

IMPLEMENTING KYOTO

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1. Introduction

The Kyoto agreement on restricting emissions of greenhouse gases has never grabbed major domestic attention in Ireland. This is partly because we are not used to debating policy changes within such a long time-scale. However, there also remains some uncertainty as to “how serious” the world is about this issue. This uncertainty will remain for the foreseeable future, in particular due to uncertainty as to whether the agreement will be ratified by the US and other major players. Within the EU there appears to be a somewhat stronger commitment to making the agreement work but there is also recognition of the problems faced by any country or region taking unilateral action. If the EU were to act alone its actions would inevitably prove futile. To be successful in reducing the world’s emissions of greenhouse gases any agreement will eventually have to involve, not just the developed world, but also the bulk of the rest of world. Most notably, China and India must eventually be involved in any world agreement if it is to work. The prospect of such agreement is today a very long way off.

However, even though there is some uncertainty about the commitment to this agreement outside the EU, the EU itself has made binding commitments that it will meet the objective set for it of achieving a substantial reduction in emissions, compared to a 1990 base level, by the years 2008 to 2012. For Ireland, because of its relatively low level of development in 1990, it was agreed that its emissions could exceed their 1990 level by 13%. This limit is to be enforced for the years 2008 to 2012. As Irish emissions have probably already exceeded this limit, there will have to be major policy changes over the next decade if Ireland’s obligations are to be met. Similar problems clearly apply to many other EU countries, including the Netherlands, one of the major advocates of ambitious targets on restricting emissions.

In this paper I first review the evidence on the task facing Ireland if we are to meet our obligations: how big is the task which we face? I will then consider the type of policy changes which will be needed domestically if we are to meet our obligations.

This firstly involves the question as to whose emissions will be monitored and where any regulation by the state will be imposed. Should individual cars be monitored and should individual motorists be responsible for their own emissions? Obviously this would be totally impractical but the level at which the state should impose the necessary policy changes is not self-evident.

The second issue concerns how the natural growth in emissions will be brought under control and even reduced to the legally binding limit. What policy options are open to the Irish and other EU governments to bring this about?

Finally, the problems in controlling emissions of greenhouse gases in an efficient manner (at least cost to society) have a major international dimension. Because emissions do the same amount of damage wherever or whoever produces them it is essential that policies in individual countries take account of what is happening elsewhere. Whether taxes or tradable quotas are used within individual countries, if the cost of meeting the Kyoto protocol is to be minimised in the EU as a whole (and at a wider international level) it is essential that some means be found whereby emission limits can be swapped or traded between countries. This need for international trading may place further restrictions on the freedom of action of individual countries.

2. The Task for Ireland

As discussed in the introduction, as part of the Kyoto agreement on reducing greenhouse gas emissions Ireland is required to limit its emissions in the years 2008 to 2012 to no more than 113 per cent of 1990 emission levels. As presently structured, any costs in meeting the targets for individual countries would have to be met by the individual member states themselves.

In forecasting carbon dioxide (CO₂) emissions in Ireland it is not enough to have total final consumption figures for the various fuels, since the emissions due to electricity will depend on the fuel-mix and the efficiency of generation. The principal adjustment which needs to be made in doing this is in converting a given final consumption of electricity into a primary requirement for coal, oil, peat and gas (ignoring generation using renewable energy sources which does not emit carbon dioxide).

When a tonne of oil equivalent of each fuel is burned, it releases a specific amount of carbon dioxide. By multiplying the primary energy requirement of each fuel by the relevant emission factor we can derive emission figures for that fuel and build up a comprehensive picture of overall emission levels.

Although the energy intensity of the Irish economy has been falling steadily since the second oil crisis of the late 1970s, the central forecast rate of growth is large enough to mean that (assuming unchanged policies) final energy consumption is likely to increase rapidly over the next decade.

Table 1 shows our forecast for the consumption of energy in Ireland by fuel out to 2010 in thousand tonnes of oil equivalent (kTOE).

Table 1
Forecast Final Consumption of Energy by Fuel (kTOE) 1995-2010

	<i>1995</i>	<i>2000</i>	<i>2005</i>	<i>2010</i>
Coal	550	268	179	81
Oil	5222	6607	7796	9043
LPG	146	124	115	104
Gas	821	1137	1374	1649
Peat	615	470	436	404
Electricity	1286	1656	1994	2343
Renewables*	178	173	168	163
Total	8818	10434	12060	13786

* Includes hydro-power, windmills.

In Fitz Gerald, Kearney, Morgenroth and Smyth, 1999, the growth in total final consumption of energy was forecast to be over 55 per cent between 1995 and 2010. The bulk of this is expected to come from growth in oil (73 per cent increase), electricity (82 per cent increase) and a doubling of gas consumption. In contrast, consumption of peat and coal is expected to fall as people switch towards cleaner and more efficient fuels. Forecasts for energy consumption by sector are shown in Table 2.

Table 2
Forecast Final Consumption of Energy by Sector (kTOE) 1995-2010

	<i>1995</i>	<i>2000</i>	<i>2005</i>	<i>2010</i>
Residential	2265	2527	2872	3291
Commercial	1231	1557	1853	2128
Agricultural	290	331	385	457
Transport	3072	3758	4503	5286
Industry	1960	2261	2447	2624
Total	8818	10434	12060	13786

Growth in the number of households and in central heating penetration is expected to lead to a 45 per cent increase in residential energy demand. Industrial energy demand is likely to grow more slowly as most economic growth is likely to occur in less energy-intensive sectors. Both the transport and commercial sectors are expected to show particularly high growth, as both are particularly sensitive to changes in economic growth. It is worth noting that the transport sector has many adverse environmental effects (Scott and Feeney, 1998) especially in relation to air

quality, global warming, soil and water pollution. By 2010, both sectors' final energy consumption levels are expected to increase by almost 75 per cent above 1995 levels, with transport accounting for almost 40 per cent of final energy consumption.

Energy consumption is the major cause of carbon dioxide emissions, the principal greenhouse gas. These energy forecasts imply a large increase in emissions of carbon dioxide under present policies. When combined with forecasts from the Department of the Environment for the other two principal greenhouse gases, Methane and Nitrous Oxide, they give the forecasts of Table 3 below.

Table 3: Forecast Greenhouse Gas Emissions by Gas (kT of CO₂ Equivalent) 1995-2010¹

	1990	1995	2000	2010
CO ₂	30719	34116	39728	49786
Methane	17038	17099	15843	17594
N ₂ O	9105	8110	7705	7638
Total	56861	59324	63276	75019
Change on 1990	0.0%	4.3%	11.3%	31.9%

By 2010 it is forecast that, on unchanged policies, Ireland will be releasing over 75 million tonnes of greenhouse gases into the atmosphere, a 32 per cent increase on emissions in 1990 and over 11 million tonnes more than our target. Sequestration by forests could remove between 1.4 and 2.2 million tonnes, but clearly there will still need to be a considerable re-orientation of policy if we are to meet our target.

As shown in Table 3, a very substantial part of Ireland's emissions is accounted for by emissions from agriculture in the form of methane and N₂O.² This situation is rather different from that in the other EU member states where agriculture is a much less important source of greenhouse gases.

3. Who is Regulated?

In considering the appropriate policies to adopt to ensure that Ireland meets its target for emissions an important consideration is the level at which emissions are monitored and at which policies to control emissions are imposed. In the case of sulphur dioxide (not a greenhouse gas),

¹ Figures shown are "gross" emissions. That is, they take no account of sequestration of carbon dioxide through afforestation, which would lower the final figures.

² The bulk of the emissions of these two gases in Ireland comes from agriculture. In the case of methane it is the production of ruminants (cattle and sheep) which is the major contributor.

emissions regulation generally takes place at the level of the plant which actually releases the sulphur into the atmosphere. But, in the case of sulphur dioxide, the number of significant emitters is small and the location of the emission is also important.

In the case of greenhouse gases neither of these considerations apply. Every car, every household which uses an open fire, every business which uses a central heating boiler, emits carbon dioxide. In the case of agriculture every cow and sheep is also an emitter. It is clearly not practical to monitor and control emissions at such a disaggregated level in a modern economy. If, instead, it were decided to regulate say the top fifty plants in Ireland this would leave uncontrolled the bulk of emissions. It would also provide a major incentive for firms to reduce plant size so as to fall below the threshold. This would cause serious distortion in the economy, especially if such a regime were in place for many years.

The obvious solution in the case of carbon dioxide is to monitor and regulate the import and production of fossil fuels. Already, in the case of oil, this is part of the arrangements for excise taxes. An extension of this to cover gas and coal would not involve a major number of market players. As a result, for administrative reasons, it seems certain that in Ireland the only practical way to implement policies designed to ensure compliance with the Kyoto limits will be through monitoring the importers and producers of primary energy. This will involve monitoring the behaviour of the existing oil and coal importers. In addition, as power generators, including the ESB, are also likely to import primary energy (in the form of coal, oil and gas) on their own behalf, their behaviour will also have to be monitored.

Obviously, where firms use primary energy in a production process which fixes that energy in a form which does not leak directly into the atmosphere (as is the case in some chemical processes), exemptions could be made provided that these companies use of fossil fuels was also independently monitored.

While this approach to monitoring and regulation is the only practical one in an economy such as Ireland's, it has certain disadvantages. In particular it makes it difficult to exempt particular firms or businesses unless their activities are subject to special monitoring. While on economic grounds there are strong grounds for arguing against exemptions for any firms or sectors, political considerations in certain other EU countries have made this an important issue. In Ireland, compared to some other EU member countries, we do not have a significant amount of energy intensive industry whose competitiveness would be affected in a major way by a substantial

increase in the cost of greenhouse gas emissions. However, in countries such as Germany, this is a major issue. This issue played an important role in the internal debate in the early 1990s within the EU Commission on the appropriate way to levy a tax on carbon emissions. DG XI (responsible for the Environment) wanted to levy it on the import or production of primary energy arguing, correctly, that this would provide the appropriate incentives for economies to reduce emissions. DG XVII, responsible for energy policy, argued for an energy tax paid by users of all forms of energy. In this latter case the tax was to be levied on electricity, rather than the inputs into generation, so that appropriate firms or sectors could be exempted. If the tax were levied on inputs into generation then an arbitrary system of imputation (of the fuels from which the electricity was generated) would be required if exemptions were to be used. This would be difficult to operate; it could interfere with the development of competition in the generation sector; and it could leave open the use of such a mechanism to provide hidden state aids. A fuller version of such an imputation scheme is discussed in Poterba, 1991.

In spite of these problems, given the industrial structure of the Irish economy, the imposition of monitoring and regulation (be it quotas, taxes or voluntary agreements) on importers and producers of primary energy seems the only practical solution. While I would argue against the granting of any exemptions to the very small number of businesses which are unusually energy intensive, this would still be possible given their limited number.

The advantage of this regulatory approach is that it would greatly simplify the cost of implementation and it would provide the appropriate incentives to all users of energy to minimise emissions. A scheme where the output of the electricity industry was regulated rather than taxing or otherwise regulating its inputs would significantly reduce the incentives to reduce emissions and significantly increase the cost of meeting Ireland's emissions targets. This is because a tax (or quota) on carbon rich inputs into electricity generation would encourage substitution away from those inputs whereas a tax (or other regulation) on electricity produced would discourage electricity consumption but would not encourage more environmentally attractive types of generation.

In the case of the agriculture sector a more simplified approach to monitoring and regulation of emissions will have to be taken. Clearly metering the emissions from each cow or sheep is not on! Instead a more indirect approach where numbers of ruminants are monitored and where the incentives under the CAP are restructured to meet the environmental needs of the EU economy is likely to prove the most practicable.

4. Methods of Control

The ERM report published last year discussed a wide range of measures which can be adopted to control the growth of emissions. There are a number of different ways of classifying the different types of policies. One classification, which has attractions for policy makers, is to consider the different instruments in terms of their likely acceptability – essentially whether or not they will be expensive for individual companies or households. The softer measures involve “voluntary agreements” with business and measures, such as insulation standards, which exploit opportunities to improve efficiency at little or no cost to firms or individuals. The less popular measures involve the imposition of real costs on firms or individuals, either through regulation, or through fiscal instruments, such as taxes or quotas. An alternative schema, beloved of economists, is to consider instruments in terms of command and control (telling people to do things) and market instruments (where market mechanisms indicate the costs of polluting and individuals are free to choose their preferred response).

There are quite a number of possibilities for action which would reduce emissions at relatively little cost. For example, Scott, 1992, showed that households were not using energy efficiently and that many households could save money by relatively small expenditure on suitable types of insulation. However, for whatever reason, lack of information or other market failures (a favourite catch-all of economists), they do not do so. In these circumstances there are opportunities for the state to intervene with relatively little cost.

Other areas where appropriate regulations could make an impact include insulation standards and standards for car fuel efficiency. In the case of insulation standards for buildings, Ireland has an opportunity which is not available to any other EU member state. Over the next decade the number of dwellings in Ireland will increase by at least 30% - a far higher figure than in any other country. Under these circumstances the imposition of appropriate insulation standards can achieve an impact on a very high proportion of the housing stock in a short space of time. To achieve the same impact through retro-fitting would be far more expensive.

In the case of motor vehicle emission standards Ireland has no opportunity to do anything on its own. No one will develop a special fuel-efficient vehicle for the Irish market. However, the EU, acting as a major world player in the consumption of motor vehicles, could significantly influence major vehicle manufacturers behaviour by announcing the imposition of more rigorous standards in the future. The effect of the pre-announced restriction on car emissions in California on research and development into making motor vehicles more environmentally acceptable has been

significant. If the EU were to take such a stance, because of the size of its market, it could make a significant contribution to promoting further such investment in Europe.

However, current research suggests that all the easy opportunities for improving efficiency, from voluntary agreements to improved insulation standards, will not be sufficient to keep the Irish economy on a growth path which adheres to the agreement on limiting greenhouse gas emissions. Under these circumstances, the government will have to take measures that impose additional real costs on energy consumption by individuals and businesses.

Thus the government is faced with using a range of different instruments which will directly cause significant pain to businesses and households to ensure that Ireland meets the environmental objective which has been set for it. These include command and control measures and, as discussed below two broad types of market instruments– quotas, which are tradable, and taxation. However, as argued in Fitz Gerald and McCoy, 1992, when the revenue from taxation (or sales of quotas) is applied to reducing other taxes, the net cost to society of greenhouse gas abatement would probably be small (or there might even be a small net gain).

Command and Control

While appropriate in many cases, such as restrictions on emissions of plutonium or on river pollution, regulation of emissions of greenhouse gases by a law (specifying the allowed emissions for individual businesses or households) would be hugely inefficient. The inefficiency would arise from the fact that the regulator can not have sufficient information to know who can reduce emissions easily and who will incur major costs to meet any reduction. As a result, the setting of individual emission quotas, which can not be avoided or altered, will produce an expensive solution to the problem.

As discussed above, there are limited opportunities where command and control solutions may still play an important role. These opportunities arise where the market may not work well, either through a lack of information or where the scale of intervention requires a coordinated response (as in the case of motor vehicle emissions).

Quotas

Given the likely overshooting of Ireland's emissions target on a business as usual basis, there is likely to be a major task for policy makers in bringing reality into line with the legal

requirements. While these requirements will not be binding till the 2008 to 2012 period, because of the magnitude of the task, if major disruption is to be avoided, action will have to be taken in the near future. One possible method of implementing the regulations would be to announce that all primary emitters of greenhouse gases would have to have a permit or quota for each tonne of carbon equivalent which they produce or import. Such a quota regime, if enforced, would guarantee that Ireland met its emissions targets.

One of the primary reasons why this type of approach has been favoured by existing industry is that they see the prospect that quotas would initially be allocated to those who are already emitting (polluting). This would have a number of advantages for them over taxation:

- The cost to them from continuing to emit the specified amount of pollution would be offset by the value of the quota granted to them.
- It would guarantee the position of incumbents against new entrants into the market, preventing competition.

The issue of whether the rights to emit greenhouse gases are handed out to existing emitters, the technical phrase is “grandfathered”³, and the implications of the regime for competitive markets is central to the question of the long-term economic impact of any greenhouse gas abatement regime.

A clear conclusion can be drawn from economic research that “grandfathering” of greenhouse gas emission rights is likely to have a serious adverse impact on the economy (Parry, Williams and Goulder, 1997). This adverse impact arises from the fact that all restrictions on production and consumption, such as taxes, have serious negative effects. However, in the case of taxes or auctioned quotas, the revenue is available to the state to reduce distortionary taxes elsewhere, offsetting the damaging effects of the regime. However, if, as with “grandfathering”, the revenue is foregone, the state has no means of offsetting the negative effects of the regime on production. In addition, giving the potential revenue away to existing polluters is likely to have negative income distribution implications.

The solution to this particular problem is to auction off the right to emit. In this case the revenue would accrue to the state and could be used to reduce other distortionary taxes, to compensate

³ It is interesting that in economics “grandfathering” stands for a bad while a “fairy-godmother” is generally a good.

those on low incomes hit by higher prices, and to fund investment in areas such as energy efficiency. In the US, to date, while accepting that this is the best solution in terms of national welfare, the “grandfathering” route has been followed because of the strength of the lobby of incumbents. The fact that the US has adopted a seriously sub-optimal solution in the face of political pressures should not be taken as a desirable precedent for the EU.

Even if it is decided to auction off the quotas there is a wide range of possibilities concerning the nature of the auction:

- It may well not be optimal to have an auction of the type used to sell houses – where the bidder(s) with the highest price takes all. This issue would need further study. Depending on the nature of the quota it may be desirable to have an auction where everyone bids for any quantity that they specify at a fixed price.⁴ The quotas are allocated to the highest bidders but the price that they pay would be the price of the highest underbidder. This might be appropriate as the objective is not to maximise revenue but to ensure that those who can reduce emissions at least cost do so.
- The size of the lot to be sold would need to be decided. It might well be the case that the unit sold would be emissions of a tonne of carbon equivalent over a specified period.
- The time period for which the quota is valid would also have to be chosen. For example, the quota might confer the right to emit a tonne of carbon equivalent at any time over the period 2008 to 2012. Alternatively it could be tied to a particular year. There are advantages and disadvantages to both types of regime. Where the right to emit pertains to a short period there is less possibility of anti-competitive practices – it is not worth “cornering” the market for only a year. However, the change in price from one time period to another may be quite sizable and potentially destabilising. Allowing firms to buy permits some time in advance would allow better forward planning and reduce firms’ uncertainty. Whatever period is chosen does not avoid the problems of transition from one quota period to another.
- The state also has the option of not selling all the quota at once. This possibility of holding back quota might allow the state to guard against anti-competitive market practices. It could also use this mechanism to itself try and smooth the price transition over time. For example,

⁴ So many tonnes at a price of €x.

by holding quota in reserve to be released towards the end of a quota period, it could help smooth the price from one quota period to the next. However, this function might also be developed naturally by market players. If the regime also involves international trading there is the possibility that the state could use the timing of the sale of quota to maximise revenue from foreign sales. Holding quota in reserve would be the obverse of a reduction in debt except that the asset held would have a more uncertain value. However, this would also provide opportunities for larger states to exert undue market power.

- If all of the 2008-2012 quota is sold at once there will be complicated issues in terms of the management of the public finances and how they are treated under the terms of the Maastricht treaty. For example, if all of the quota for the 2008 to 2012 period were sold off in 2008, then the revenue received should be applied to reducing other taxes evenly over the whole period. However, in terms of the government accounts, it would show a big surplus in 2008, with corresponding small deficits in future years. If the total value of the quota was large, and the regime was applied at an EU level, the overall financing implications of such a regime and the implications for the EU financial system would need to be considered.
- Finally, the handling of trading in emission quotas and the tax treatment of capital gains and losses on such trade would have to be clarified.

The competition implications of a quota regime are potentially severe, especially if there is no possibility to trade quotas internationally. Consider the current Irish situation where over 40% of carbon emissions come from the ESB and a very few other major firms. If emission rights were grandfathered then, without trade, there would be no possibility of new entrants to the generation market.

Even if the quotas are auctioned and there is a possibility of trade, within the very restricted Irish market, there still remains the “Bunker Hunt” possibility.⁵ It could well be worthwhile for incumbents to pay over the odds for emission rights because, in so doing, they could prevent new entry into the market. While I am sure that the ESB, certainly in its current public service role, would not adopt such a practice, in an evolving market with emerging competition this issue could prove very relevant.

⁵ He tried to capture the world market in silver, driving up prices.

As discussed above, in the Irish context, the appropriate level at which to restrict emissions is likely to be the producers and importers of primary energy – the oil companies, BGE, the ESB, Bord na Mona etc. However, given the small size of the market and the distribution of trade across the existing major importers and producers, my conclusion is that it would not be possible to have a regime of tradable quotas purely restricted to an Irish market. So long as the limited number of market participants knew that the auction would involve a fixed total amount of quotas there would remain the likelihood that, as well as restricting emissions, the regime would limit competition, with a potential serious additional unnecessary loss of welfare to the community.

The reason why such a quota regime potentially gives rise to dangers of fostering anti-competitive practices is that the publicly available knowledge that the quota is fixed allows market participants to know that they can “corner” the market. Under a regime based on carbon taxes, where the state sets the tax and allows any quantity of emissions, provided that the tax is paid, it is not possible to “corner” the market - the market is open-ended. The best safeguard against such anti-competitive practices is to make the market sufficiently large that no individual player can afford to “corner” the market.

The situation could be very different if the regime involved a simultaneous introduction of EU wide (or world-wide) tradable emissions permits. This could involve either trading between governments or trading by authorised individual legal entities (such as importers or producers of primary energy). By extending the pool of potential traders the potential for a small number of individuals to capture the market would be greatly reduced.

In addition, by greatly increasing the number of players, the liquidity of the market would also be improved. In a purely Irish market, to ensure availability of adequate quotas over the full 2008 to 2012 period, many firms might feel that they would have to overbuy quota to ensure that they could meet all future eventualities. In a much larger and more liquid market firms would know that they could buy and sell quota as needed; there would always be sellers and buyers.

However, even at the EU level, there would be some substantial firms, such as the oil majors and some major energy utilities, which would be significant players in the market. As a result, there would probably still be some concern about dangers to competition and market liquidity. In particular, if the regime involved permits to emit which must be exercised within a certain time-scale (e.g. 2008 to 2012), the period coming up to the end of the regime could see possible disruption as a result of unexpected tightening (or weakening) of the market for permits.

The major advantage to the state of such a regime of traded quotas would be that it would ensure that Ireland (and the EU) exactly met its legal obligations - there would be certainty about meeting the environmental objective.

The quota regime would impact on the economy through raising the price of energy. The firms which are importing primary energy, or producing it, would bid for the emission quotas. Because of the large world-wide market for primary energy the importers in Ireland, acting on their own, could not pass back the cost of buying the quota to the supplier.⁶ The rise in the price paid by domestic consumers – electricity generators and other businesses - would ultimately be passed on to consumers. Businesses and consumers would, in turn, react to the higher prices by reducing their consumption of energy and their emissions of greenhouse gases. In this way a quota regime would have an identical effect on the domestic price level to a tax regime, which achieved the same impact on emissions.

However, there are some differences compared to a tax based policy of reducing carbon emissions. While the target for emissions reduction would be hit with greater certainty under a quota regime than under a tax regime, this increased certainty would be achieved at the expense of greater uncertainty for consumers and businesses. The price of the quota would vary from one year to the next in line with EU (or world) demand and abatement costs. In particular, if quotas relate to a particular time period, for example, 2008 to 2012, then the uncertainty about the price could rise as the end date approaches. Unused quotas would be valueless after the end date while quotas, being essential to produce at all, would mean that any miscalculation could lead to very high prices as the regime period draws to a close. To some extent financial markets may be able to help smooth such uncertainty but such “insurance” must, inevitably, come at a significant cost to business.

Finally, the introduction of a quota regime would involve significant administrative costs. Some of these costs are inevitable whatever regime is introduced: the need to monitor trade in imports or production of primary energy. However, a regime involving trading in emissions quotas will require a new administration to handle sales, register ownership, and oversee the market. If the regime involves international trading there will be further issues of co-ordination to be addressed.

⁶ Obviously if such a regime covered much of world demand there would be a very significant effect on oil producers (Burniaux, 1992).

Taxes

There is a popular misconception about a tax based regime to control carbon emissions that it would involve higher prices for consumers and businesses than a quota based regime. As outlined above, a quota regime where quotas are required to import or produce primary energy and where the quotas themselves are auctioned, would appear identical to a tax based regime for all households and all but a tiny minority of businesses. The cost of buying quota would be passed on to consumers and businesses in just the same way that the cost of taxes is. This is apparent in the case of excise taxes on oil where the vast bulk of consumers, businesses or households, just see higher prices. They never need be aware that the Customs and Excise authorities exist. Thus for nearly all economic agents the choice of regime will not be of any direct significance to them in their daily life.

A quota regime, where the quotas applied to emissions in an individual year, would appear very similar to a tax regime. In both cases there would be a substantial payment to the state and in both cases the cost of this payment would be paid in higher prices to final consumers of energy.

However, there would be some significant differences:

- In the quota regime there would be a reasonable certainty of achieving a precise target reduction in emissions within a particular year. In the case of a tax regime, uncertainty about the precise response of the economy in a particular year to a change in price (tax) would make it difficult to hit the target exactly. Depending on the penalties to be imposed for overshooting on emissions in a particular year, it might be necessary to aim to continually undershoot through raising taxes. However, the margin of error from one year to another is unlikely to be very great and, over a period of 5 years (for example, 2008 to 2012), it should be possible to approach a target level of emissions reasonably precisely through varying tax rates once or twice over the period.
- The administration for excise taxes is already in place, well understood, and cheap to run. The administrative costs of any quota regime are likely to be higher, not just because it is new, but because of the need to develop and supervise a market in emission rights. The compliance costs for participants – the costs of making the market work – are also likely to be much higher than for an excise tax regime.
- Under a quota regime there will always be the danger that major players may be able to use undue market power.

Excluding the costs of operating any policy to reduce emissions and the potential for market distortions, for a given reduction in emissions, the cost to consumers (businesses and households) will be identical whether a tax or a quota regime is used.

Conclusions

Provided that there is international tradability of emission rights, the choice between a quota regime and a tax regime will turn on the following points:

- How important is it to hit a particular target for emissions exactly in a particular time period? If the environmental costs of overshooting by a small amount are small (and can be made good in a subsequent period) then a tax regime will be better than a quota regime. This is because a tax regime can provide a more certain time path for prices, reducing uncertainty for firms, while producing a less certain time path for emissions.
- How great will be the additional administrative costs involved in running a trading regime compared to a tax regime.
- To what extent can the dangers to competition in existing markets, inherent in a quota regime, be overcome.

If international tradability is not introduced simultaneously with the introduction of a quota regime in Ireland then there would be serious dangers of non-competitive practices developing. In the absence of a well worked out regime of international trading, taxation is the only option for policy action in a market as small as Ireland's.

5. The International Dimension

Given the arbitrary way in which emission rights have been allocated within the EU, it is very important that a trading regime be established. The current allocation of emission rights will probably prove beneficial for some countries, possibly even Ireland, but the level of uncertainty is such that no country can be certain at this stage as to the final burden.

The uncertainty involved in trying to pick a "winning formula" for choosing quotas is illustrated by the probability that, if the restriction was confined to carbon dioxide alone, then it seems likely that such an EU quota regime would give rise to a greater than average cost for Ireland (Conniffe *et al.*, 1997). As a result, it would be dangerous to try and design a rigid mechanism which

conferred a possible temporary advantage on Ireland at the risk of a serious long-term cost. This argues all the more forcefully for the adoption of a flexible regime which will ensure that burdens are shared evenly across the EU with each polluter paying the same price per unit of pollution. This would also maximise output and employment in the Union in the longer term, while abiding by the "polluter pays" principle.

With this in mind Ireland should advocate a strategy which would minimise the economic cost to the EU as a whole. At the very least this will require the implementation of some kind of trading regime to equate the burdens of adjustment across countries. However, it is not clear to what extent the need for such a regime will preempt the scope for independent choices by member states on how they implement the regime within their own countries.

One possibility is that the trading regime is confined to national governments with governments swapping quotas on some formal or informal basis with suitable compensatory payments. However, as discussed above, a regime involving such a small number of players, and players of very different sizes, has inherent dangers.

In the case where there is trading between governments each country could choose to implement the regime domestically either through a regime of taxes or through tradable quotas. This regime probably would require the most limited degree of co-ordination between states on how they implement it domestically. If a member state found that the tax necessary to reduce emissions or the domestic price of the quota was greater than the price at which it could buy quota from other governments, then trade between countries would take place. This two stage regime could ensure that the price or tax per tonne of carbon in each country was equated. The danger would be that the EU price could be artificially increased through unilateral action by individual states.

A second possibility is that some countries adopt a domestic quota regime, allowing individual companies to buy and sell quota across national boundaries. In other countries where taxes were used, the national authorities could buy and sell quota on this international market ensuring that the tax (or price of quota) domestically was equal to the EU market price. As a variant of this, all countries could choose a quota regime involving international trading. However, such a solution would not necessarily prevent individual large states acting strategically by withholding quota from the market or through acting as a separate buyer or seller on the market.

In either of the first two approaches identified here, the trade in quotas will involve net transfers of resources from some member states to others. However, this cost to individual states will be

