8. Carbon taxes get to the root of the problem and are the fairest approach for reducing CO_2 emissions.

Carbon taxes are best applied as a switch away from existing taxes on labour, for instance by reducing income taxes and PRSI. Such a switch has been widely analysed and already applied in 6 EU member states with good results, though modest, given limited application.[8] Studies indicate that good results would also arise in Ireland: emissions would be reduced, correct domestic use of the revenues would improve competitiveness and protect the vulnerable, and improvements would grow over time especially if carbon taxes were applied EU-wide.[9] There is much support in the independent peer-reviewed literature[10] for a global carbon tax to be applied, with difficulties foreseen if the fundamentals are not addressed in such a manner. Removal of existing subsidies to fossil fuels is also deemed a priority; there are better ways to give this social support, if that is their aim.

Carbon taxes commensurate with fuels' CO_2 emissions can start at a low level[11] and be applied through existing excise taxes on fuels, without needing new administrative, trading and monitoring apparatus. A perceived disadvantage of a carbon tax is that, unlike a quota system, it does not guarantee a target level of reductions; but the cost curve above suggests setting the tax at the price to do that.

If adjustment is needed, it is easier to alter the carbon tax than to adjust the allocation of permits. Vulnerable firms can be offered an alternative, such as negotiated agreements.[12] In sum, a carbon tax is transparent and correctly targets pollution, to the advantage of recycling and cleaner technology. It avoids the need to raise *extra* taxes to pay subsidies, and the government receives revenues that can help the vulnerable and allow labour taxes to be set at a lower level than otherwise. Cheaper and fairer overall, a carbon tax is the best policy for helping the competitiveness of "Ireland Inc".

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[8] COMETR, p. 36, http://www2.dmu.dk/cometr/COMETR_Summary_Report.pdf . Also W. Nordhaus: http://nordhaus.econ.yale.edu/recent_stuff.html.

[9] Conefrey, Fitz Gerald, Valeri and Tol, 2008, *Impact of carbon tax*, WP 251, Economic and Social Research Institute. http://www.esri.ie/publications/search_for_a_publication/search_results/view/index.xml?id=2607

[10] And from the US Government Accountability Office, 2008. *Climate change - expert opinion on the economics of policy options*, "... preferred either a tax on emissions or a hybrid policy that incorporates features of both a tax and a cap-and-trade program." http://www.gao.gov/new.items/d08605.pdf .

[11] Carbon taxes at €5/ tonne are shown in Annex 2 of McCarthy and Scott, 2008, *Controlling the cost of controlling the climate*. Initial yield at over €100 million could be used for selected home upgrades. http://www.esri.ie/publications/search_for_a_publication/search_results/view/index.xml?id=2526 . Also Table 6.

[12] As in UK, see COMETR, *op. cit.*, p. 277 in http://www2.dmu.dk/cometr/COMETR_Final_Report.pdf ; or for Ireland, see Sustainable Energy Ireland, *Large Industry Energy Network, Annual Report 2007*, http://www.sei.ie/Your_Business/Large_Industry_Energy_Network/LIEN_Annual_Reports/

8th Scientific Statement

Market-based policies for reducing carbon dioxide emissions

This is the eighth in a series of scientific statements by the CCSC. Previously published statements

• Economics and Climate Change • Climate Change and Irish Agriculture • Climate and Sea Level Change
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1. There are many options for reducing CO_2 emissions – some are cheap, some are very expensive...

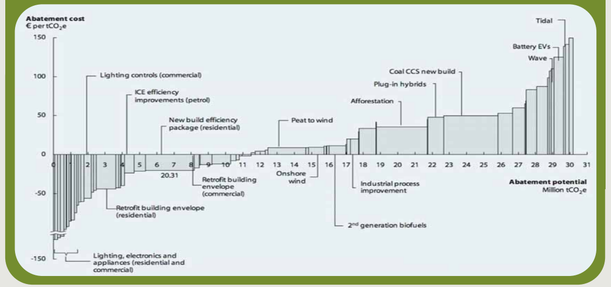
Many current and promising technologies can be used to reduce CO_2 emissions. Take, for example, the Irish situation – the chart below shows the options available, such as insulation refits for buildings or developing onshore wind power.[1] The chart gives the costs of reducing or "abating" emissions on the vertical axis, expressed in € per tonne (t) of CO_{2e} reduced.[2] The scope for reductions, in million tonnes of CO_{2e}, is shown on the horizontal axis. Options are ranked from left to right, in increasing order of cost, giving this useful tool called a Marginal Abatement Cost (MAC) schedule.

The chart is illuminating, in that it shows that there is a broad range of options and also of costs. The profitable or cheap options on the left-hand side, such as lighting controls, are priorities for action. By contrast, some renewable energy options on the right-hand side are expensive and less worthwhile, at least until the technology becomes cheaper. Such charts show that selecting no-cost or low-cost options could spare the nation unnecessary expense. The ideal policy, then, would be one that automatically encourages progressing *up* the options till the national emission-reduction target is met. In that way, Ireland as a whole would avoid unnecessary high-cost abatements.

[1] SEI, 2009. In brief, abatement costs are calculated as discounted streams of estimated net cost changes divided by the emissions changes. The unit in the chart is CO_{2e}, defined in Note 2 below, and it considers all greenhouse gases including CO_2.

[2] "CO_{2e} is "CO_2 equivalent", which is a measure that includes other greenhouse gases expressed in terms of CO_2.

Chart: Options for abatement in Ireland, ranked from left to right in increasing order of cost (Reference Scenario MAC 2030)



2. … but at the individual level, costs vary hugely and are not known with precision.

Of course, many assumptions underlie these costs, which vary between individuals. Despite the economic downturn, Ireland's target for cutting emissions by 2020 is still demanding, requiring at least a 20% reduction on 2005-level emissions, so that exploiting relatively cheap options is all the more important. In the absence of perfect knowledge on relative costs at individual level, an ideal policy would be one that encourages individuals and entities to take up the options that are cheapest *for them*, to keep overall costs down.

3. CO_2 price and potential reduction level are linked, as seen in the schedule of options.

The MAC chart has further importance in showing how the abatement cost per tCO_{2e} reduced is linked to the scope for worthwhile reductions. The cost of a target reduction of, say, 20 M tCO_2 on the horizontal axis is seen to reach about €25 per tCO_{2e} abated, seen on the vertical axis. Thus, a carbon emission price or carbon tax actually charged at €25 per tCO_{2e} would make it worthwhile for emitters to undertake abatement options that cost up to that amount. That is, they would *want* to reduce emissions by 20 million tCO_{2e} because reduction would be cheaper than paying the carbon tax bill. A still higher carbon price would make it worth their while to reduce more. True, most people do not exploit existing profitable energy efficiency options at the present mainly zero carbon price: but this could be due to lack of knowledge or uncertainty on their part, or real but hidden costs and the hassle of taking action, meaning that the chart is over-optimistic about these options. People are sensibly planning to take action to reduce emissions more cheaply by other means, or perhaps they expect a subsidy.

4. The issue is how to make CO_2 reductions happen.[3]

The issue, then, is not so much the feasibility of reducing CO_2 emissions as how to alter behaviour. The logical approach to finding a solution is to ask how to make our emissions "unhappen" — what made human beings emit this level in the first place?

5. Free helpings of the atmosphere's (valuable) assimilative capacity are the root of the problem.

Predictions about the fate of valuable, finite common resources are unambiguous. The *capacity of the atmosphere* to absorb CO_2 without leading to climate change is just such a valuable, finite common resource. If left un-priced, capacity is over-used. Each and every tonne of CO_2 emitted causes damage. The value of the assimilative capacity of the atmosphere lies in the benefits we derive from its use, such as profits from running machines and warmth from burning fossil fuels. Informing and helping people to understand the issues will lead the conscientious to restrain their emissions; but, alas, they will be exploited by those preferring and able to free-ride on their efforts. Furthermore, no amount of standards and regulations can address the manifold actions that cause emissions or could remove the underlying pressures to over-use. The root cause can be tackled by pricing emissions.[4] Two economic instruments can be called on to do this:(1) emissions trading schemes, which place a limit on emissions permits that can then be traded, like milk quotas; and (2) carbon taxes imposed on fuels, differentiated by fuel according to how much CO_2 each emits. Indeed, these instruments might be extended to cover other significant greenhouse gas emissions.

[3] As stated in DECC (Department of Energy and Climate Change, UK) 2008, Committee on Climate Change, http://www.theccc.org.uk/reports/. Barry, Clinch and Convery, 2002, previously covered this issue in http://www.ria.ie/committees/iccc/pdfs/economics.PDF

[4] The good record on price approaches in Ireland includes the 40% reduction in leakage and water use after pilot metered water-charging by the National Federation of Group Water Schemes, a 40% reduction in waste after pay-by-weight refuse collection was introduced in west Cork (despite low price elasticity of -0.27), and an 80% reduction in use of plastic bags since the levy. There are other policies not covered here, such as education and research, that have a vital part to play, as do regulations applied on foot of sound assessments. These help deal with barriers and address situations requiring technical knowledge, for example.

6. But people seem to expect government subsidies – unaware of how costly this could be!

The economy would be severely strained by reliance on subsidies, given the full cost of sourcing funds from taxation[5] and the scale of the task. Worse, if subsidies do not reward emission reductions *per se* but, merely, other items such as insulation or bio-fuels, harmful side effects and disappointing cuts in emissions may result. Subsidies have to be generous in order to entice applicants, and they often reward people who would have invested anyway. Hitches in relation to eligibility and administration and monitoring requirements can be substantial, and governments often make poor choices that cause prices of scarce inputs to rise. This discourages action in more suitable situations and causes other side effects, e.g. from encouraging biofuels, or solar panels in cloudy countries.

[5] Due to distortions associated with taxation, it costs €1.50 to raise €1. Honohan, 1998, *Key issues of CB Methodology*; Forfas, 2001, *The Economic Appraisal System*.

7. Next in popularity are emissions trading schemes (ETS) – these are not ideal [6]

The Eu's scheme for large emitters, as an example of an ETS, sets a cap on CO_2 emissions and gives permits to entities in relation to their past or expected emissions. As with milk quotas, a limit is placed on the number of permits, so they are valuable. Recipients of permits can trade them, selling if their emissions turn out to be less than their number of permits awarded, or buying permits if they need more; and they will apply those abatement options that are cheaper. The target is achieved and society as a whole is spared excessive expense. The limit on the supply of permits and the cost of abatement at any time determine their price, which will fluctuate due to varying individual circumstances, as discussed. Three problems stand out:

(a) The share-out of permits is difficult, subject to domestic and foreign political manoeuvring and almost inevitably unfair. Companies already employing cleaner technology, for instance in cement manufacture, do not automatically benefit.

(b) The permits are assets, as of now mainly given out free of charge because of industry resistance to paying, e.g. by auction. The permit value nevertheless gets added to prices of output and profits (e.g. electricity). But with no revenue flowing to government to enable it to compensate the economy for the price rise, the value of the scarce resource (assimilative capacity) is in effect transferred to industry's profits, at consumers' expense. Variants of emissions trading schemes, such as cap-and-share schemes, that hand out equal amounts to individuals and likewise yield no revenue to government, cannot compensate the economy or help the vulnerable according to need. The appeal of "free" permits masks these serious shortcomings.

(c) Volatile carbon prices discourage investors in cleaner technology. Volatile prices are no way to encourage investment or R&D in cleaner technologies, such as in carbon capture and storage (CCS). Carbon prices in the ETS could be stabilised by adopting an internationally agreed floor price, whereby a carbon tax chips in when permit prices are low, and a ceiling or rebate when prices are high. A long-run course would thus be set, with a credible long-term price of carbon, similar to a carbon tax.[7] ETS schemes currently apply to about 30% of emissions, but, rather than struggle to make them behave like a carbon tax, international effort should move to actually adopting carbon taxes that would be applied to each and every emission.

[6] Due to low curvature of benefit functions relative to cost functions in the case of stock pollutants, see Weitzman, 1974, *Prices vs. Quantities*, RES XLI.

[7] Helm, 2008. *Caps and floors for the EU ETS*. http://www.dieterhelm.co.uk/publications/Caps_Floors_Oct_2008.pdf, and US GAO (2008) below.