unlikely to be justified by the underlying costs and benefits: 2020 is short term, as is the supporting EU ETS and the renewables target. The critical component of a long-term price of carbon is therefore absent. The overlap between the price instrument and the renewables target has not been fully considered. On energy efficiency, it is not clear why the EU (as opposed to individual member states) has a target at all and, in particular, why in the short term it is targeting energy efficiency rather than energy demand. These criticisms are serious: the package is flawed. But yet more serious is what is left out of the package—the policy measures which would otherwise form a core part of a credible EU climate-change package. These include: a long-term price of carbon; base-load technologies, notably

[9] For example, the average temperature of houses in the UK has gone up from about 13ºC in 1970 to around 18ºC now (Committee of Climate Change, 2009). See also Sorrell (ch. 17).

nuclear and CCS; R&D; and a mechanism for addressing carbon consumption. There is little or no recognition that climate-change policy is not the only objective with respect to the energy sector—there is also little account taken of the implications for security of supply of the main climate-change targets. Market failures are multiple and, important though it is, climate change is not the only issue confronting governments and policy-makers in the energy sector.

Almost everyone agrees that a long-term price of carbon is an essential part of the architecture of a climate-change policy regime: it is necessary, but not sufficient (Stern, 2007, 2009). A price is needed to incentivize the demand and supply sides of the market, given that imperfect information pervades the economy, and the political economy of rent-seeking influencing public interventions. It needs to be long term for three reasons: climate change itself is a long-term problem; the capital stock in the energy sector is lumpy and long-lived; and R&D is an essential part of the solution. Why then does the EU ETS make little provision for the longer term? In its defence, the

Commission claims that the EU ETS is itself a long-term project: it does not end in 2020. So the 20-20-20 programme provides not only for the third-phase national allocation plans, but also the basis for an open-ended carbon regime. It argues that the commitment to the EU ETS should give confidence to investors whose time horizon is beyond 2020 that there will be a price.

This defence, however, places significant regulatory and political risk on private investors who are not well placed to bear it, and thereby raises the cost of capital. This risk is real: having witnessed the political debate in the run-up to the December 2008 Summit, it would be rational to conclude that the EU political commitment to the EU ETS is far from robust, and that the putting in place of mechanisms which enable *ex post* interventions signals that the EU support is tempered by the focus on the political acceptability of the resulting price of permits. Furthermore, there is not even a short-term stable price in the current EU ETS: it is volatile and in early 2009 much lower than the architects envisaged.

But the real political reason why there is no long-term price is that the Commission has repeatedly failed to advance the case for a carbon tax, and this, in turn, is tied up in the arguments about sovereignty over taxation. As a result, a major opportunity was missed in the design of the 20-20-20 package. As indicated above, a floor price could have been introduced—as a tax, rather than an internal mechanism to the EU ETS. It would be an external floor because, if internal to the EU ETS, it would have involved buying back permits at the floor price, which would have required public funds—in turn probably politically unacceptable. The long-term aspect could have been entrenched by an agreement to introduce the mechanism at a low initial level (given that the capital stock is fixed in the short run) and never to lower it in the future. Such a floor would have had the additional advantage that, should the EU ETS fail to develop as the central mechanism that the Commission envisages, it could be increased to take the strain of establishing a long-term carbon price.

As an alternative, had the Commission wished to entrench the EU ETS and give a longer-term price signal, it could have facilitated the auctioning of long-term carbon contracts, as advocated by Helm and Hepburn (2007). By holding partial future auctions of permits beyond 2020, there would be an intermediary between the sellers (the Commission or member states) and buyers for the period before the national allocation plans post-2020 were set. As a result, governments and the Commission would have a strong incentive to make sure that the EU ETS rolled forward after 2020 in order to transfer their (temporary) liabilities as counterparties to the auctioned contracts into the market.

To date, the Commission has vigorously opposed both floors (and ceilings) and long-term carbon auctions, in order to preserve the 'purity' of the existing scheme. The consequence for climate-change policy is very significant: there is no long-term price of carbon.

This absence of a long-term price of carbon bears down considerably on two base-load technologies which have the potential to play a major role in reducing emissions: nuclear and CCS.

Nuclear power is a known, deployable, low-carbon technology, capable of producing large quantities of base-load electricity. It is therefore not surprising that several European countries, notably France and the UK, are embarking on large-scale expansions, with most other major European economies at least actively considering the option.

Nuclear power stations have several economic characteristics that present particular climate-change policy challenges. The stations are typically large-scale, capital-intensive projects which take around 5 years to complete and last for decades thereafter. They also have very long-term waste issues. These characteristics require, first, a long-term carbon price, and, second, some form of long-term contract which binds customers to honouring the sunk costs of the investments. The former condition, as we have seen, is absent. The latter is largely absent, too, since the competitive liberalized market that the Commission has mandated into EU law tends to favour short-term spot markets and short-term contracting. There is, in the European version of liberalized competitive markets, no mechanism to commit customers over the relevant time horizon.
These problems are acute in nuclear, but not unique. Renewables similarly raise issues of long-term contracts, and the member countries and the Commission have encouraged renewables obligations which provide such contracts. Interestingly, while such mechanisms are deemed essential for wind, and competition issues are therefore put aside, the same path is not followed for nuclear. An appropriate way of addressing this issue is through expanding the renewables obligation into a low-carbon obligation.[10]

[10] See chapter 12 in this volume. Note that creating a level playing field does not of itself make nuclear power necessarily economic for the private sector.

Why has the Commission not pursued a level playing field for nuclear? As with the problem of a carbon tax, the answer is political. Several member states have political commitments to either phase out nuclear, or at least have a moratorium on future development. Germany is the key player here, and this position is a legacy of the Red–Green coalition under Chancellor Gerhard Schröder. The price of Green Party membership of the coalition was, in practice, the closure of at least one nuclear plant and an agreement to eventually get rid of the rest. It was a policy carried over to the Grand Coalition between the Christian Democratic Union/Christian Social Union and the Social Democratic Party.

The result of the anti-nuclear policies has been to create more room for renewables (as was intended by the supporters of renewables), and to encourage a further dash-for-gas across Europe—just as external gas dependency on Russia has become an increasingly serious problem for the EU. It is gas rather than coal, because the latter technology is under pressure for obvious environmental reasons, and the LCPD is forcing the closure of the coal industry across Europe. So just as the base-load capacity gap opens up across Europe, EU policies have been limiting the nuclear option (by failing to provide for either a long-term carbon price or long-term contracts) and accelerating the closure of coal.

As noted above, this will create major problems for both security of supply and climate change: by the middle of the next decade, the security-of-supply problem may turn out to be a binding constraint in Europe. Faced with the prospect of the lights going out, it is likely that the LCPD regime may have to be relaxed, both to provide that base-load and to provide back-up for the intermittency of a much greater share of wind.

The coal problem will not go away, however. Coal is the growing fuel globally, and hence it is the major problem for any effective global climate-change policy. Put simply, unless coal can be burnt in a less harmful way from a climate-change perspective, there will be little or no progress in abating global emissions. Any credible climate-change policy therefore has to have the coal problem at its core. The EU, by contrast, has it at the periphery.

The Commission has not entirely neglected coal. It is providing for a programme of demonstration plants for CCS technology, though the funding remains far from clear. But it is a question of scale and priority: the 20-20-20 programme places its overwhelming emphasis on renewables, and especially wind. The amount of resources to be devoted to wind across Europe up to 2020 dwarfs any contribution on the coal front. There is virtually nothing in the programme which provides for CCS gas transmission, the establishment of large-scale storage, and the deployment of CCS technologies—other than up to 12 demonstration plants, probably not running before the middle of the next decade. There is little thought being given to how the lessons of the demonstration plant

might be shared, or how the demonstration plants fit into wider international efforts. The contrast with the USA could not be greater. FutureGen has focused on R&D for large-scale technologies—notably nuclear, CCS, and hydrogen.[11]

R&D more generally is an area where the Commission would clearly like to have a larger role, but is hamstrung by the national approaches of member states (notably the UK) and lack of resources. The European MIT-type initiative is a case in point: jealous of national research funding, and of the loss of national expertise to a European institution, the original vision has been watered down considerably.

The comparative neglect of nuclear, CCS, and R&D provides a missed opportunity in tackling global warming. By concentrating on the EU ETS and renewables, the EU's contribution to addressing global warming between now and 2020 is likely to be marginal. Though there will be some emissions reductions as a result of these policies, they are likely to be partially offset by the need to rely on coal and other fossil fuels to back up the intermittency of wind. The EU ETS carbon price itself between now and 2020 will also have some effect, though at the low levels witnessed in 2009 it is likely to be swamped in its impact by volatility in the oil price.

While the EU focuses on the short-term carbon price and renewables, global emissions are likely to go on rising, driven by coal and by developing countries such as China and India. Both of these countries will increase their populations by 1 billion by 2050 and are heavily dependent on coal. Therefore, were the EU serious about climate change, the emphasis would be overwhelmingly on coal and China and India. But, as noted above, the production base for the 2020 20 per cent target (and for Kyoto) means that the measurement of 'success' is not the impact on global concentrations of CO_2 in the atmosphere, but the production of CO_2 in the EU. As also noted above, it is perfectly possible for the latter to go down, and the former to go up, and, indeed, possible that the consequence of reducing the latter might actually further exacerbate the former. So why has the EU not taken seriously the China/India/coal problem? The answer is that there appears not to be the political will to do what would be implied: not only to make much larger cuts in EU carbon production, but also to make the large financial and technology transfers to the developed countries. On the contrary, the EU has been lulled into the false assumption that tackling global warming is cheap. Across the EU, the most widely quoted number from the Stern Review is that it will only cost 1 per cent GDP (Stern, 2007). Politicians drop the caveats about 'good policy' and have been very keen to assure voters that climate-change policy will not have a significant impact on their standard of living. They can have their cake and eat it: claiming that economic growth can go on at 2–3 per cent per annum for the rest of the century *and* the world (and not just Europe) can decarbonize.

[11] The package includes a 'Directive on the Geological Storage of Carbon Dioxide', but this is primarily about the legal framework, not the delivery of a CCS industry.

The Stern Review cost estimates are seriously flawed. Even Stern himself acknowledges that once policy costs are taken into account 2 per cent may be more realistic (Stern, 2009). Probably the numbers are significantly higher. But it is the political interpretation of the number which has most damaged climate-change policy. For if the costs are much higher, voters have to be told that they will have to make greater sacrifices—that their current carbon consumption is unsustainably high, and that they will have to pay for the carbon embodied in the energy-intensive imports from countries such as China and India, and, in addition, pay for the industrialization of China and India in a less carbon-intensive way. Instead of the complacent line of 'no need to change living standards', the implication is a much more unpalatable one about having been living beyond our (carbon-constrained) means, and hence requiring an adjustment down in living standards in the West to accommodate the industrialising East.

This is a hard political 'sell', but probably necessary if climate change is to be addressed. It is the central challenge to the 'leadership' the EU has claimed, shaping global climate-change policy. It can be done by carrots and sticks. The carrots are direct transfers. These are, in part, included within the EU ETS through the CDM. But here the sums involved are trivial compared with the scale of the problem, and there are significant questions marks over the credibility of the projects financed in this way. More importantly, the CDM tries to go below the parapet of direct government-to-government agreements, and thus is unlikely to play a significant role.

The sticks are the use of border taxes and standards. A carbon consumption base could be constructed through a border carbon tax. This would internalize the consumption externality, and, indeed, it could be harmonized with a floor carbon price for the EU ETS, as discussed above. In effect, there would be a minimum carbon tax across the EU and at its borders. The objections are twofold: that it would be practically difficult to define and apply; and that it would encourage protectionism. There are obvious practical difficulties, but the perfect should not be allowed to over-rule the pragmatic: an upstream carbon intensity measure could be applied initially on crude bands of goods and then gradually refined. On protectionism, the objection is weak: the carbon problem is separate from the trade problem, and the border carbon tax improves the efficiency of trade since it prevents the artificial subsidy being applied implicitly in countries such as China by not pricing the carbon externality.

Taken together, a long-term carbon price via a floor price, a level playing field for all low-carbon technologies including nuclear, a major emphasis of CCS and R&D, and a border carbon tax would comprise an appropriate climate-change package for the EU. In comparison, a short-term emphasis on the EU ETS without a floor price and on renewables will have at best a marginal effect on global warming.

VIII. Conclusions

The EU has made climate change one of its principal concerns. It has recognized that an EU-wide approach is likely to be more efficient than a piecemeal national one, and that the EU as a whole has greater power in the process of forming global agreements. It is a major achievement to have gained acceptance of its role in climate-change policy among even its more Eurosceptic members. The design of its 2008 climate-change package is inevitably flawed—all such packages are political, and they require negotiations and concessions. The initiatives began well with the recognition that the price of carbon has a central role to play in the process of decarbonization. Yet the early promise of a market-based approach has been gradually emaciated by the politics.

There is a history here. The Common Agricultural Policy was the EU's main project in the 1960s. Its aim was to stabilize agricultural markets, but over time it metamorphosed into a grossly distorting and expensive policy. The agricultural lobbyists captured the rents. The danger is that the climate-change policy will go the same way—as interested parties battle for the very considerable economic rents attached to the various components.

The 2008 climate-change package is the result of a political process. The 20-20-20 catchy title cannot be economically efficient. The rationale for the 20 per cent overarching production-based target is hard to fathom, and it is a short-term approach to a long-term problem. The EU ETS is flawed, though not irredeemably so. The renewables target is costly and unlikely to be met. The energy efficiency target is centralized rather than localized. And, most importantly, the package leaves out arguably the more important bits—the long-term price of carbon, base-load technologies, and R&D.

Policy, however, is rarely designed on a blank piece of paper. We are where we are, and the task now is to take what has been placed in legislation and try to improve its efficiency. Fortunately there are a number of steps which can be taken. A floor price of carbon can be placed on the EU ETS through a carbon tax, which can also serve as a border tax. The renewables target can be modified before its costs and almost inevitable failure to be delivered have serious consequences. Policy can be directed towards CCS, R&D, and even nuclear. Given the over-riding urgency of climate change, the EU has the scope to move on towards a more credible and better-designed policy framework.

References

CEC (1997), 'Energy for the Future: Renewable Sources of Energy', White Paper for a Community Strategy and Action Plan, COM(97)599 final, 26 November, Commission of the European Communities.

CEC (2001), 'Directive 2001/80/EC of the European Parliament and of the Council of 23 October 2001 on the Limitation of Emission of Certain Pollutants into the Air from Large Combustion Plants', *Official Journal*, L309/1, 27 November, Commission of the European Communities.

CEC (2006), 'Renewable Energy Road Map. Renewable Energies in the 21st Century: Building a More Sustainable Future', COM(2006)848 final, Commission Communication of 10 January, Commission of the European Communities.

CEC (2007), 'Report on Energy Sector Inquiry', 10 January SEC(2006)1724, DG Competition, Commission of the European Communities.

CEC (2008*a*), 'Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions—20-20 by 2020—Europe's Climate Change Opportunity', COM(2008) 13 final, COM(2008) 16 final, COM(2008) 17 final, COM(2008) 18 final, COM(2008) 19 final, 23 January, Commission of the European Communities.

CEC (2008*b*), 'Brussels European Council 11 and 12 December 2008: Presidency Conclusions', 17271/08, Commission of the European Communities.

CEC (2009), 'Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Towards a Comprehensive Climate Change Agreement in Copenhagen', Brussels, 28 January, COM(2009) 39 final.

Committee of Climate Change (2009), 'Sectors, Emissions, Current Levels of Emissions', available at http://www.theccc.org.uk/sectors/buildings/emissions-2

European Parliament and Council of the European Union (2008), 'Regulation (EC) No 294/2008 of the European Parliament and of the Council establishing the European Institute of Innovation and Technology', *Official Journal*, L97/1, 9 April.

Helm, D. R. (2008), 'Caps and Floors for the EU ETS—A Practical Carbon Price', Polish Office of the Committee for European Integration, 4 September, available at www.dieterhelm.co.uk

Helm, D. R., and Hepburn, C. (2007), 'Carbon Contracts and Energy Policy: An Outline Proposal', ch. 3 in D. R. Helm (ed.), *The New Energy Paradigm*, Oxford, Oxford University Press.
Kérébel, C. (2009), 'The Results of Negotiations on the "Climate Change and Energy Package"', 18 February, available at
http://www.ifri.org/frontDispatcher/ifri/publications/actuelles_de_l_ifri_1197584475485

National Grid (2008), 'GB Seven Year Statement', Table 5.1, available at
www.nationalgrid.com/uk/electricity/sys
Nordhaus, W. D. (2008), *A Question of Balance: Weighing the Options on Global Warming Policies*, New Haven, CT, Yale University Press.

Philbert, C., and IEA (2008), 'Price Caps and Price Floors in Climate Policy: A Quantitative Assessment', International Energy Agency Information Paper, December, available at
http://www.iea.org/textbase/papers/2008/price_caps_floors_web.pdf

Stern, N. (2007), *The Economics of Climate Change: The Stern Review*, Cambridge, Cambridge University Press.

Stern, N. (2009), 'Time for a Green Industrial Revolution', *New Scientist*, 2692, 21 January.
WCED (1987), 'Our Common Future', Brundtland Report, World Commission on Environment and Development.

Smith School of Enterprise and the Environment
University of Oxford
South Parks Road
Oxford, OX1 3QY
United Kingdom

E enquiries@smithschool.ox.ac.uk
T +44 (0)1865 614942
F +44 (0)1865 614960
www.smithschool.ox.ac.uk/research/stranded-assets/