The Climate Change Challenge

Strategic Issues, Options and Implications for Ireland

Edited by Peter Brennan and Joseph Curtin

IIEA

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Foreword

I have great pleasure in writing the foreword to this publication, which addresses issues that are not only critical to Ireland, but for the world as a whole. The Intergovernmental Panel on Climate Change (IPCC) in its Fourth Assessment Report has carried out a comprehensive assessment report of climate change globally as well as projections for the future which would have serious impacts in different regions of the world. Against this background the IPCC has also carried out an assessment of mitigation options, which can help to define actions for reducing the emissions of greenhouse gases by providing a context within which mitigation decisions need to be taken as an important part of initiatives to minimize, delay or avoid negative impacts of climate change. The IPCC has provided a clear rationale for national policies for combating climate change. As the world moves towards an agreement that would come into effect from 2012, countries will need to map out their options for taking action. In this respect the following pages provide a source of knowledge that would certainly be of interest to readers in Ireland or those who are studying the climate policy of Ireland, but should also be of great interest to other countries round the world.

Indeed, I am sure the quality of material contained in this book will be of great value to a wide range of readers.

RK Pachauri
Director General, The Energy and Resources Institute (TERI)
and Chairman, Intergovernmental Panel on Climate Change (IPCC)

Acknowledgements

In the eighteen months that have elapsed since the Institute of International and European Affairs' Climate Change Working Group was formed, a number of extraneous developments have added to our understanding of climate change and the political responses necessary to address the problem.

Most noteworthy was the European Commission's groundbreaking Energy and Climate Change Package, published in January 2008, and subsequently signed off by European leaders at the March European Council three months later. This package of proposals is of key strategic significance for member states as they design their policy response to the challenge of climate change.

On the international stage in June 2007, the G8 reached an historic agreement in Heiligendamm, Germany, to consider "substantial cuts" in emissions. This promise was substantiated by G8 leaders in Hokkaido where a shared vision to cut global emissions by half by 2050 was articulated. At Bali in December 2007, the international community agreed to open negotiations on a successor to the Kyoto Protocol with a view to finalising a deal in Copenhagen in December 2009.

The scientific understanding of climate change has also advanced. The IPCC published three working group reports and a synthesis report in 2007. Subsequent papers published by Professor Hansen of the NASA's Goddard Institute and others rendered even the worst-case scenarios of the 4th Assessment Report conservative.

Within this fast-changing policy and research backdrop, a number of people have worked tirelessly to keep this ship on course. First and foremost among them is Peter Brennan, Chairman, initiator of the project and lead editor. His great energy and commitment to the project are very much appreciated. Second is Joseph Curtin, overall project leader, lead author of the policy context section, and assistant editor. Their efforts and those of IIEA Director-General, Jill Donoghue, are sincerely appreciated.

The Institute brought together over sixty stakeholders and experts in four working groups on this project. The Measures and Instruments sub-group was Chaired by Mary Kelly, Director-General of the EPA. Her insistence on the highest degrees of excellence was evident throughout. Norbert Gallagher was project leader and Thomas Legge lead author on the final submission. The group comprised Etain Doyle, John FitzGerald (ESRI), Conall Bolger (Airtricity), Ian Simington (NTR), Pat Finnegan (Grian), Oisin Coghlan (Friends of the Earth), Paul Harris (Bank of Ireland), Francis Jacobs (European Parliament), John Burke (Department of Finance), Richard Douthwaite (Feasta) and Mark Rutledge (EPS Consulting).

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Airport Authority), Michael MacCarthy and Patricia Kelly (Department of Agriculture and Food), Ciaran Black (Coillte Teoranta), Eoin McLaughlin and Brian Motherway (Sustainable Energy Ireland), Tom Ferris (Independent Consultant) and Michael Kelly (Eirgrid).

Jonathan Healy of Forfás, whose time commitment also went well beyond what he initially envisaged, chaired the Competitiveness group and took a central role in the drafting of the final document. Debbie Quinn (Forfás) also played a vital role in putting together the final submission. The group consisted of Emer O'Siochru (Feasta), Gerard O'Brien (Enterprise Ireland), Sinead Smith (Deloitte) and Donal Buckley of IBEC (whose advice and expertise are greatly appreciated).

The Economic and Social Consequences group was chaired by Gerry Wardell of CODEMA, whose diplomacy and consensus building skills were much in evidence. Deric O'Broin (DCU) was project leader and Tadgh O'Mahony (DIT) was lead author. The group comprised Sue Scott (ESRI), Gerard O'Neill (Amárach), Noel Cahill (NESC), Loraine Mulligan (SIPTU) and Charlie Roarty (Energy Action).

Four Occasional Papers have also been published to support the analysis. Rowan Fealy (ICARUS, NUI Maynooth), played a central role in drafting the science paper. Ray Bates (UCD), Laura McElwain and John Sweeney (both of ICARUS, NUI Maynooth), also made valuable contributions and supported him in this endeavor. Richard Douthwaite and the IIEA Research Office both published submissions on the Economics of Climate Change and Peter Brennan prepared a paper on Flexible Mechanisms and Ireland's Carbon Fund.

A number of others have commented on the report or have played a role in the editing and publishing process including Richard Tol (ESRI), Donal de Buitléir (AIB), Patrick King (DCC), Tony Brown, Elizabeth MacAulay, Margaret Ahearne, Kaitlin Moran, Johnny Ryan, Rebecca Schneider and Lauren Sims (all IIEA).

We would also like to thank Tom O'Mahony, Owen Ryan, Matt Collins and Frank Maughan from the Department of the Environment, Heritage and Local Government, and the previous Minister Dick Roche as well as the incumbent Minister John Gormley for the support and encouragement we have received throughout the long life of this project.

The commitment of several of the above contributors went far beyond what might have been reasonably expected. Although I have no knowledge of their inner motivations, I can only speculate that they were driven by a desire to act in the best interests of this and future generations.

Brendan Halligan,
Chairman, IIEA

Acronyms

AAUs	Assigned Amount Units
BER	Building Energy Rating
CCS	Carbon Capture and Storage
CDM	Clean Development Mechanism
CERs	Certified Emission Reductions
CER	Commission for Energy Reduction
CHP	Combined Heat and Power
CIF	Construction Industry Federation
COMETR	Competitiveness Effects of Environmental Tax Reforms
COP	Conference of Parties
ECCP	European Climate Change Program
EGS	Environmental Goods and Services
EPA	Environmental Protection Agency
ERPA	Emissions Reduction Purchase Agreement
ERUs	Emissions Reduction Units
ESRI	Economic and Social Research Institute
ETS	Emissions Trading Scheme
EUA	EU Emission Allowance
GCM	Global Climate Model
GHG	Greenhouse Gas
GIS	Green Investment Scheme
GISS	Goddard Institute for Space Studies
GO	Guarantee of Origin
GWP	Global Warming Potential
ICARUS	Irish Climate and Research Units
IEA	International Energy Agency
IEI	International Environmental Issues
IFI	International Financial Institutions
IIEA	Institute of International and European Affairs
INC	International Negotiating Committee
IPCC	Intergovernmental Panel on Climate Change
ISME	Irish Small and Medium Enterprises Association
ISO	International Standards Organization
JI	Joint Implementation
LULUCF	Land Use, Land Use Change, and Forestry
MAC	Marginal Abatement Cost
MACC	Marginal Abatement Cost Curve
MOTR	Mineral Oil Tax Relief
NAB	National Accreditation Board
NAP	National Allocation Plan
NCCS	National Climate Change Strategy
NDP	National Development Plan
NSAI	National Standards Authority of Ireland
NSS	National Spatial Strategy
NTMA	National Treasury Management Agency
OECD	Organisation for Economic Cooperation and Development
OMSP	Open Market Selling Price
PCF	Prototype Carbon Fund
POLES	Polar Exchange at the Sea Surface
PPO	Pure Plant Oil
PSO	Public Service Obligation
PTP	Personalised Travel Planning
REFIT	Re-invention for Innovated Technologies
RPG	Regional Planning Guidelines
SCC	Social Cost of Carbon
SDZ	Special Development Zone
SEI	Sustainable Energy Ireland
SRES	Special Report on Emissions Scenarios
TDM	Travel Demand Management
TERI	The Energy and Resources Institute
TFC	Total Financial Consumption
TPER	Total Primary Energy Requirement
UNEP	United Nations Environmental Program
UNFCCC	United Nations Framework Convention on Climate Change
VRT	Vehicle Registration Tax
WMO	World Meteorological Organization
WTP	Workplace Travel Planning

Introduction

I have always considered global warming to be a matter of utmost urgency, now I believe we are on the verge of a catastrophe if we do not act.

Ban Ki-moon, UN Secretary-General, September 2007

Opening remarks

We cannot negotiate with nature.

Greenhouse gas emissions caused by human activity have resulted in significant global warming since the beginning of the industrial revolution. Further warming is inevitable – even if all man-made emissions were eliminated immediately, inertia in the climatic system means that temperatures would continue to rise significantly for some time to come. We are, in all probability, close to a point where dangerous climate change becomes inevitable. As we approach this threshold, the real cost of each additional tonne of carbon emitted rises inexorably as the impacts of climate change become more unpredictable and severe. Ultimately, we face a catastrophe if urgent action is not taken.

Vulnerable and less developed communities are the first to suffer, but people in all countries will be exposed to negative impacts if emissions continue unchecked. If dangerous climate change is to be avoided, emissions reductions should begin immediately in the developed world, global emissions should peak by 2020 at the latest, and fall by at least 50% by 2050.

This is the accepted consensus of leading experts worldwide.

Ireland's approach

In addressing the global climate change challenge it is clear that there can be no opt-outs, no derogations. Ireland's per capita emissions are among the highest of all developed countries and are many times those of any developing country. An argument for inaction is that Ireland may not be immediately exposed to the negative impacts of climate change. This, however, ignores Ireland's embedded position within the global economy – we live in a globalised world where one country's instability can become every country's problem. It further ignores the medium- to long-term impacts of climate change which are predicted by ICARUS, NUI Maynooth, and others, to have negative consequences for this country.

Irrespective of these arguments, the EU is committed to a minimum 20% reduction in overall EU greenhouse gas emissions by 2020 on 1990 levels, with the expectation of a much more onerous target after 2020. Ireland, as a member of the EU, has been apportioned its share of this target and is required to make substantial emissions reductions in the period to 2020.

There is therefore a political, economic and a moral imperative for action.

This imperative is reinforced by global energy trends: the International Energy Agency has consistently cautioned policy-makers about worrying trends in global energy supply and demand,[1] not least the growing body of evidence that global oil production will peak by 2030 at the very latest, with many analysts predicting a peak in production much sooner.

This report therefore takes as its starting point that Ireland *must* act to maintain its international competitiveness, *must* demonstrate leadership among – or at the least solidarity with – developed countries, and play its part in solving this global crisis. The main question we address is not *whether* action is necessary, but rather, *what* form that action will take.

Need for a clear strategy

Ireland will be required to reduce emissions from the agriculture, transport, light industry and services and residential sectors by a minimum of 20% on 2005 levels by 2020. This, taken at face value, is a huge challenge. Two of these sectors – agriculture and transport – account for approximately 80% of all domestic sector emissions. No easy mitigation options for these sectors present themselves and emissions from both would escalate under "business as usual" scenarios.

The EU Emissions Trading Scheme covers the heavy industry and power generation sectors. These sectors will be required to reduce emissions by 21% on 2005 levels by 2020. Irish operators will thus see their allocation of emissions permits gradually reduced over the period to 2020 and probably beyond.

To reduce emissions by the magnitude required in the space of only twelve years is an enormous political, economic and social challenge. It is immediately apparent that incrementalism will not deliver the magnitude of change required, a paradigm shift in thinking is necessary if Ireland is to manage this transition successfully.

Developing strategic goals for the future, defining roles and responsibilities and harnessing all societal actors behind these goals are prerequisites to action. Government and the policy community are aware that Ireland needs a strategic plan. In addition to a clear policy framework, Ireland also needs appropriate institutional arrangements to ensure full and coordinated implementation of the measures necessary to achieve the medium- to long-term carbon reduction targets.

The response to this challenge will not only define Ireland's ability to remain competitive in a global environment where economic activity becomes increasingly fossil fuel free, but will, more broadly speaking, also define our attitude to how we face the new challenges of the 21st century.

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[1] International Energy Agency (2007), *World Energy Outlook*, November 2007.

Stakeholders

The urgency and magnitude of the challenge will require all stakeholders – from Government to businesses, householders and individual citizens – to appreciate and understand the fundamental changes to society involved in delivering Ireland's legally binding climate change commitments.

All sectors and all citizens will be required to be open to change and to shoulder a portion of the costs. Many opportunities will also arise which Ireland needs to be in a position to capitalise on. Cross-society consensus is needed if some of the policy changes proposed in this report are to be implemented with the minimum amount of social dislocation and the maximum effect.

Methodology

With such considerations in mind, this project was launched in February 2007 and the IIEA Climate Change Working Group was established under the Chairmanship of Peter Brennan. At our first meeting, over 60 stakeholders were brought together from across a broad spectrum of society. Representatives from academia, semi-state organisations, government departments, financial institutions, industrial sectors, employers associations, unions and NGOs attended.

It was decided that the key focus of the report should be on mitigation strategies which will determine the country's ability to meet our Kyoto and EU commitments rather than the important issue of adaptation to the impacts of climate change. Agreement was reached on the main subject areas to be researched and debated and four working sub-groups were set up each with a dedicated chair and project leader. The sub-groups were:

- Policies and Measures
- Sectoral Responses
- Impact on Competitiveness
- Economic and Social Consequences of Climate Change.

Stakeholders were subsequently assigned to the respective sub-groups and meetings were held on a monthly basis through to September 2007. A number of concurrent workshops and seminars were hosted by the IIEA to provide information on different aspects of climate change policy. For example, the Institute hosted a Carbon Day with Dr Rajendra K Pachauri, Chairman of the Intergovernmental Panel on Climate Change, in June 2007. Further events explore themes such as carbon taxation, energy efficiency, biofuels and emissions trading. The working groups submitted final reports in October 2007.

Report structure

These submissions constitute the main body of this report which is divided into two parts. Part I, The Policy Context, contains three chapters on the international, EU, and national policy environment for climate change. Part II, Working Groups' Analysis, contains four submissions by our working groups. These strands are synthesised into a conclusion.

Four substantiating expert contributions were submitted and published as Occasional Papers on our web-site: One paper on the science of climate change drafted by Rowan Feeley, ICARUS, NUI Maynooth; two on the economics of climate change by the IIEA Research Department and Richard Douthwaite respectively; and the fourth on Carbon Market Insights by Peter Brennan.

Strategic Options

The final chapter sets out three coherent strategic options and their implications.

These options are

- Business as Usual: the key aspects of this strategy are minimum compliance with binding targets and using the carbon market to the maximum extent possible to buy carbon credits. While this strategy may appear attractive in the short term as it implies minimum disruption to the structure of Ireland's economy, in the medium to long-term, it may prove unsustainable, both economically and environmentally.

- Proactive Compliance: the key aspect of this strategy is the adoption of a long-term national emissions reduction target at the lower end of the EU's indicative targets for 2050 – a 60 to 70% reduction in emissions on 1990 levels. A corresponding comprehensive package of domestic measures, beginning with the immediate introduction of a carbon levy, would be put in place to ensure effective delivery of the long-term target.

- Carbon Neutrality: would involve Ireland joining the leading "clean, green and rich" countries. It would require the adoption of a long-term emissions target for 2050 of an 80% reduction on 1990 levels and raising the bar on all corresponding intermediate targets and measures, as well as the consideration of several radical additional measures. This approach corresponds with what climate scientists tell us is necessary for developed countries if dangerous climate change is to be avoided. It might, however, imply greater immediate cost to the current taxpayer for measures that would benefit future taxpayers, and as a result Irish business could be exposed to increased competitive pressures in the short-term.

Closing Remarks

For policymakers and stakeholders, these are complex issues to consider. This report provides a comprehensive starting point for the debate on Ireland's future strategy. It is important to point out that there are areas which we have not been able to address exhaustively. For example, we have not covered the detail of how emissions in the agriculture sector will be reduced or the role that Common Agricultural Policy reforms might play in this process; second, we have only touched on the role of micro-generation in electricity generation, though there are several promising technologies on the horizon which might be considered; third, we have not fully explored the electrification of transport, the great potential of which only became apparent as the final report was being drafted. These are challenges that we expect will be taken up by the ESRI and other researchers working in the area in subsequent reports. We hope that future research can build on this preliminary report which is aimed at developing a general understanding of the broad issues involved and at designing a strategic framework within which Ireland can build a response to the challenge of climate change.

Part I The Policy Context

Chapter 1 International Policy Context

After 2020, developing country emissions will overtake those of the developed world. In the meantime, the rate of growth of overall developed country emissions should start to fall, followed by an overall absolute reduction from 2020 onwards.

European Commission, *Communication on Limiting Global Climate Change to 2° Celsius*, January 2007

Introduction

This chapter reviews the development of the international climate change regime and assesses prospects for a post-2012 international climate change agreement. The first section highlights key characteristics of the climate change problem in a brief theoretical overview. The second outlines early political responses to the climate change problem, including the establishment of the Intergovernmental Panel on Climate Change (IPCC), culminating in the negotiation and ratification of the Kyoto Protocol. The third section evaluates efforts on the part of the EU and other major emitters to work towards a post-2012 international agreement on climate change. Some brief concluding remarks follow.

Characteristics of the climate change problem

Climate change presents a unique set of challenges for policymakers. Highlighting certain characteristics of the problem allows for a greater understanding of why this might be the case.

Climate change is a pronounced and wide-ranging form of market failure, as described in the UK's Stern Review.[2] The pricing of global resources (in this case the earth's atmosphere) does not take appropriate account of their scarcity value or of the services they provide and actors in the global economic system do not have the information or ability to act in the long-term collective interest of the planet. As with other kinds of market failure, climate change requires governments to intervene with policies and measures that benefit society as a whole. Government intervention can correct this market failure by providing an enabling framework, through legislation, incentives and, above all, the predictability of conditions for forward planning.

No country, however, has the incentive to unilaterally implement policies to control the exploitation of this resource because the negative consequences of climate change would still occur, while the self-imposed restriction would entail additional costs for the country in question. Under these conditions, no country acting in its own self-interest would choose to control emissions. In the long run, dangerous climate change would still occur with negative impacts arising globally.

[2] Nicholas Stern, *The Stern Review on the Economics of Climate Change* (London: HM Treasury, 2006).

On the global level, a rational political response would be for all countries to build an international regime to regulate access to this resource in order to avoid a long-run sub-optimal outcome. Several factors, however, militate against the development of such a regime.

First, the "intergenerational" cost-benefit implications of unchecked emissions have to date retarded effective political responses. The negative consequences of climate change will, by and large, be felt by future generations while the cost of action is borne by the current generation. Because policy-makers tend to prioritise short-run impacts, generating the political will necessary to reduce GHG emissions is problematic.

Second, the impact of climate change is projected to be asymmetric geographically. Developed countries, which have the greatest levels of historic responsibility for the problem, will suffer less relative to developing countries from the negative impacts of climate change and have at their disposal the political and economic resources to adapt more successfully.

Consequently, the negative impacts are perceived as distant, not only temporally, but also geographically and the incentive for developed countries to take action on climate change is low.

Finally, deciding the rules of an international climate change regime is extremely complex for a number of reasons. Countries' *per capita* emissions vary greatly. Yet emissions *per capita* are not a good measure of "responsibility" because some countries industrialised earlier than others and have been polluting far longer.

Climate change is therefore a problem which requires a worldwide response, but countries have different levels of responsibility, ability and incentives to tackle the problem. There are strong disincentives for countries to demonstrate leadership by taking early action.

Early policy responces

Although anthropogenic climate change has been with us for the past century, until the 1980s political responses to the threat of climate change were muted and international efforts to respond to the threat were weak. This can, to some extent, be attributed to the degree of uncertainty surrounding the science of climate change and the impact of human activity on the environment.

Establishing scientific consensus

The political debate on climate change is fundamentally underpinned by a developing consensus among the scientific community on the causes and effects of climate change. The journey to consensus on the science, and the increasing ability to communicate that consensus, was an essential precursor to the early policy responses to the threat of climate change.[3]

In 1985, a seminal conference on climate change, organised by the World Meteorological Organisation (WMO) and the United Nations Environmental Programme (UNEP) led to the establishment of the IPCC. It was given a remit to assess the magnitude and timing of weather variations, the socio-economic consequences arising and to propose realistic policy responses. Its modus operandi is to synthesize the available peer-reviewed research and to compile the results into periodic assessment reports. By virtue of their comprehensive nature these reports have come to be accepted as the consensus of scientific opinion on climate change. For example, the Fourth

[3] See IIEA Occasional Paper, available at: http://www.iiea.com/projectsxtest.php?project_id=21 for description of the scientific consensus.

Assessment Report, published by the IPCC in November 2007, provided a stark warning to policymakers of the dangers of a Business As Usual (BAU) approach to GHG emissions as well as an evaluation of the viability of different policies and measures which might be employed to mitigate emissions.[4] The IPCC reports have been decisive in encouraging policymakers to take into account the long-term implications of policy, and difficult decisions can be justified by referring to this consensus of scientific opinion.

Towards an international framework

The UNEP/WMO conference of 1985 led also to the establishment of the International Negotiating Committee (INC) with a mandate to establish an international "Convention" on climate change. The First IPCC Assessment Report, published in 1990, added impetus to the process. As a result, the UNFCCC was opened for signature at the Earth Summit in Rio de Janeiro, Brazil in 1992.

The Convention was an attempt to overcome the barriers to communication between countries by establishing an overall framework for intergovernmental efforts to respond to climate change. It recognized that the atmosphere is a shared resource, the stability of which can be affected by human-related emissions of carbon dioxide and other greenhouse gases. It established the overall objective of "stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system". No definition was offered for "dangerous anthropogenic interference" and this therefore remains a contested term.

The important principle of "common but differentiated responsibility" was also enshrined in the Convention. This principle is based on the understanding that "the largest share of historical and current global emissions of GHG has originated in developed countries" and as a consequence that "developed country parties should take the lead in combating climate change". A clear onus was thereby placed on developed countries to take the first step towards a global solution.

Under the Convention, governments committed to the following measures:

- Establishing inventories and reporting standards for GHG measurement;
- Sharing information on emissions and mitigation measures;
- Launching national strategies for addressing GHG emissions; and
- Cooperating in preparing for adaptation to the impacts of climate change.

The Convention also established a Conference of Parties (COP) as the supreme body of the Convention charged with overseeing its implementation. It would meet annually, with extraordinary sessions to be held at other times as deemed necessary. The COP was also given the right to adopt Protocols to the Convention.

The UNFCCC contained no specific commitments, but rather sought to create a designated international forum for the climate change debate that would bring the main parties together. It was hoped that specific commitments would follow. Because developed (referred to as Annex I) countries effectively undertook to bear the compliance costs of developing (referred to as Annex II) countries, and because of the recognition of common but differentiated responsibility, the Convention was ratified relatively quickly and came into force in March 1994.

[4] The Fourth Assessment Report is the culmination of six years' work by 450 lead authors, 800 contributing authors and 2,500 expert scientific reviewers from 130 countries. A synthesis of this report, launched in Valencia on 17 November 2007, is available at www.ipcc.ch.

Kyoto

At the first COP, held in Berlin in April 1995, a group with a mandate to negotiate a Protocol specifying emissions reduction obligations for Annex 1 countries was formed. This mandate was fulfilled at COP 3 in Kyoto, Japan, in 1997, when legally binding emissions reduction targets were agreed. The EU played a leadership role by insisting that all Annex 1 countries set quantified emissions limitations and reduction objectives (QUELROS) within a defined time period.[5] Annex I countries, in recognition of their historical "responsibility" and greater economic resources, undertook to reduce their 1990 GHG emissions levels by an aggregate 5.2% by 2012. This aggregate target was differentiated among developed countries; the major emitters were apportioned targets as follows: the US – 7%, Russia – 8%, Japan – 6%, and the EU – 8%. The terms of the Kyoto Protocol allowed for groups or "bubbles" of countries (such as the EU) to manage their efforts in unison. This in itself was a controversial proposal – the US and Canada argued that it was inequitable because it allowed for wide differentiation between member states but not for other Annex 1 countries.

The Annex II countries, including those with substantial emissions, such as China, India and Brazil, were not required to make any stabilisation commitments under the terms of the Protocol, as had been envisaged in the Convention. It was hoped that the Annex I countries, by moving first to control emissions, could convince developing countries to follow in the future, thereby breaking the vicious circle of inaction.

Many groups and commentators argued that the commitments were too distant (2008-2012) and lacked in ambition on the grounds that targets made under the commitment period, even if reached, would be more than offset by rising emissions in the developing world. In defence of the Kyoto Protocol, it was argued that it was justifiable as an attempt to establish the international architecture and instruments to tackle climate change which could be enhanced and built upon by future agreements.

The Kyoto Protocol broke new ground by defining three flexible mechanisms that had the potential to reduce the cost of meeting emissions reduction targets in developed countries. In justifying these mechanisms, it was argued that the cost of limiting emissions varies considerably from region to region, while the benefit is the same irrespective of the location of the emissions reduction. The three mechanisms are Joint Implementation (JI), the Clean Development Mechanism (CDM) and Emissions Trading. JI allows an Annex I Party to implement an emission-reducing project in another Annex I Party; the emissions reductions units (ERUs) achieved count towards meeting the Kyoto target of the first party. The Clean Development Mechanism (CDM) allows for Annex 1 countries to fund emissions reductions projects in Annex II countries to offset their own emissions; this allows parties not included in Annex I to benefit from project activities resulting in certified emissions reductions (CERs). The third mechanism, emissions trading, allows for the transfer to, or acquisition from, other Annex I parties of assigned amount units (AAUs). However, according to the Protocol "any such trading shall be *supplemental to domestic actions* for the purpose of meeting quantified emission limitation and reduction commitments under that Article".[6]

Ratification Process

The road to ratification proved difficult. In 1997, the US Senate unanimously passed the Byrd-Hagel Resolution, which stated that the Senate would not be a signatory to any Protocol that did not also include binding targets for developing countries which otherwise might harm the American

[5] Chad Damro and Pilar Luaces Mendes, "Emissions Trading at Kyoto: From EU Resistance to Union Innovation", in Andrew Jordan (ed.), *Environmental Policy in the European Union: Actors, Institutions and Processes* (London: Earthscan, 2005), p. 264.

[6] UNFCCC, *Kyoto Protocol*, Article 6.1.d; Article 17 (2007).

economy. As a consequence, the Clinton Administration did not submit the Protocol to the US Senate for ratification.

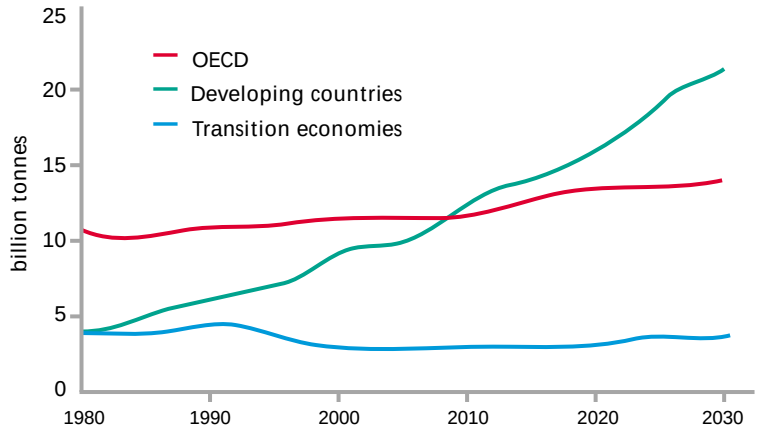
The Kyoto Protocol received a major setback with the election of George W Bush as President of the US in 2000. In March 2001, the new President announced that Kyoto would not be ratified, describing it as "a lousy deal for the American economy".[7] One of the main arguments used against US ratification was that the competitive position of the US would deteriorate vis-à-vis the developing countries, which had not taken on any commitments. Higher energy prices resulting from emissions trading, carbon taxes and other measures that would be needed to meet emissions reductions targets, it was argued, would make goods less competitive, damaging exports and jobs. "Carbon leakage" – the migration of energy-intensive economic activity from one country to another as a result of policy – would result in no net emissions reductions occurring. The US was primarily concerned with increased competition from fast growing developing countries such as China.

Despite this major setback, delegates at COP 7 in Marrakesh, Morocco in 2001 managed to breathe new life into the Protocol by reaching an agreement on a number of outstanding issues, including rules governing the use of the flexibility mechanisms, reporting, land use, land use change and forestry (LULUCF), compliance measures and support mechanisms. The EU also played a leadership role in keeping Kyoto alive – the EU and its member states ratified the Kyoto Protocol on 31 May 2002. With Russia's ratification in November 2004, the Protocol reached the 55% coverage of global emissions it required and came into force in February 2005.

Looking beyond 2012

Global emissions continue to rise by an average of 3% per annum.[8] A small number of developed countries are responsible for more than 50% of global emissions. On average, their per capita emissions are more than five times higher than those of developing countries. On a BAU basis, it has been estimated that the developed countries will need to cut GHG emissions by 60% to 80% by 2050 to achieve the EU's target to limit average global temperature increases to no more than 2° Celsius of pre-industrialised levels.

Figure 1.1 Energy-related CO_2 Emissions by Region (International Energy Agency Reference Scenario)



Source: WEO 2006 © OECD/IEA 2006

Developed and developing countries take markedly different approaches to climate change negotiations. Given emissions projections (see diagram) in the medium-term, both will have to take action to control emissions if the problem is to be adequately addressed. No agreement has yet been reached on how this might be achieved in a universally acceptable manner.

[7] FOX News, Bush Dubs Kyoto "Lousy Deal" For America, Aired 11 July 2005.

[8] Netherlands Environmental Assessment Agency, *China Now No. 1 in CO_2 Emissions; USA in Second Position* (Bilthoven: Netherlands Environmental Agency, June 2007).

The task of negotiating a successor agreement to Kyoto that would be acceptable to all parties has begun. At the G8 meeting in Heiligendamm in Germany in June 2007, the G8 countries agreed to launch negotiations on climate change under the United Nations umbrella.[9] Under the UNFCCC, Environment Ministers from around the world, supported by more than a thousand national experts, have begun working on a new accord. A roadmap to begin negotiations on an accord to succeed Kyoto was agreed at the Bali Conference of Parties (COP) in December 2007. It comprised the following main elements:[10]

- An agreement to develop a shared vision on a long-term global goal for emissions reductions based on the principle of common but differentiated responsibility, respective capabilities and socio-economic conditions;
- Enhanced national and international action on mitigation;
- Enhanced national action on adaptation technology development and the provision of financial resources and investment;
- Enhanced national action on technology development and transfer to support mitigation and adaptation efforts;
- Enhanced action on the provision of financial resources and investment to encourage mitigation, adaptation and technological development; and
- The setting of targets with reference to the IPCC Fourth Assessment Report which calls for 25 to 40% emissions reductions by 2020.

It is envisaged that a new deal could be concluded by December 2009 at the Conference of Parties in Copenhagen. This would allow for outstanding issues to be resolved in time for ratification to take place the following year.

Developed Countries

All developed countries are signatories to the UNFCCC, and thus – at least in theory – subscribe to the notion of "common but differentiated responsibility", that is, they have primary responsibility to take first action to reduce emissions. Industrialised countries have, however, different levels of responsibility for climate change, different potentials for mitigation, different levels of economic resources to adapt to the impacts of climate change, and different levels of exposure (or perceived exposure) to competition from the developing world. It is not surprising, therefore, that approaches to negotiating a post-2012 agreement differ widely among these countries. Differences of perspectives on the role of mandatory emissions reductions targets, the role of developing countries in international agreements, and the prospective role of an international emissions trading scheme, are pronounced.

The EU: Europe is responsible for 10% of global GHG emissions and the EU-25[11] has an overall 8% emissions reductions target for 2008-2012 on the 1990 base line under the Kyoto Protocol. The EU is playing a global leadership role in post-2012 climate change negotiations. In March 2007 the European Council agreed a unilateral commitment to a 20% emissions reduction on the 1990 level by 2020 and a 30% emissions reduction if other developed countries make a comparable commitment (see Chapter 2).

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[9] G8 Summit, Chair's Summary (Heiligendamm, 8 June, 2007), Accessed Online: www.g-8.de

[10] UNFCCC, *The United Nations Climate Change Conference in Bali* (2007), Accessed Online: www.unfccc.int/meetings

[11] Malta and Cyprus are Annex 2 countries and consequently have no reduction commitments.

The US: The success or failure of the upcoming round of negotiations on climate change will depend largely on what approach the White House takes to post-2012 negotiations after the forthcoming Presidential election. The US was the world's biggest emitter of CO_2 until 2007 (when China's emissions overtook those of the US) and accounts for 21% of global emissions annually.[12] Emissions have risen 15.8% in the period 1990-2004 (the comparative figure for the EU15 was -0.6%).[13]

The Bush Administration's initial position on international climate negotiations was that mandatory emissions reductions targets remained unnecessary, as the anthropogenic component in climate change was unproven.[14] It was further argued that emissions reductions targets were useless unless developing countries such as China and India also took them on board. President Bush consistently expressed a preference for finding technological solutions through increasing funding to research projects with climate change implications, such as those exploring efficient and renewable technologies, clean coal, carbon capture and storage technology, ethanol and biofuels. President Bush said he wanted to see an 18% cut in GHG intensity by 2012 over 2002 levels. At first glance this may appear more ambitious than the Kyoto target but the reality is quite different – this target refers to the percentage reduction after GDP annual growth is taken into account, whereas the Kyoto Protocol does not factor in economic growth.[15]

A number of domestic and international developments forced the Bush Administration into a re-evaluation of its approach:

- Greg Nickels, Mayor of Seattle, started a campaign in 2005 to get US mayors to unilaterally opt into Kyoto just as President Bush had unilaterally opted out. By the end of 2007, 527 mayors representing over 66 million Americans had signed up.
- In 2003, nine Northeast States led by New York formed the Regional Greenhouse Gas Initiative (RGGI). This programme will be officially launched on 1 January 2009.
- 25 US states have renewable energy portfolio standards applying to nearly 50% of electricity load as of 2007, albeit with widely varying degrees of ambition.
- Arnold Schwarzenegger, Governor of the State of California, also set up a Western Regional Climate Action Initiative. California Legislature Bill Ab-32, 2007 is also aimed at curbing carbon emissions and set a number of ambitious targets including a commitment to reduce emissions to 80% below 1990 levels by 2050.[16]
- The US Supreme Court, on 2 April 2007, issued a landmark ruling in favour of environmentalists who argued that the US Environmental Protection Agency should regulate the emissions of CO_2 from new vehicles.[17] The long-running dispute between the State of California, the EPA and the White House rages on with the White House objecting to California's attempt to improve efficiency standards for vehicles.
- Chief Executives of some of the largest companies in the US urged President Bush to introduce measures to tackle global warming. They formed the US Climate Action Partnership (USCAP) that

[12] Netherlands Environmental Assessment Agency, *China Now No. 1 in CO_2 Emissions; USA in Second Position* (Bilthoven: Netherlands Environmental Agency, June 2007).

[13] European Environment Agency, *Annual European Community Greenhouse Gas Inventory 1990-2005* and *Inventory Report 2007* (Luxembourg: Office for Official Publication of the European Communities, 2007).

[14] White House Press Release, "Bush Climate Change Speech" (June 2001), Accessed Online: www.whitehouse.gov/news

[15] Kurt Volker, US Principal Deputy Assistant Secretary of State for European and Eurasian Affairs briefed the Institute of International and European Affairs Climate Change Working Party on the US Administration's climate change policy (March 2007).

[16] Union of Concerned Scientists, *AB 32 Global Warming Solutions Act: A Fact Sheet* (2007).

[17] Supreme Court of the United States, *Massachusetts et al vs Environmental Protection Agency No.05-1120* (2 April 2007).

advocated a cut of at least 60% in GHGs by 2050.[18] Members of the USCAP include CEOs of Duke Energy, Alcoa, BP America, DuPont, Caterpillar, General Electric, Lehman Brothers, FPL Group and PG & E.

- On 7 November 2007, the US Senate Sub-committee on Climate Change proposed the Lieberman-Warner Bill which called for 15% emissions reductions by 2020, 70% by 2050, and a cap and trade system for major polluters. The Bill was defeated in Congress in June 2008.

As a consequence of these developments, the US Administration's attitude to international climate change negotiations has begun to change. At the G8 Summit in Heiligendamm, President Bush committed the US to "consider seriously" halving of emissions by 2050. No baseline was given. The White House, however, continued to call for developing nations to curb their GHG emissions. Without their cooperation President Bush maintained that drastic measures in the United States to combat climate change made little sense. "We all can make major strides," he stated after the Summit, "and yet there won't be a reduction until China and India are participants."[19] The White House would have each country set its own technology deployment and emissions control goals and would give individual countries responsibility for achieving their own targets, with the ultimate objective of achieving an internationally agreed long-term goal.[20] This promise to "consider" the target was substantiated by President Bush in Hokkaido in 2008 where a shared vision to cut global emissions by half by 2050 was articulated.

At a September 2007 meeting of all major emitters hosted by the White House, a new "International Clean Technology Fund" was also proposed by the American Administration to shift more money from industrial to developing nations in order to facilitate the meeting of these objectives.[21] This initiative resulted in the World Bank's two international investment funds – one for technology transfer and one for adaption – that will provide innovative financing for developing countries to pursue cleaner development paths and protect themselves from the impacts of climate change. The funds received financial support from the US, the UK and Japan.

The experience of being a signature to the Kyoto Protocol and Congress's subsequent failure to ratify is one which the US will be loath to repeat. What is agreed will be largely determined by domestic constraints. Congress will likely determine how far the US is willing to go prior to international negotiations and the US delegation will follow this mandate closely. Given that a new Congress and Presidency will sit from January '09, it is difficult to predict what approach will be taken. A number of trends can, however, be identified.

The US first of all favours sectoral benchmarking. The modalities of this approach are seen in the Asian-Pacific Partnership on Clean Development and Climate, an initiative launched in 2005 where seven major American and Asian countries have come together in 8 key areas and agreed targets for slowing the increases in emissions. Information exchange on best practice and diffusion of clean technologies and processes are offered to developing partners in order to encourage compliance. Sectoral benchmarking has the benefit of avoiding carbon leakage and protecting competitiveness. It will, however, be for the US to prove that this approach can be combined with the principle of common but differentiated responsibility and the Kyoto process if it expects it to yield dividends at COP 15.

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[18] "Bush Must Fight Climate Change", in BBC World News (23 January 2007).

[19] Judy Pasternak, "Bush Seeks Overseas Curbs as US-Backed Banks Help Emit More", in *Los Angeles Times* (12 August 2007).

[20] For more information please see: http://www.whitehouse.gov/infocus/environment

[21] John J. Fialka, "Bush's Alternative to Kyoto Pact on Warming Gets a Cool Response", in the *Wall Street Journal* (30 September 2007).

It is unclear if Congress will be able to agree a position in time for the Copenhagen COP in December 2009 and, given that Congress works in two-year cycles, a date in 2010 might be a more realistic target.

Japan: Japan is responsible for 5% of global emissions. While Japan signed and ratified the Kyoto Protocol and undertook to reduce emissions by 5% by 2012, its emissions had risen 7% by 2004. The closure of the earthquake-struck Kashiwaki-Kariwa nuclear power plant will add a further 2% annual increase in emissions as the lost capacity is replaced by oil and coal power generation. Japan is expected to struggle to meet its Kyoto targets and is likely to have to rely on the global carbon market in which it will be a key player.[22]

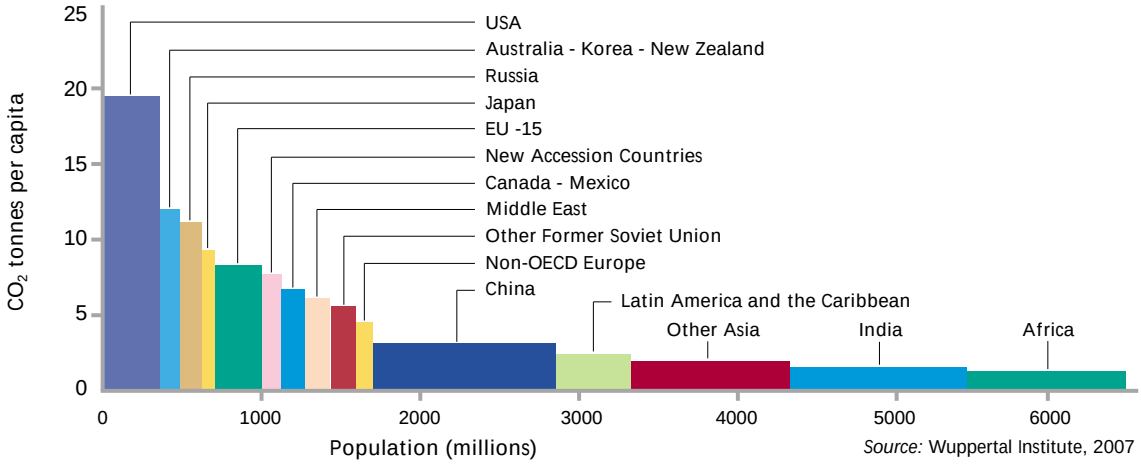
The main domestic policy measure is a Voluntary Emissions Trading Scheme established in 2005. Some 34 companies and corporate groups have been selected as participants. Under the scheme, the Government subsidises the installation cost of CO_2 emissions reductions equipment to help businesses that are actively attempting to reduce GHG emissions. In exchange for the subsidy the participants are required to commit to a certain reduction in their CO_2 emissions. The scheme also allows them to trade CO_2 emissions quotas to meet their reduction targets. The total government budget for the subsidy is $23.6 million.

As a large industrialised country, Japan plays a key role in international negotiations and was central in brokering a compromise between the EU and US at Kyoto in 1998. Former Japanese Prime Minister Abe's main contribution to this round of negotiations was a proposal to reduce global emissions by 50% by 2050 in an agreement which would include all the world's major emitters, including China. According to the Executive Secretary of the UNFCCC, Yvo de Boer, however, this proposal "is not a great deal more than empty talk".[23] It is thought that Japan is increasingly concerned with the emergence of China and wishes to avoid measures that might result in the leakage of carbon intensive industry to its competitor. In summary, although a signatory to the Kyoto Protocol, Japan's efforts at cutting emissions have been of limited success.

Developing Countries

Developing countries have consistently refused to adopt emissions reductions targets, arguing that their per capita emissions are only a fraction of those in the developed world. The following Figure demonstrates the power of this argument. The contrast between the US and China is noteworthy.

Figure 1.2 Per Capita Emissions of GHG



Source: Wuppertal Institute, 2007

[22] Karan Capoor and Phillipe Ambrosi, *State and Trends of the Carbon Market 2007* (Washington DC: World Bank, 2005).

[23] Living on Earth (10 August 2007), Accessed Online: www.loe.org/shows

While some would argue it is inconceivable that developing countries would agree to take on emissions reductions targets in the early post-2012 commitment period, it is possible they may agree interim intensity targets. The main issue becomes how to integrate developing countries into an international framework to reduce emissions without requiring them to commit to mandatory emissions targets in the short term.

China: Though China and US emissions are roughly equal in absolute terms, *per capita* emissions are only a fifth in China. Emissions are, however, rising exponentially – by 73% between 1990 and 2004. In 2006, China added 102 gigawatts of power capacity – equal to the entire grids of the UK and Belgium combined, 90% of it coal-fired.[24]

Given that 76 million rural Chinese were living in extreme poverty in 2004 with average income levels below $110 per annum there will clearly be a strong incentive for China to prioritise growth over other policy objectives for some time to come.

Within China there is an increasing recognition, however, of the potential negative impacts of unmitigated climate change and other environmental damage. The National Climate Change Assessment Report foresees higher temperatures causing droughts, spreading deserts and reducing water supplies.[25] Most alarmingly, its projections suggest that production of rice, corn and wheat could fall by 10% by 2030, and by up to 37% during the second half of the century. "If we do not take action, climate change will seriously damage China's long-term grain security", the assessment pointed out. The report concluded nevertheless that China should not risk slowing its economic growth by curbing the growth of GHG emissions.

China has responded to the challenge in a number of ways:

- It launched a drive to use energy more efficiently, a move some analysts say could have a similar impact to an emissions cap;
- It invested heavily in nuclear, wind, hydro and biofuel power generation, and has acted to control the use of methane gas from coal beds;
- An extensive reforestation programme is underway; and
- It has become the largest proponent of CDM emissions.

China continually puts the onus on developed countries to lead the way on emissions reductions. It also hopes that the developed countries can provide financial and technological support to developing countries to better meet their needs for technology transfer and co-operation, particularly in climate change observation and monitoring, reduction of GHG and adaptation to climate change. President Hu Jintao clarified China's climate change policy at the G8 Summit in June 2007. He reminded his interlocutors of the UN principle of "common but differentiated responsibilities", and insisted that developed countries have to take the lead on emissions reductions. This was a position reiterated to members of a European Parliament's delegation to China in November 2007. The delegation concluded that China was politically committed to tackling climate change, though not willing to accept quantitative emissions reductions targets.[26] China would be more responsive to participating in global initiatives on energy efficiency, the development of renewables and carbon capture and storage technologies. According to Yu Jie, Climate Advisor of the Heinrich Boll

[24] Richard MacGregor, "China's Data on Soaring Energy Use Give a Shock", in the *Financial Times* (February 2007).

[25] Joanna I. Lewis, *China's Climate Change Strategy* (Washington DC: Jamestown Foundation, June 2007).

[26] For more information please see the European Parliament Article (November 2007), Accessed Online: www.europarl.europa.eu/news/public

Foundation in Beijing, the Chinese Government is deeply concerned about climate change, but is waiting for US action. According to Ms Yu, "China will be a follower if the US leads".[27]

India: India is the world's fourth biggest GHG emitter and produces about 5% of global carbon dioxide emissions. Emissions rose by about 88% between 1990 and 2004.[28] With poverty more prevalent in India than China, and per capita emissions only about a third of those in China (about 6% of per capita emissions in the US), growth in emissions is likely to continue into the foreseeable future. In June 2007, India's National Council on Climate Change agreed to draft national policy by October 2007 but made no commitment to mandatory emissions targets. Several domestic measures have been taken including a tree-planting programme, and projects to improve energy efficiency, fuel usage, industrial processes and management of solid waste. India and China agree that developed countries need to make stronger emissions reductions commitments. This position was articulated clearly by India's Environment Minister, Pradipto Ghosh, before the G8 met at Heiligendamm when he said that, "reducing greenhouse gas emissions is likely to have significant adverse impacts on GDP growth of developing countries, including India, and serious implications for our poverty-alleviation programmes".[29]

In June 2008 Prime Minister Manmohan Singh launched India's first National Action Plan on Climate Change. The plan outlines eight national "missions" for sustainable development: solar energy; energy efficiency; creating a sustainable habitat; conserving water; preserving the Himalayan ecosystem; creating a green India; creating sustainable agriculture; and establishing a platform of "strategic knowledge" for climate change. The plan lacks a budget and plan of action at this point, but a Council on Climate Change, with stakeholders from the government, industry, and civil society, has been formed to come up with directives and funding. Among the eight missions, the strongest focus seems to be on solar power. The plan contains no reference to emissions reductions targets.

Conclusions

Developing countries take a different perspective to emissions reductions than some developed countries. The developing countries' perspective is shared by Yvo de Boer who commented that, "I don't have the feeling that it is feasible, or realistic, to expect China, India, Brazil, Indonesia, and developing countries to accept legally binding targets to reduce their emissions because they have to grow their economies. They have to eradicate poverty. What I do see those countries perhaps being willing to do is to limit the growth of their emissions and to improve the energy efficiency in certain sectors of their economy and to improve vehicle standards, those kinds of actions."

Any post-2012 international agreement would likely run to 2020. It will be necessary for developed countries to pave the way by showing that emissions reductions can be combined with economic development in the hope that developing countries can be convinced to follow their lead in the post-2020 period.

There is a consensus in the international community that climate change must be addressed and that the requisite institutional architecture be put in place. For the post-2012 period, reduction targets are likely to be more ambitious than for the first commitment period. The EU has taken a leadership role and has placed increasing pressure on the US to take a more proactive approach by announcing

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[27] Fiona Harvey, "Yo Kyoto: Bush Shifts His Stance on Global Warming", in the *Financial Times* (2 October 2007).

[28] G. Marland, T.A. Boden, and R. J. Andres, "Global, Regional, and National CO_2 Emissions", in *Trends: A Compendium of Data on Global Change* (Oak Ridge, Tennessee: US Department of Energy, 2006).

[29] "India Rejects Greenhouse Gas Limits", in *Terra Daily*, Accessed Online: www.terradaily.com

its own ambitious unilateral measures. The US holds the key to a successful agreement and the signs are that it will take a more constructive attitude. China and India are also key players in the negotiations and they will seek flexibility to increase their emissions, at least until 2020. Developed countries will have an increasing incentive to engage as the impacts of global warming become more pronounced.

Part I The Policy Context

Chapter 2 The EU Policy Context

The EU's climate change package, one of the most radical sets of proposals to come out of Brussels, is on par with monetary union.

Dieter Helm, January 2008

Introduction

EU member states have varying degrees of commitment to climate change policy and have had differing levels of success in controlling emissions. The European Commission has, however, been consistent in offering internal leadership among member states on the issue; this has resulted in an overall ambitious level of commitment in the EU to emissions reductions. This high internal commitment has, in turn, allowed the EU to play the role of external leadership in international climate change negotiations.

In this chapter the internal and external dimensions of EU climate change making are assessed. The first section explores the principles, rules and actors of EU climate change policy. Next, an analysis of policies and measures implemented by the EU to achieve its Kyoto targets and the EU's recent emissions performance are evaluated. This is followed by an analysis of the EU's approach to the post-2012 period as expressed in the package of climate measures proposed by the European Commission on 23 January 2008. Some brief concluding remarks follow.

Climate Change Policy in the EU – Principles, Rules and Actors

The EU'S 2° Celsius Target

The central tenet of EU climate change policy is the goal of limiting global mean temperature rises to +2° Celsius, first agreed in 1996,[30] and reaffirmed at the March European Council of 2007.[31] This target is based on the Kyoto Protocol concept of avoiding "dangerous anthropogenic interference with the climate system". The scientific evidence suggests that stabilisation at 450 ppm CO_2-equivalent would yield a 50% probability of staying within this target. It is likely that global average mean temperature rises above this threshold would greatly increase the risk of non-linear and potentially catastrophic events being triggered. The precautionary principle would thus suggest that this target is necessary from a scientific perspective.

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[30] European Environmental Agency, *Communication on Community Strategy on Climate Change* (Brussels: European Environmental Agency, 1996).

[31] *Presidency Conclusions* (Brussels: European Council, 8-9 March 2007).

Whether it is achievable at a politically acceptable cost is questionable given that current GHG concentrations in the atmosphere are approaching levels at which a 2° Celsius temperature rise would appear inevitable.[32] A cost-benefit analysis undertaken by the European Commission found that the impact of stabilisation at +2° Celsius would have only minimal impacts on global GDP.[33] The IPCC's Fourth Assessment Report produced similar findings.[34] The Stern Review, however, concluded that it would be very costly to stabilise at a level of concentrations considered by the Commission.[35] Stern estimated the cost of stabilisation at a level of GHG concentrations which would likely equate to a 2.4 – 2.8° Celsius rise in global average mean temperature at 1% of GDP. [36]

It has been argued that the possibility of "temporarily overshooting" the emissions trajectory needed for stabilisation below +2° Celsius and compensating with more severe emissions reductions at a later date might reduce the costs of stabilisation.[37] GHG concentrations would need to be reduced in the long term after exceeding a safe level in the coming two to three decades. This approach could allow for more room to manoeuvre in staying within +2° Celsius, and would reduce the cost. Either way, the opportunity to stabilise at +2° Celsius is slipping away fast.

Actors and Rules in Internal EU Climate Change Policy-Making

Directives and regulations relating to climate change policymaking fall under the environment chapter of the EC Treaty (Articles 174-176). Under the Environmental Title, qualified majority voting in the Council and the co-decision procedure is used for the adoption of legislative acts. The European Parliament thus plays a co-equal role in legislation with national governments.[38] However, several exceptions to the use of qualified majority voting exist, meaning that decisions taken in these areas must be taken unanimously. Proposals with fiscal implications require unanimity – a proposal on an EU-wide carbon tax in 1992 was opposed by the UK, Ireland, France, Spain and Portugal and failed to garner the unanimous support it required – as do measures affecting member states' energy mix. In practice, agreement is needed by a high proportion of participants across the spectrum of EU institutions for climate change policy to be adopted.

In the areas of climate change policy where the EU has a role, the Directorate General (DG) Environment of the European Commission is responsible for drafting legislation, with its Climate Change and Air Directorate given the lead. In several areas with implications for climate change, such as education and awareness, policy oversight and coordination, planning, transport and infra-structural development, and competences remain largely in the hands of member states and the Commission's role is marginal.[39]

The Lisbon Treaty, signed on 15 December 2007, includes a number of significant new provisions on climate change. Article 191.1 commits the EU to, "promoting measures at international level to deal with regional or worldwide environmental problems, *and in particular combating climate change*".[40] For the first time combating climate change is explicitly stated as an EU Treaty objective. Although

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[32] For more information see: Dr RK Pachauri's presentation to the IIEA on 1 June 2007, Available Online: www.iiea.com

[33] Commission of the European Communities, *Limiting Global Climate Change to 2° Celsius, the Way Ahead for 2020 and Beyond* (Brussels: European Commission, 10 January 2007).

[34] Between 435 – 535ppm/ CO2-eq

[35] 450ppm/CO2-eq

[36] Between 500-550ppm/CO2-eq

[37] Professor H.J. Schellenhuber's presentation to the IIEA, Dublin, June 2007. See: www.iiea.com/audio/schellenhuber/mp3

[38] A. Weale, "Environmental Rules and Rule-Making in the European Union", in *Journal of European Public Policy*, Vol. 3 No. 4 (1996), p.598.

[39] For further discussion of competences of the EU see: *What the Treaty of Nice Means* (Dublin: IIEA, 2001).

[40] Peadar ó Broin, *Consolidated Version of the Treaties as amended by the Treaty of Lisbon* (Dublin: IIEA, 2008).

this reference to combating climate change is limited to the international level, it is possible that a proactive ECJ could take a maximalist approach and use this Article to challenge other EU laws. The Commission could also use this reference to challenge a member state's policy that is incompatible with "combating climate change".

Several aspects of the new Energy Title could also have implications for EU climate change policy. Article 194.1 which refers to the establishment of an internal market for energy references "the need to preserve and improve the environment" in so doing and goes on to commit Union policy to "promote energy efficiency and energy savings and the promotion of new and renewable forms of technology".[41] Although arguably EU policy is already committed to, for example, the promotion of renewables and energy efficiency, these Articles offer a clear legal basis outside the political agreements at European Councils for these policies.

Actors and Rules in External EU Climate Change Policy-Making

International environmental policy-making is described as an area of "mixed competences".[42] This means that individual member states have competences to negotiate in international bodies and to conclude international agreements (a right enshrined in Article 174.4 of the EC Treaty).[43] Positions adopted prior to UNFCCC negotiations must therefore be based on consensus. Positions are prepared by the EU's working party on International Environmental Issues (IEI) that meets twice a month and the Council of Environment Ministers or the European Council adopts final positions, where necessary. The Presidency has responsibility for drafting the EU's position and representing the EU at negotiations as part of the "troika".[44] Given the requirement for consensus, the Presidency plays an important role in moving negotiations forward at EU coordination meetings – attended by climate change delegations and representatives of the Commission – which take place during UNFCCC negotiations on a daily basis.

The Lisbon Treaty contains provisions which may influence external EU climate change policy-making, not least the previously quoted Article 191.1. Article 218 outlines how negotiations would be undertaken. It states that, "The Council shall authorise the opening of negotiations, adopt negotiating directives, authorise the signing of agreements and conclude them", and "the Commission … shall submit recommendations to the Council, which shall adopt a decision authorising the opening of negotiations and, depending on the subject of the agreement envisaged, nominating the Union negotiator or head of the Union's negotiating team".[45] The nominee would replace the Presidency as the lead EU negotiator.

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[41] Peadar ó Broin, *Consolidated Version of the Treaties as amended by the Treaty of Lisbon* (Dublin: IIEA, 2008).

[42] Chad Damro and Pilar Luaces Mendes, "Emissions Trading at Kyoto: From EU Resistance to Union Innovation", in Andrew Jordan (ed.), *Environmental Policy in the European Union: Actors, Institutions and Processes* (London: Earthscan, 2005), p. 271.

[43] In fact, both the EU and its member states were signatories to the Kyoto protocol, leading to some ambiguity as to who was ultimately responsible for implementation.

[44] The Foreign Minister of the country holding the Presidency of the Council, the Commissioner for External Relations and the High Representative of the Common Foreign and Security Policy.

[45] Peadar ó Broin, *Consolidated Version of the Treaties as amended by the Treaty of Lisbon* (Dublin: IIEA, 2008).

Policies and Measures

Deciding Targets

At a meeting of Energy and Environment Ministers in October 1990, the EU agreed for the first time to stabilise emissions. At Kyoto, the EU agreed to an 8% emissions reduction by 2012 based on 1990 levels; this aggregate target was then divided among member states as in Table 2.1 below.

Table 2.1 EU-15 Kyoto Burden-Sharing Agreement

Country	Kyoto Target – 2012 % 1990
Portugal	+27
Greece	+25
Spain	+15
Ireland	+13
Sweden	+4
Finland	0
France	0
Netherlands	-6
Italy	-6.5
Belgium	-7.5
UK	-12.5
Austria	-13
Denmark	-21
Germany	-21
Luxembourg	-28
EU	-8

Source: European Environmental Agency, 2004

The "rich and green" grouping of countries (Germany, the Netherlands, Finland, Denmark and Austria) took on ambitious reduction targets, with Germany's reduction target (facilitated by the process of re-unification) accounting for more emissions reductions than the rest of the other member states combined.[46] The "cohesion countries" – Ireland, Portugal, Spain and Greece – were allowed to increase their emissions in order "to allow for different economic development patterns".

Policy Implementation

Since 1991, when the first community strategy to limit emissions was launched, several notable initiatives have been undertaken. The SAVE Directive [47] introduced in 1993, required member states to control emissions through a range of energy efficiency measures, including certification of buildings and inspection and certification of boilers.

Further to the negotiation and ratification of the Kyoto Protocol, in 2000 the European Climate Change Programme (ECCP) was established to find cost-effective ways to reduce GHG emissions and to comply with the EU and member states' commitments under the Protocol. Working groups were established in several areas with a remit to propose new Common and Coordinated Policies and Measures; these groups ran until 2003.

Perhaps the most significant outcome from this process was the Emission Trading Scheme (EU ETS), based on Directive 2003/87/EC.[48] In January 2005, the EU ETS commenced operation as the largest multi-country, multi-sector GHG emission trading scheme. The first phase ran from 2005-07 and the second phase will run until the beginning of 2013 to coincide with the first Kyoto commitment period.

The scheme works on a "Cap and Trade" basis. Each member state is required to set an emission cap covering energy activities, production and processing of ferrous metals, mineral and pulp, paper and board activities. Together, these industries form the "tradable sector". The installations are allocated permits to emit a certain quantity of CO_2 for the period in question. The proposed

[46] L. Ringius, Differentiation, *Leaders and Fairness: Negotiating Climate Change Commitments in the European Community*, Report 1997: 8 (Oslo: Cicero, 1997), p.36.

[47] European Directive 93/76/EEC of 13 September 1993 to limit CO_2 emissions by improving energy efficiency (SAVE).

[48] European Commission Directive 2003/87/EC. The EU ETS was established pursuant to Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 and was transposed into Irish legislation by the European Committees (Greenhouse Gas Emissions Trading) Regulations 2004 (SI No 437 of 2004). Norway, Iceland and Lichtenstein will join the ETS in 2008.

aggregate number of allowances allocated to each installation for the period is set down by each member state in a National Allocation Plan (NAP).

The NAP must also include emissions projections for sectors not covered by the scheme and the combined total of projected emissions from the "tradable" and "non-tradable" sectors which must be consistent with the member state's Kyoto target. The Commission may reject the NAP if it is not consistent with the criteria for the NAP set out in the Directive.[49]

The EU ETS Directive recognised that credits from project-based mechanisms, such as the CDM and JI, would increase the cost-effectiveness of reaching emissions reductions targets. They would also result in technology transfer to transition and developing countries, thus assisting these countries in achieving their sustainable development goals. In October 2004, it was therefore decided to link the Kyoto mechanisms with the EU ETS.[50] As a result, from 2008, member states are allowed to purchase Kyoto Emissions Reductions Units (ERUs) and to permit installations to use ERUs to fulfill their emissions reductions commitments as well as the Certified Emissions Reductions (CERs) of the ETS, within certain limits. These limits are defined by the principle of "supplementarity". This is interpreted by the Commission to mean that "use by operations may not lead to a situation where more than half the (emissions reductions) efforts undertaken by a member state, taking into account government purchases (of emissions permits), is made through Kyoto flexible mechanisms". [51]

Following a comprehensive review of the EU ETS focusing on its functioning and scope, the Commission proposed a number of comprehensive modifications to the scheme, which would become operational in 2013 (see below for further details).

Although the EU ETS may be the most high profile of EU Climate Change policies, a number of directives and decisions arising from the ECCP have had a significant impact on the climate change policies of member states. For example, Directive 2002/91/EC on the energy performance of buildings, Directive 2005/32/EC on the efficiency of electric products, the aforementioned Linking Directive, and initiatives to promote increased use of combined heat and power, biofuels and rebalancing of vehicle taxation. The ECCP also led to Regulation 842/2006 and Directive 40/2006/EC on containment, recovery and use of fluorinated (greenhouse) gases. Directive 280/2004 EC further established a mechanism which is intended to monitor greenhouse gas emissions within the Union and implementation of the Kyoto Protocol.

The Second European Climate Change Programme was launched in October 2005. Working groups were established to review ECCP 1, and in the areas of CO_2 from private transport, carbon capture and storage, aviation, adaptation and emissions trading and to review ECCP 1. Findings of the working groups form the basis for the current wave of climate change-related proposals.

The EU's Emissions Record

A report by the European Environmental Agency shows that the EU-15 reduced emissions by 2% in the period 1990-2005.[52] Projections suggest that the EU-15 can meet its Kyoto target. Kyoto flexible mechanisms are expected to account for 2.5% of this reduction and carbon sinks an additional 0.8%. This means that domestic policies and measures will be responsible for an emissions reduction of 4.7% of the overall target of 8%.

[49] European Commission Directive 2003/87 Annex 3.

[50] European Commission Directive 2004/101.

[51] European Commission Decision (29 November 2006).

[52] European Environment Agency, *Annual European Community Greenhouse Gas Inventory 1990-2005* and *Inventory Report 2007* (Luxembourg: Office for Official Publications of the European Communities, 2007).

Looking to 2020

The Spring European Council 2007

The EU continues to play a leadership role in post-2012 climate change negotiations. In its *Energy and Climate Change Package*, published in January 2007, which was later approved by European leaders at the Spring European Council in March 2007, the EU committed itself to a 30% emissions reduction target by 2020 compared to 1990 levels "provided other developed countries commit themselves to comparable emissions reductions"; a "firm independent commitment" to achieve "at least" a 20% reduction by 2020 based on 1990; a commitment for 20% of energy consumed to come from renewables by 2020; and a further objective to reduce emissions by 60-80% by 2050.

The January 23 Commission Proposals

On January 23, 2008, the European Commission published a comprehensive body of proposals designed to act on the decisions of the March European Council of 2007. The package of proposals was made up of seven papers:

- A proposal on revision of the EU Emissions Trading Scheme for the post-2012 period;
- A proposal on effort sharing the 20-30% binding emissions reductions target (on 1990 levels by 2020) between member states;
- A proposal to establish a legally binding target for renewables of 20% of EU energy consumption by 2020, binding national targets and a 10% target for biofuels in transport for all member states;
- An impact investment on the emissions and renewables targets;
- New guidelines on state aids for environmental protection;
- A communication on Carbon Capture and Storage (clean coal); and
- An assessment of Energy Efficiency Action Plans.

A number of these papers are of particular importance for the development of EU climate change policy in the post-2012 period.

1. Emissions Trading Review

The proposals under the EU ETS review will, once adopted, radically alter climate change policy-making of the EU and its member states in the post-2012 period. In a key proposed revision of the EU ETS, cap setting for emissions from member states' tradable sectors[53] would be set by the Commission from 2013, and permits allocated accordingly. Member states currently have control over the allocation of emissions among installations operating within their borders. In the National Allocation Plans (NAPs) produced at the beginning of each trading period, member state agencies allocated the available permits among the installations operating under the tradable sector. This process led to a lack of uniformity in allocation rules, intense lobbying by industry in certain member states and differing approaches to cap-setting across the EU (several member states taking the precaution of allocating more permits than there had actually been emissions the previous year).

These factors created an uneven playing field for industry across the EU and, initially, a collapse in the price of permits. Although the price stabilised in the second trading period, the process is

[53] The term "tradable sector" refers to sectors covered by the EU ETS; this currently includes energy activities (power generators, combustion installations with a rated thermal input exceeding 20MW, mineral oil refineries, coke ovens), production and processing of ferrous metals, mineral industries (cement, clinker, glass and ceramic bricks), and pulp, paper and board activities. 11,500 installations and 41% of EU greenhouse emissions are covered by the EU ETS.

cumbersome and leads to a constant tension between member states and the Commission. The Commission argued that an EU-wide cap-setting process would lead to greater predictability in the price of permits and greater emissions reductions.

The Commission proposed that emissions from the tradable sector be reduced by 21% on 2005[54] levels by 2020, or 1.74% per annum. This would equate to an emissions cap of 1720Mt by 2020 for the EU ETS sector. This sector will thereby be required to shoulder a large share of the emissions reduction burden – it currently makes up about 41% of overall emissions but will be required to contribute 60% of total abatement. As the greater share of cost effective abatement options exists in the tradable sector, particularly in power generation, this move was widely anticipated. Provisions for the inclusion of carbon capture and storage technology into the EU ETS were also set out.

Significantly, in the post-2012 ETS, auctioning of permits will replace current allocation methodologies to a significant extent. Installations will be treated according to the characteristics of their industrial sector. The power generation sector, characterised by an ability to pass through price increases (and avail of windfall profits) and insulation from international competition, would face full auctioning in 2013. A second group of installations (described by the Commission as "normal industry"), which is less exposed to international competition and "carbon leakage",[55] would have to bid for 20% of their overall allocation of permits initially; this would be increased incrementally to 100% by 2020. Aviation – which will be included in the EU ETS from 2013 – is included in this intermediate category. In a concession to energy intensive companies the Commission proposed the continued free allocation for up to 100% of permits for energy intensive sectors. Sectors eligible for this special dispensation are to be identified by 2010 and a proposal would be submitted by June 2011.

The Commission indicated that it would consider protecting energy intensive industries via a requirement on international competitors operating under a liberal carbon regime (read the US and China) to surrender allowances when exporting goods to Europe. This proposal elicited a sharp response from US Trade Representative, Susan Schwab, among others, when first announced.

Member states would retain the right to auction emissions permits to installations according to harmonised rules which the Commission will set out. Revenue would go to member state coffers; the only caveat is that 20% of proceeds must be hypothecated for climate policies. Ninety per cent of permits would be allocated according to 2005 emissions in member states, with the remainder allocated according to GDP levels and investment requirements.

No additional Kyoto units would be allowed for the period 2012 to 2020. The emphasis on reducing emissions within the EU would thereby be increased and paying for emissions reductions in poorer countries reduced. In order to ensure increased price stability of credits, installations will be allowed to bank unused credits from the second trading period, for use in the post-2012 period. Financial institutions and business interests in general have expressed misgivings at what they consider the overly severe restriction on the use of Kyoto credits. The counting of carbon sinks will not be permitted under the -20% scenario and the Commission has taken the view that under a -30% scenario the question of sinks will have been resolved at international negotiations.

It is further proposed that the scheme be widened to include other greenhouse gases. The inclusion

[54] Confusingly, 1990 was replaced by 2005 – the latest year for which verifiable emissions figures are available – as the baseline for measurements.

[55] "Carbon Leakage" describes the displacement of emissions from one geographical area to another as a result of policy, without any reduction in global emissions.

Table 2.2 Emissions Effort-Sharing Proposal

Country	Target (% of 2005)	GDP 2005 % of EU Average	Emissions per capita 2005 (tonnes CO_2-eq)
EU27	-10	100	10.5
Luxembourg	-20	251	28
Ireland	-20	139	17
Denmark	-20	122	11.4
Sweden	-17	115	7.4
Austria	-16	123	11.8
Ned	-16	126	13
UK	-16	117	10.9
Finland	-16	111	13.2
Belgium	-15	118	13.4
France	-14	108	9.1
Germany	-14	110	12.1
Italy	-13	100	10
Spain	-10	98	10.2
Cyprus	-5	89	13.2
Greece	-4	84	12.6
Portugal	+1	71	8.1
Slovenia	+4	82	10.2
Malta	+5	70	8.5
Czech	+9	74	13.2
Estonia	+10	60	15.3
Hungary	+10	63	8
Slovakia	+13	57	9
Poland	+14	50	10.5
Lithuania	+15	52	6.6
Latvia	+17	48	4.2
Romania	+19	34	7.4
Bulgaria	+20	33	9

Source: European Commission, 2008

of nitrous oxide from fertilisers and perfluorocarbons from aluminium, it is argued, would lead to new and more cost-effective abatement opportunities.

The proposal also allows for the exclusion of installations emitting less than 10,000 tonnes per annum in acknowledgment of their higher proportionate administrative burden. However, their exclusion will only be permitted provided there are additional compensatory measures (such as taxation) in place in the member states in question.

2. Effort-Sharing of Emissions

Under the Commission's proposals, the effort sharing of emissions between the 27 member states of the EU would no longer apply to the sectors and installations covered by the EU ETS. As outlined in the previous section, the tradable sector would no longer remain under the jurisdiction of member states. Therefore, the effort-sharing agreement proposal applies only to approximately 59% of emissions across the EU.

The 20% emissions reduction on 1990 levels equates to -14% on the new 2005 baseline.[56] Thirty per cent of this target can be met from flexible mechanisms. The non-tradable sector – agriculture, transport, small industry, construction and residential – will be required to contribute a 10% reduction on 2005 levels under the proposals. This equates to an approximate 0.7% emissions reduction per annum (compared to 1.74% for the EU ETS sector).

[56] Aggregate EU emissions having fallen 6% since 1990, 4% of which is attributable to restructuring in new EU member states since the collapse of the Soviet Union in 1991.

Table 2.3 Renewables Burden-Sharing Proposal

Country	Target for 2020 %	Penetration (2005) %	Distance	Biofuels %
EU	20	8.5	11.5	10
Sweden	49	39.8	+9.2	10
Latvia	42	34.9	+7.1	10
Finland	38	28.5	+9.5	10
Austria	34	23.3	+10.7	10
Portugal	31	20.5	+10.5	10
Denmark	30	17	+13	10
Slovenia	25	16	+9	10
Estonia	25	18	+7	10
Romania	24	17.8	+6.2	10
France	23	10.3	+12.7	10
Lithuania	23	15	+8	10
Spain	20	8.7	+11.3	10
Germany	18	5.8	+12.2	10
Greece	18	6.9	+12.1	10
Italy	17	5.2	+11.8	10
Ireland	16	3.1	+12.9	10
Bulgaria	16	9.4	+6.6	10
UK	15	1.3	+13.7	10
Poland	15	7.2	+7.8	10
Ned	14	2.4	+11.6	10
Slovak	14	6.7	+7.3	10
Cyprus	13	2.9	+10.1	10
Hungary	13	4.3	+8.7	10
Czech Rep	13	6.1	+6.9	10
Belgium	13	2.2	+10.8	10
Lux	11	.9	+10.1	10
Malta	10	0	+10	10

Source: European Commission, 2008

The aggregate emissions reduction on 2005 levels is then divided among the 27 member states according to their GDP per capita (see: Table 2.2). The formula is, however, modified so that member states all receive inside the range plus or minus 20% on 1990 levels. So, for example, Luxembourg, with a GDP of 251% of the EU25 average in 2005,[57] was given a proposed target of -20% while Bulgaria, with 33% of the community average, receives a proposed target of +20%.[58] Although the targets differ widely for non-tradable sectors, each member state received the same tradable sector

[57] European Commission Statistics, Reference: STAT/06/166 (18 December 2006).

[58] Ibid.

target (-21%). The proposal is devoted to provisions for the division of a 20% emissions reduction target on 1990 levels. In the event of other developed countries making a comparable commitment, however, the EU remains committed to a 30% emissions reduction target.

Article 6 of the Proposal outlines the provisions for the division of a 30% target, should other developed countries: "commit themselves to comparable emissions reductions". Any additional emissions reduction commitment agreed by developed countries would be divided among EU member states "in proportion to their share" of the target for the non-tradable sector (see Table 2.2) member states will be permitted to purchase emissions credits from third countries which have ratified the post-2012 international agreement "by up to half of the additional reduction taking place".[59]

Although several NGOs point out that the EU's unilateral target is below the 25-40% which the IPCC estimates will be required to avoid dangerous climate change, the Commission argues that the 20% target strikes the right balance between demonstrating leadership and sustaining international competitiveness.

3. Effort-Sharing of Renewables Target

In order to support the emission targets for 2020 and to provide a stable environment for investors, the 2007 Spring European Council agreed that 20% of all energy consumed and 10% of road fuel should come from renewable sources by 2020. The Commission proposal divided this target among member states and outlined the conditions under which individual targets could be achieved.

The most significant aspect of the 20% renewables target is the effort sharing. The Commission settled on a model which requires each member state to increase renewables by 5.5% (a controversially high starting point for member states such as Austria and Sweden with high penetration of renewables) and modulated this to reflect GDP and early progress in developing renewables. It was thought that this model reflected the criterion of fairness more fully than a model using resource potential. Table 2.3 lists the targets assigned to member states.

Table 2.4 Interim Targets

Year	Portion of National Target to be Achieved
2012	25%
2014	35%
2016	45%
2018	65%
2020	100%

Source: European Commission, 2008

The 2020 target will be legally binding. Table 2.4 sets out the indicative trajectory for each country based on the same formula.

It is proposed that member states be allowed the flexibility to determine the respective penetration of renewables in the three relevant sectors: power generation, heating and cooling, and transport. Targets for member states are to be set out in a National Action Plan. In order to further ensure the greatest levels of flexibility, countries and installations would be permitted to count renewable energy consumed in third member states to their targets. For this reason each member state is required to produce a verifiable "guarantee of origin" (GOs – already used in the trade of renewable electricity between states to prove that electricity has come from a renewable source) for each unit of renewable electricity produced from renewables. This will only be permitted, however, if a strict set of conditions is met. Member states that have met their indicative targets (after the first assessment in 2012) will be permitted to sell GOs to other member states. This, it is argued, will

[59] European Commission, Proposal on the Effort of Member States to reduce their GHG emissions, Art. 6.4 (23 January 2007).

ensure that targets do not act as caps and that there is an incentive to go beyond the national target. Member states can also restrict installations from trading certificates if they are having trouble meeting their national targets for renewables. Member states, such as Germany and Spain, had objected to unrestricted trading (initially favoured by the Commission), which they argued would endanger national support schemes for renewables.

Countries allocated higher increases such as Belgium and the UK have expressed misgivings about the cost that their targets would imply for their economies. Countries with higher levels of nuclear power, such as France, continue to object to the idea of binding targets for renewables and argue that nuclear is an equally low carbon source of power, and countries with high penetration of renewables such as Austria are also concerned that the targets may prove unachievable.

The only exception to the flexibility granted to members was the much criticised biofuels target – each member state must ensure 10% of transport fuel consumed comes from biofuels by 2020. It was hoped that this target would ensure that emissions are addressed in the intractable transport sector, a sector that has witnessed the most rapid increases in emissions and is characterised by a critical over-dependence on oil. Given the expense related to biofuels' production it was thought that without a specific target this sector would remain largely unchanged.

In an attempt to allay mounting fears on the effectiveness of biofuels in reducing emissions and to counter the unintended consequences of the target on, for example, food production and food prices, the proposal establishes several environmental criteria. The greenhouse gas emissions savings accruing from use of biofuels must be 35% or more (measured against the product they displace) and must not be sourced from areas designated for nature protection, bio-diverse grasslands, wetlands or forests. The Commission would report on "a sustainability scheme for energy use of biomass" by 31 December 2012.[60] It is hoped that with these criteria, the manner in which first generation biofuels are developed to meet the target would ensure environmentally positive outcomes. In the medium to long-term, it is expected that second generation biofuels would play an increasingly important role.

Revised state aid guidelines were proposed as part of the package to ensure effective support schemes could be designed in member states to achieve renewables targets. The new rules would allow for an increase in state funds to the renewable energy sector, including biofuels' producers, with the Commission's sustainability criteria being tied in with state aid eligibility. In order to qualify for state aid projects must, in general, have high investment costs.

Companies wishing to exceed community environmental requirements would also be eligible for subsidies. Carbon Capture and Storage (CCS) technology would be expected to benefit from these revised guidelines (as it will from a more robust emissions trading regime). The draft proposal on CCS also stipulates that all combustion plants which are granted a licence after the entry into force of the CCS Directive, "must have suitable space on the installation site for the equipment necessary to capture and compress CO_2".

The Commissions also set out a raft of procedures for calculating, reporting, monitoring and verification of progress. A number of requirements to remove barriers in the areas of planning for renewables include the granting of mandatory priority grid access for renewables. Proposals to remove administrative procedures and market information failures, which could hinder the achievement of the targets, were also set out.

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[60] European Commission, Draft Directive on Promotion of Renewables (2008), p.34.

Conclusions

The European Commission, with the help of "green" member states, played a role in galvanising the EU into action on climate change in the pre-Kyoto period. This activism resulted in the adoption of relatively ambitious domestic targets and measures that in turn have provided the EU with an opportunity to play the role of leader at international climate change negotiations.

This is a pattern that is being repeated. The EU has set an ambitious legislative agenda. The target date for the adoption of legislation is before the European Parliamentary elections in the first half of 2009. Implementation will certainly not begin until mid-2009 at the earliest. With a new President expected to be in the White House by then, this would set the stage for the 15th COP in December 2009, where it is hoped that a deal to supersede Kyoto can finally be reached. The EU expects that with its ambitious climate change agenda, it can have a decisive influence on the international stage in the post-2012 period.

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Part I The Policy Context

Chapter 3 Irish Policy Context

Nationally, at European level and globally, climate change is one of the most demanding and urgent concerns that humanity faces.

An Taoiseach, Brian Cowen, 2008

Introduction

Irish climate change policy must be considered within the context of international and EU political developments, which in turn are informed by the emerging scientific consensus on climate change. Although countries such as Ireland have a measure of control over their own emissions policies, overall mitigation targets are determined at international negotiations under the auspices of the United Nations Framework Convention on Climate Change (UNFCCC). As a member of the EU, Ireland's position at these negotiations is determined by consensus decisions taken at the Council of Ministers, and modified by consensus throughout. Its specific target for emissions reductions is negotiated as a share of the EU aggregate target with other EU member states.

This chapter first offers a summary of the current climate change policy framework and procedures in Ireland. This is followed by an initial evaluation of the implications of the Commission's climate change package for Ireland. Some concluding remarks follow.

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Current Policy

Ireland's Emissions

Ireland is the fifth highest emitter per capita of GHGs in the world, and the second highest in the EU, with each citizen responsible for emitting 17 tonnes of GHG equivalents per annum, up from 15 tonnes per annum in 1990. Ireland's emissions were 25.5% above 1990 levels in 2006, or almost 13% above its Kyoto target.[61]

Ireland's Commitments

Ireland's climate change policy is bound by international agreements into which it has entered and by climate legislation implemented at EU level. At Kyoto the EU agreed to reduce emissions by 8% on 1990 levels by 2012. Under the EU's burden-sharing agreement, which followed the agreement, Ireland's emissions are currently limited to a 13% increase on 1990 levels by 2012.

[61] Environmental Protection Agency, *Ireland's Greenhouse Emissions in 2006* (Johnstown Castle, Wexford: Environmental Protection Agency, 15 January 2008).

Under the EU ETS, Ireland is required to produce a National Allocation Plan at the beginning of each trading period which sets the allocation of emissions among installations operating under the scheme in line with Ireland's Kyoto target and outlines how the country will meet its Kyoto commitments. Ireland's second National Allocation Plan for the period 2008 – 2012 was originally submitted to the European Commission in July 2006 and was conditionally accepted in July 2007. Further to certain revisions, the European Commission accepted Ireland's National Allocation Plan on 5 February 2008 and the EPA took the Final Allocation Decision on the Plan.[62]

The National Climate Change Strategy (NCCS)

The NCCS for 2007-2012 sets out in detail how Ireland will meet its commitments to reduce GHG emissions under the Kyoto Protocol. It includes measures put in place on foot of the first NCCS (2000-2006), and takes account of Ireland's NAP (2008-2012), the National Development Plan (NDP) (2007-2013), Transport 21, the Energy White Paper and the Bioenergy Action Plan. The NCCS also announced the setting up of a Carbon Fund to administer and manage purchases of Kyoto Units on behalf of the Irish Government. The NCCS acknowledged that Ireland "will be expected to achieve further significant reductions in GHGs in the post-2012 period" and that this would necessitate "radical changes across the economy, particularly in relation to the way Ireland produces and uses energy". It did not, however, deal in a comprehensive manner with the post-2012 scenario.

Carbon Budget

The Programme for Government contained a political commitment that Ireland will reduce its GHG emissions by 3% per annum for the period of the Government. In addition, it was agreed that a "carbon budget report" would be presented in conjunction with the annual Budget Statement.[63]

Ireland's first carbon budget was presented on 6 December 2007 and its objectives were stated as follows:

- To integrate climate change considerations into the government's budgetary policy and into the decision-making process across all sectors of government;
- To provide a clear measure of the progress made towards meeting national targets for emission reductions; and
- To help efforts to increase public understanding of climate change and the government's response.

The Table below, included as part of the carbon budget statement, shows how Ireland's GHG emissions are expected to develop over the five years from 2008 – 2012.

The budget indicates that a significant proportion of Ireland's distance to Kyoto target will be met through the purchase of Kyoto flexible mechanisms. Furthermore, the NCCS projection of 66.2 Mt is about 2.2 Mt above what is required to meet the Programme for Government target of an annual average reduction of 3% in GHG emissions.

The following additional measures were announced in the carbon budget statement: the motor tax regime will be based on the rated carbon emissions from vehicles and a mandatory labelling system will be introduced in tandem; new regulations will deliver energy and emissions savings of 40% in new homes; the building standards will be further strengthened in 2010 to achieve a 60% improvement in current levels; and a new national energy efficiency standard for light bulbs was announced.

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[62] Environmental Protection Agency, *EPA Announces Final Decision for Ireland's National Allocation Plan* (5 March 2008), Accessed Online: www.epa.ie/news

[63] Department of the Taoiseach, *An Agreed Programme for Government* (Dublin: Department of the Taoiseach, June 2007), pp 19-20.

Table 3.1 Carbon Budget Statement

	1990 Kyoto Baseline	2005	2006	NCCS Figures	New Reduction Measures	Updated Projections 2008-2012
Energy	11.846	16.337	15.526	16.159	0.246	15.913
Transport	5.176	13.309	14.013	12.769	–	12.769
Residential	7.35	7.384	7.290	6.676	0.251	6.425
Industry/Services	9.766	12.261	12.031	13.211	0.109	13.102
Agriculture	19.918	19.581	19.309	17.644	–	17.644
Waste	1.461	1.774	1.831	1.831	–	1.831
Gross Emissions	55.517	70.646	70	68.29	–	67.684
Carbon Sinks		-0.86	-1.06	-2.074	–	-2.074
Net Emissions	55.517	69.786	68.94	66.216	–	65.61
Flexible Instruments				3.184	–	2.578
Kyoto Target				63.032		63.032

Source: Department of Environment, Heritage and Local Government, 2007

Policy Outlook

The Commission's climate change package, if adopted, will have a profound impact on Irish climate change policy in the post-2012 period. The proposal for the removal of the EU ETS sector from national inventories and establishing cap setting at EU level fundamentally changes the ground rules for member states and restricts their room for manoeuvre in designing their post-2012 policies in relation to domestic measures.

The Tradable Sector

The Irish tradable sector covers approximately 34% of Irish emissions, compared to 41% across the EU. Under the Commission's proposals the aggregate reduction faced by the tradable sector across the EU would be 21%, or 1.74% per annum. Emissions will occur where they are cheapest across the EU, and thus the cost to Irish industry covered by the EU ETS would be capped at the EU marginal cost of abatement. The price of Certified Emissions Reductions Permits (CERs) should reflect the abatement cost to industry. Predictions of the price of permits in the post-2012 period vary from € 20 to € 50 per tonne. These costs will be passed on to consumers in the form of higher energy and commodity prices.

The few Irish operators covered by the EU ETS who are exposed to external competitive pressures will to some extent be protected from the negative cost implications of the proposals. They will continue to receive free allocations of permits to an extent which will be determined in ongoing negotiations. In broad terms, according to the Commission, the intra-EU competitiveness effects of the EU ETS should be neutral.

The EU ETS proposal creates something of a contradiction for Irish policy-makers in that the emissions reductions arising from increased penetration of renewables and measures to improve energy efficiency in the powergen sector will not be counted in national emissions inventories. Yet

government will not be indifferent to strategic choices made by the power sector bearing in mind it will be responsible for meeting the proposed renewables targets by 2020, not to mention its security of supply and competitiveness goals.

The full implications of this new policy environment need to be carefully assessed in the context of future National Climate Change Strategies and carbon budgets.

Domestic Sector

Government policy will thus be focused on the Irish domestic sector – agriculture, transport, commercial and services and light industry – which account for 66% of overall Irish emissions. The largest two of these are responsible for 70% of domestic sector GHG emissions: agriculture (41%) and transport (29%). Emissions from these two sectors are projected to rise to 2020.[64]

Under the EU's proposals the domestic sector would collectively be bound to reduce emissions by at least 20% on 2005 levels by 2020. The use of flexible mechanisms would be restricted to 3% of the overall target. Although less onerous than either the government's own target of a 3% annual emissions reduction if extrapolated to 2020, or even the calculations set out in the NCCS, this is an enormous challenge for Ireland.[65] Unlike the tradable sector, the marginal cost of abatement in the domestic sector is not capped at the EU marginal cost and there are few cheap abatement options available. It is difficult to see how this target can be met in Ireland without a restructuring of the Irish economy and in the absence of very significant behavioural change. A major review of Irish climate change policy is therefore required as a priority.

Prospects for Renegotiating Ireland's Target

Although targets have, as yet, to be agreed by the Irish government, it is difficult to envisage a significant renegotiation as there are no criteria which would justify a softer target. Even the use of GNP instead of GDP would not have significantly affected Ireland's proposed -20% target. The creation of an artificial floor of -20% for all countries in fact cancels out the negative implications of using GDP instead of GNP. Neither were emissions *per capita* – a primary consideration in international climate negotiations – considered. Again, this criterion would not have been favourable for Ireland.

It might also be borne in mind that the negotiations to follow will be zero-sum – one country's gain will come at the expense of another. It is hard to imagine any country agreeing to an increase in its target, making a renegotiation increasingly unlikely.

Table 3.2 Statistics for Ireland

Criteria Considered	Criteria Not Considered			
GDP *per capita* (% EU Av)	GNP *per capita* (% EU Av)	Emissions *per capita* (% EU Av)	Emissions per unit GDP (% EU Av)	Emissions (% of 1990)
139	125	161	111	125

Source: European Commission 2005, 2006, 2007

[64] See Chapter 5 for further analysis of implications for sectors of Irish economy.

[65] Which had, for illustrative purposes, predicted a best-case scenario target of -2% for the whole economy on 1990 levels by 2020.

More likely than a renegotiated target at EU level is an international agreement where other developed countries commit to emissions reductions. Provisions have been proposed for the division of an EU target up to -30% on 1990 levels. Ireland would face the prospect of shouldering a disproportionately large portion of this target, as it would be divided on a pro rata basis based on the division of the -20% target. The question thus becomes how would Ireland deal with the target for the non-tradable sector of between -20 and -30% on 2005 levels by 2020? Given the time lag that often exists, a time lag between the adoption of policy, implementation of the required measure, and the emissions reduction it yields, this is a critical issue to be addressed.

Ireland's proposed share of the target for renewables of 16% is broadly in line with the Government's own targets as set out in the Energy White Paper of 2007. While it may be challenging and ambitious, it is within the bounds of what can be achieved.

Implications for Ireland

That the targets proposed by the EU pose significant challenges for Ireland in the period to 2020 is clear. The first issue to be addressed is the precise quantification of Ireland's target. It is probable that current projections for 2020 are too low given the increases expected in car ownership, population and economic growth.

The division of the economy into a tradable and non-tradable sector with differing marginal costs of abatement in each will have significant implications for Irish climate change policy moving forward. Given the differences in costs of abatement in the two sectors, significant unintended consequences may arise. For example, there would be incentives to "migrate" emissions from the domestic sector (residential and transport sectors) to the tradable sector through electrification.[66]

The issue of cross-sectoral equity within the non-traded sector needs also to be addressed. It could be argued that it would be inequitable to place a disproportionate share of the burden on one or more sectors if other sectors did not engage in trying to secure a reasonable GHG emissions reduction strategy over the medium term. A general assessment of the allocation of burden between sectors will be required. This should be based on more complete marginal abatement cost curves than those to hand.

Long-term Target

The indicative EU targets of 60-80% GHG emissions reductions by 2050 agreed at the Spring European Council in March 2007 could be interpreted by Irish policy-makers as a guide to long-term direction. It is clear that decisions taken on the Commission's climate change package will have major implications for the post-2020 period.

By 2050, on the basis of the (November 2007) Synthesis Report of the IPCC Fourth Assessment Report, Irish economic activity will need to be largely carbon-free. Given this prognosis, the period to 2012 might be considered a window of opportunity, a chance to make the difficult decisions which will safeguard Ireland's future competitiveness in a new global environment.

[66] If, for example, a car runs on electricity rather than petrol, the emissions would be counted in the EU ETS sector – where the electricity was generated – rather than in the transport sector. Emissions from transport would be reduced; the company producing the electricity would have to purchase permits on the carbon market to cover its increase in emissions.

Conclusion

The overall direction of Irish climate change policy will be determined at EU and international level. It is highly probable the EU will agree to an onerous legally binding GHG emissions reduction target for the post-2012 period.

As per capita emissions are high and have risen rapidly since 1990 and Ireland's GDP is among the highest in Europe, Ireland will receive among the most challenging targets and a any attempted renegotiation would be unlikely to succeed.

The Commission's package of proposals will profoundly impact on the direction of Ireland's climate change policy in the post-2012 period. A new approach, cognisant of the division of the economy into two sectors and the removal of allocating allowances to the tradable sector as a national competence, is now required. This reality will have to be reflected in future carbon budgets and the revised NCCS in the post-2012 period.

The focus of future policy will be on the domestic sector. An awareness of the interrelationship between the two sectors will, however, be required. The EU's indicative emissions reduction target for 2050 could be considered when planning for the long-term future of the Irish economy.

Part II Working Groups' Analysis

Chapter 4 Measures and Instruments

Policy options to reduce Ireland's greenhouse gas emissions

Summary of policy options identified

The key Terms of Reference of the IIEA Working Group on Measures and Instruments are:

To identify and evaluate possible policies and measures to be deployed in Ireland in the post-2012 scenario to combat climate change. This will involve:

- Initial listing of available and potential policies and measures
- Review of international experience
- Evaluation of options for Ireland
- Identification of best options in short/medium/long term.

Under *legislative instruments and measures*, options identified were:

i Targets and reporting: the adoption as a national objective of an indicative target for the reduction of greenhouse gases by 2050, with an interim target for 2020, shorter-term (a maximum of five years) interim targets, a transparent compliance system and regular reporting

ii Climate Change Commission: the creation of an appropriately resourced Climate Change Commission with the necessary legal mandate, independence and technical expertise to facilitate a continuous and dynamic review of Ireland's mitigation of and adaptation to climate change.

Under *incentive- and market-based instruments and measures*, options identified were:

iii Domestic carbon tax: the introduction of a carbon tax or similarly effective means of pricing carbon across the entire Irish economy as soon as possible, preferably as part of Budget 2009 and announced in Budget 2008

iv EU carbon tax: the promotion of an EU-wide carbon-tax

v Congestion- and road-pricing schemes: a review of the likely costs, benefits (especially in terms of greenhouse-gas emissions) and effects of congestion- and road-pricing schemes, possibly introduced before the completion of Transport 21

vi Carbon-proofing of transport infrastructure: the subjection of infrastructure projects such as foreseen under Transport 21 and the new Programme for Government to multi-goal cost-benefit analysis to assess their possible impact on Ireland's greenhouse gas emissions.

vii Auctioning of permits under the EU Emissions Trading Scheme: the allocation of emissions permits by auctioning to the maximum extent permitted under EU rules, and the advocacy in EU negotiations of a move towards total auctioning

viii Exclusion of transport, especially aviation, from the EU Emissions Trading Scheme: the advocacy in EU negotiations of the exclusion of transport, especially air travel, from the EU Emissions Trading Scheme as currently designed and the development of alternative policies for the transport sectors, as its inclusion could have perverse effects

ix Consideration of an individual carbon trading scheme: a policy review to consider the introduction of a scheme of individual carbon trading, focusing especially on reducing emissions from the transport sector

x Limited use of the Kyoto Protocol's flexible mechanisms: the introduction of a cap (per cent to be defined) on Ireland's use of International Emissions Trading, Joint Implementation and the Clean Development Mechanism towards its national target

xi Targeted use of the project mechanisms: discrimination in favour of credits from projects with the best environmental and social returns, endorsed by a reputable monitoring initiative such as the NGO-backed Gold Standard

xii Voluntary offset scheme for official travel: the development of a voluntary offset scheme by defining suitable funds into which Government agencies and individuals could pay on a voluntary basis to offset some of the carbon emissions from their daily activities, especially official travel

xiii Domestic carbon offsetting scheme: consideration of a scheme to make funds available to emission-reducing projects that take place in Ireland but would not otherwise be economically viable

xiv Smart subsidies and incentives: targeted use of subsidies – addressing a known and quantifiable market failure, time-bound and goal-oriented, and non-market-distorting

xv Alignment of R&D with climate policy: a review of the state research and development budget foreseen under the National Development Plan and to maximise the synergies with Ireland's climate-change goals.

Under *behavioural instruments and measures*, options identified were:

xvi Early action on energy efficiency: proactive adoption of the measures outlined in the European Commission's Action Plan on Energy Efficiency, exceeding the measures wherever possible (consistent with EU Internal Market rules)

xvii Education and awareness: incentives and funding for bottom-up measures to improve energy efficiency through education and awareness, particularly in schools, universities and public buildings

xviii National debate on spatial planning: a national debate on spatial planning to connect local and national land-use planning to transport planning, including discussion of the costs of our current trajectory in terms of greenhouse gas emissions and the impacts of urban sprawl on quality of life, personal health, social cohesion and natural habitats

xix Strong national institutions for transport and land-use planning: the establishment of the necessary national authorities to carry out modelling and research for an evidence-based transport and land-use policy and to guide a more sustainable form of spatial development in an integrated way, including through the upgrading of the National Spatial Strategy and regional planning guidelines.

Under *technical instruments and measures*, options identified were:

xx Reorientation of the national grid to accommodate wide-spread renewable and micro-generated electricity: a strategy, supported by the necessary funding and political direction, to transform the national electricity grid so that it can accommodate widespread penetration of small-scale and intermittent sources of electricity including microgeneration, through simplified protocols for connection to the grid, smart metering and investment in electricity inter-connectors, among other measures

xxi National debate on the role of nuclear energy: a focused and time-bound national debate on the possible role that nuclear power could play, including an examination of its potential effects on energy efficiency and distributed electricity generation, and its continued exclusion from Ireland's domestic electricity generation prior to the conclusion of this debate

xxii Transition from carbon-heavy fuels for electricity generation: the requirement to sequester CO_2 as a condition for the continued use of coal to generate electricity; the phasing out of support mechanisms for peat as a plant feedstock in electricity generation and their replacement with incentives for biomass.

Introduction

The European Council – the regular summit of EU heads of state and government – made a political commitment in March 2007 that the European Union would reduce its overall emissions by 20% below 1990 levels by 2020, and by 30% if other major industrialised countries make similar commitments (EU 2007, 12). This goal is also seen as a contribution to an overall reduction by developed countries to reduce their emissions collectively by 60-80% by 2050. In January 2008 the Commission followed up on the decision of the March European Council by proposing emissions and renewables targets for member states and measures to improve the functioning of the EU Emissions Trading Scheme. Ireland received the most onerous target of all member states – a minimum -20% reduction in emissions [67] by 2020. The proposal sends a signal to stakeholders in individual member states that the debate about climate change has turned from *whether* to act to *how* to act. The ongoing negotiations within the aegis of the United Nations Framework Convention on Climate Change (UNFCCC) provides a further signal as they are likely to result in a new set of targets to succeed those of the Kyoto Protocol's initial commitment period of 2008-2012.[68] Any international agreement where other developed countries take on comparable emission reduction commitments would lead to a target of up to -30% for Ireland by 2020.

The -20% political target is binding and will remain valid even if the international negotiations fail, however. The EU policy framework is already supported by significant legislation – notably the EU Emissions Trading Scheme – and a multi-stakeholder process in the European Climate Change Programme to identify innovative policy approaches. At the domestic level, meanwhile, the new Programme for Government foresees an all-party agreement on climate-change targets and, in advance of such agreement, an annual reduction target of 3%.[69]

A useful way of looking at climate change is to see it as a great and wide-ranging form of market failure (as described in the Stern Review: HM Treasury, 2006). The pricing of global resources (in this case the Earth's atmosphere) does not take appropriate account of the services they provide or their

[67] On Ireland's domestic sector.

[68] The UNFCCC was negotiated in 1992. The 1997 Kyoto Protocol is a subordinate treaty to the UNFCCC.

[69] Department of the Taoiseach, *An Agreed Programme for Government* (Dublin: June 2007).

scarcity, and actors in the global economic system do not have the information or ability to act in the long-term collective interest of the planet. As with other kinds of market failure, climate change calls on governments to intervene with policies and measures that benefit society as a whole. Government intervention can correct for this market failure by providing an enabling environment, through legislation, incentives and, above all, the predictability of forward planning.

This paper takes as a given that Ireland will contribute equitably and fairly, on the agreed basis of common but differentiated responsibilities and respective capabilities, to the reductions in EU greenhouse gas emissions. The paper likewise assumes that Ireland will contribute to further, deeper emissions reductions by 2050. Faced with this new political clarity, it is now time for the debate in Ireland to turn to the policies and measures that will help Ireland to achieve the necessary substantial reductions in its greenhouse gas emissions. Policy intervention is necessary to change Ireland's emissions trajectory. The costs of not intervening, as identified by the Stern Review and many other studies, are likely to be much higher than the costs of action. More positively, the challenge of addressing climate change offers Ireland an opportunity to lead by example and introduce a wide-ranging policy response that reduces Ireland's emissions in an effective, economically efficient and socially equitable way. For this reason this paper has assumed that Ireland will make an imaginative and ambitious response to climate change that goes beyond mere legal compliance with her international commitments to making a real contribution to the ultimate goal of realising sustainable development.

The challenge and opportunity of climate policy in Ireland

Climate change is one of the most complex of policy challenges. Greenhouse gas emissions are bound up in almost every aspect of the economy, often through complex and poorly understood causal relationships. Controlling emissions requires a degree of coordination across sectors, which is hard to achieve even in countries with the strongest systems of governance. The problem is compounded by the need to persuade other countries to act in tandem. Climate change is also a form of "market failure", the greatest and most wide-ranging example ever seen (to use the language of the 2006 *Stern Review of the Economics of Climate Change*), by which many investment decisions are taken without complete information about the price of carbon in the future, or indeed without having to consider paying for them at all. As a result, and due to the novel nature of many interventions, at both national and international levels the payoffs from reducing emissions are often uncertain, delayed or diffuse. The result is a policy challenge that requires action across many different sectors for uncertain gain, with plenty of opportunities and incentives for cheating. The presence or absence of strong climate policies will help determine whether Ireland invests in social and economic infrastructure that commits us to a carbon-intensive or a carbon-efficient future.

To date, Ireland's climate policy has been characterised by an insufficiently clear strategy or coordinated approach across different government departments and agencies. The 2000 National Climate Change Strategy contained a number of measures that could have helped constrain Ireland's greenhouse gas emissions but some critical policy proposals, particularly the carbon tax and the conversion of the Moneypoint coal-fired electricity generating plant to natural-gas firing, were dropped for other policy considerations (a desire to increase fuel diversity in the face of concerns over security of supply in the latter case). Meanwhile, major infrastructure programmes have been launched with an incomplete regard to climate change. The national roads programme was an essential response to the poor quality of Ireland's primary roads and a prerequisite for future economic growth, but the focus on building roads without accompanying measures (e.g. equivalent investment in public transport; controls on urban sprawl) has driven up transport-related emissions.

Much national policy in Ireland is developed through consultative processes, particularly through the Social Partnership. This is a forum where representatives of Government, employers, trade unions, farming interests and other sectors negotiate wage agreements and other policy directions. The Social Partnership has been successful in aligning Ireland's economic and social policies while improving competitiveness and avoiding inflation and has been credited with leading the country out of the political, economic and social crises of the 1980s. Until recently, the Social Partnership has paid inadequate attention to the environment, although the current agreement, "Towards 2016", has a specific chapter on "environmental sustainability".[70] The multi-stakeholder consultative and negotiated approach of the Social Partnership could provide a valuable model for the kind of cross-societal measures that will be required to effect a decarbonisation of the Irish economy.

At the same time, however, radical policy change in Ireland has been shown to be a hostage to important sectoral interests. The failure of the carbon tax in 2004 was partly due to active lobbying by business groups and the opposition from the then-minister for finance, Charlie McCreevy, who said that the tax would bring minimal emissions reductions at a high bureaucratic cost, as well as by some trade unions, who said that a carbon tax would have a disproportionate effect on the poor. Both these claims were disputed at the time. The then chairman of Sustainable Energy Ireland, Frank Convery, said that the Government seriously underestimated the likely emissions reductions that a carbon tax would achieve.[71] The Economic and Social Research Institute showed that the potentially regressive effect of a carbon tax could be offset by directing some of the revenues to social welfare.[72] Arguably, opponents of the carbon tax in 2004 could base their position on the possibility that the Kyoto Protocol might fail, and that no action was a plausible alternative to a carbon tax. Today that is no longer the case: "no action" is no longer a possible response to the challenge of climate change. The burden of proof is on opponents of a carbon tax or other policy approach to present an alternative measure that addresses the problem in a better way.

Other features of the Irish policy-making process could also present obstacles. In common with many democracies, Ireland's electoral cycle (with elections every five years) gives politicians an incentive to prioritise short-term benefits over long-term cost. Ireland's political system has the added complication that all politicians, including ministers, are elected by an almost unique system of proportional representation in multi-seat constituencies that makes them particularly sensitive to local issues. Nevertheless, such systemic explanations only go so far to explain why Ireland has not fully realised sustainable development to date. Indeed, Ireland has successfully met past challenges (notably the economic and social crises of the 1980s, outlined above) and, with the same kind of political leadership and cross-sector participation, the goal of reducing our greenhouse gas emissions is likewise wholly attainable.

Trends in Irish emissions

The overall trend in Ireland's greenhouse gas emissions has been a steady rise since 1990, the baseline year for most greenhouse gas emissions, with the exception of a significant but temporary drop in emissions in 2003 due to some plant closures and the replacement of some oil with natural gas for electricity generation. Emissions in 2005 were 25.4% above 1990 levels. The most significant and sustained increase has been in the transport sector, where emissions have increased by 160% since 1990, due almost entirely to road transport. Emissions from the energy-industries sector (mainly electricity generation) in 2005 were 38% above 1990 levels: although these emissions had declined since 2001, the commissioning of new peat-fired electricity generating plant has reversed this trend. Emissions in the agriculture sector increased over the course of the 1990s but have

[70] Department of the Taoiseach, *Towards 2016: Ten-Year Framework Social Partnership Agreement 2006-2015* (Dublin: June 2006).

[71] Liam Reid, "Government 'underestimated' effect of abandoned carbon tax", in the *Irish Times* (29 November 2004).

[72] Scott, Sue, and John Eakins, "Carbon Taxes: Which Households Gain or Lose?", Environmental Protection Agency, (Wexford: 2004).

recently declined as a result of a reduction in both livestock populations and fertiliser use. Emissions from the residential sector fell somewhat as households shifted from coal and peat to oil and natural gas, but this trend has been countered by recent increases in population and housing stock. Emissions from the industry sector, following increases over the latter part of the 1990s, have stabilised somewhat in recent years.[73]

According to the Government's calculations, without additional policy interventions Ireland's emissions in 2020 will rise to about 74.1 million tonnes of CO_2 equivalent (Mt CO_2e), which is 37% above 1990 levels, although the Government estimates that measures foreseen in the 2007 revised National Climate Change Strategy will reduce this amount to about 64 Mt CO_2e. The Government has estimated that Ireland could face an annual target of about 54.7 Mt CO_2e in 2020, under a plausible scenario that translates the EU target into a national one on a pro-rata basis, and about 48 Mt CO_2e if the European Union adopts the more ambitious target of 30% below 1990 levels.[74] This means that Ireland will face an annual gap of at least 9.4 Mt CO_2e even if the measures outlined in the revised strategy deliver the expected results. The later sections of this paper set out some of the ways that the gap might be bridged.

Costs and benefits of implementation

Reducing emissions raises legitimate questions about costs, especially to Ireland's competitiveness. Although many companies and individuals can reduce emissions at little or no cost (many energy-saving measures can be effected at negative cost), a tough climate target raises legitimate concerns about real problems to Ireland's economic competitiveness and the effect on vulnerable sectors of society. As the targets become more ambitious, companies will exhaust the low-cost options and be forced to turn to more expensive means of reducing emissions. The effect of this on Ireland's competitiveness depends on the extent to which Ireland's competitors are similarly affected by emissions reductions. According to research by Scott *et al.*, most of Ireland's economic actors compete with firms in other EU countries, which are likely to be similarly constrained by domestic climate policies, rather than with developing countries who have lower environmental standards, so the impact on competitiveness for the economy as a whole might be relatively small compared to that for specific sectors. Affected sectors may require a targeted policy approach, but this should not be allowed to become a brake on national policy.

Consideration of costs must also include the costs to Ireland of relying on means other than reducing emissions at home. The current National Climate Change Strategy foresees an outlay of €270 million to purchase credits on the international market. This is assuming a permit price of about €15 a tonne of CO_2 equivalent.[75] The price of carbon on the EU Emissions Trading Scheme is currently about €20, however, and the international price of carbon is projected to rise by 2020 and beyond. This means that relying on international trading will impose a substantial and growing burden on the national economy. The price of emissions permits in the EU Emissions Trading Scheme for 2008–2012 is predicted to be between €17[76] and €39[77] per tonne of CO_2 equivalent, with many analysts predicting a price of between €20 to €25/t CO_2e.[78] Predicting prices beyond 2012 is more uncertain. Some studies point to a price of between €20 and €25 per tonne,[79] whereas other

[73] EPA, *Ireland's Emissions of Greenhouse Gases for the period 1990 – 2005* (Wexford, 2007).

[74] Department of the Environment, Heritage and Local Government, *A National Climate Change Strategy for Ireland 2007 – 2012* (Dublin, 2007).

[75] Ibid.

[76] Point Carbon, *A New Climate for Carbon Trading* (30 March 2007), Accessed Online: www.pointcarbon.com

[77] Societé General (24 August 2007).

[78] Energy White Paper (UK), *Meeting the Energy Challenge DTI* (2007); use a €20 per tonne of carbon estimate for 2012.

[79] Point Carbon, *A New Climate for Carbon Trading* (March 2007); and Energy White Paper (UK), *Meeting the Energy Challenge DTI* (2007); use a €20 per tonne of carbon estimate for 2012.

analysts believe that as the options for cheap emissions reductions are used up, prices are more likely to be determined by the cost of carbon capture and storage technology, currently between €50 and €70 per tonne (although the cost is likely to fall before 2020). Bank of Ireland Global Markets predict a price of €50-60/t CO_2e.[80] Most analysts agree, however, that carbon prices are on an upward trajectory, which means that the cost of relying on permit trading to meet emissions reductions obligations will rise. It should also mean that governments wishing to avoid mounting cost to the exchequer would increasingly consider costly policy alternatives.

In general, reducing emissions is a sound investment in the future. If Ireland fails to reduce its emissions early in the process it will be faced with an increasingly expensive task of reducing its emissions at just the time when the country could be struggling with the changes that altering weather patterns could bring to tourism, agriculture and other important sectors.[81] The potential costs of inaction to society as a whole must therefore be considered alongside the costs of action. At the same time, adaptation to climate change presents opportunities as well as challenges. Climate change policy is likely to be disruptive for some sectors, but this does not mean that its overall impact will be negative in the long term. Indeed, a European Commission study found that tackling climate change could have a limited, but positive, impact on overall employment across the European Union provided that appropriate policies are in place, with some important shifts in employment patterns within sectors.[82] Moreover, businesses that have low energy requirements or deal with the technologies that are suited to a low-carbon economy will prosper in a carbon-constrained economy, and Ireland could benefit by being among the first movers in this significant area of future economic development. Ireland therefore has an opportunity to lead by example by showing that greener policies can be cost-efficient and beneficial to society.

An imaginative response to climate change

Ireland faces a choice as it considers its long-term response to climate change. It is certain that the country will be faced with some kind of restraint on its emissions, as part of the EU effort to reduce overall emissions by at least 20% by 2020, and possibly more. There are two broad ways that Ireland could meet this constraint. On the one hand, Ireland could pursue technical compliance with its international commitments, through a minimalist application of policies and measures and wide use of flexible mechanisms such as international emissions trading. On the other hand, Ireland could make a political commitment to meet or exceed its targets in a more ambitious way. Countries and regions like Denmark, Iceland and California have made unilateral commitments to position their economies as leaders in the climate debate. Denmark made a political decision in the 1970s to wean its electricity sector off fossil fuels and as a result is a leading exporter of wind-power technology to the rest of the world. Iceland has made a political commitment to be the world's first hydrogen economy. The US state of California has made a commitment to reduce its greenhouse gases by 80% by 2050, and even though there is no similar target in the United States, other states are following California's lead by introducing legislation of their own. The experience of these countries suggests that early action can bring benefits to society as a whole, through the promotion of the industries of the future and through the development of knowledge and prestige that such initiatives often stimulate. Figure 4.1 below presents a schematic of these two broad options.

Ireland's position on this schematic in 2020 is not yet determined, but we propose that Ireland should aim to meet the challenge of climate change in an "imaginative" way, going beyond formal

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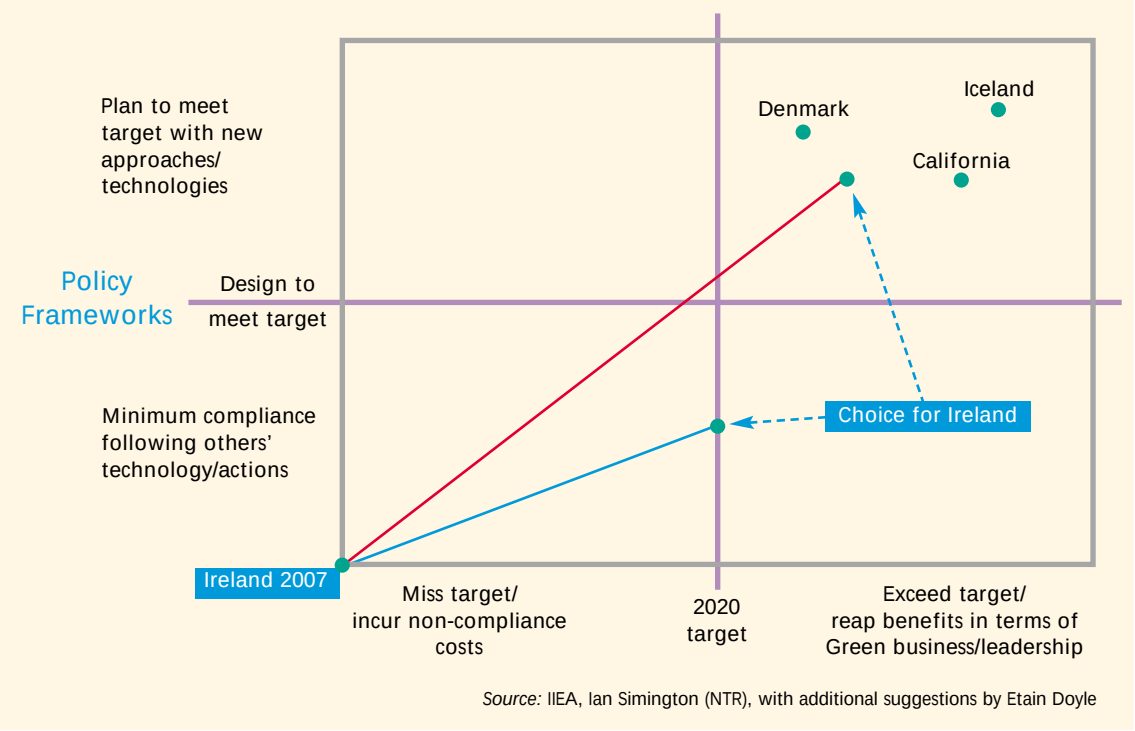
[80] In conversation with Paul Harris, Head of Natural Resources Risk Management, BOIGM.

[81] Although the effects on Ireland may be relatively moderate in the short-term compared to other European countries, the European Commission's recent Green Paper on adaptation to climate change cautions that "nearly all European regions are expected to be negatively affected" by climate change. European Commission (2007).

[82] Department of the Taoiseach, *An Agreed Programme for Government* (Dublin: June 2007).

Figure 4.1 Policy Options for Ireland



Source: IIEA, Ian Simington (NTR), with additional suggestions by Etain Doyle

compliance and pursuing instruments and measures that set an international example and increase the chances that other countries will follow suit. The recommendations in this report are based on the assumption that Ireland will choose to count itself among the leaders of the coming climate debate.

Potential instruments and measures to reduce Ireland's emissions

Policy approaches to address climate change can be divided into the following broad categories:

- Legislative, e.g. legally binding time-bound targets
- Economic and incentive-based, e.g. environmental tax reform, emissions trading
- Behavioural, e.g. focusing on demand-side management
- Technical, e.g. performance- and technology-based standards.

Of course, there are other ways to categorise the galaxy of policy options but it is hoped that this taxonomy is reasonably comprehensive. This paper restricts itself to policy approaches rather than sector-specific policies, which are the subject of more specific IIEA Working Group papers.

Legislative instruments and measures

Several jurisdictions have enshrined their long-term climate targets in law. California passed a bill in 2006 requiring a reduction in CO_2 emissions by 80% by 2050. The UK parliament adopted a similar measure requiring reductions of CO_2 emissions by 60% by 2050. The advantage of such a legislative approach to the overall target is that it presents an additional degree of certainty for Government departments, private businesses and other stakeholders under which to plan future operations. Reducing Ireland's emissions by 2050 to about 11 $MtCO_2e$ would equal an approximate 80% reduction below Ireland's 1990 levels, a pro-rata contribution to the overall EU target of reducing

emissions by 60-80% by 2050. Such a long-term target could be complemented by shorter-term (e.g. annual) targets. Friends of the Earth Ireland has proposed a Climate Bill that would require annual reductions in Ireland's greenhouse gas emissions of 3% and the Programme for Government includes a similar target (although presumably non-binding) of emissions reductions by 3% annually on average.[83] An annual 3% reduction would deliver reductions of about 60% below 1990 levels by 2050, to about 20 $MtCO_2e$; an 80% target (to about 10 $MtCO_2e$) would require average annual cuts of 4%. An additional advantage of a legislative approach is that politicians would be discouraged from postponing some politically difficult decisions until after the next election cycle: one of the weaknesses of the Kyoto Protocol's targets was, arguably, that the 2008-2012 target date was too far in the future to spur appropriate action. A system of interim (e.g. annual, five-yearly) targets could be strengthened by a transparent facility for "borrowing" from future targets, with appropriate penalties, or "banking" better-than-expected reductions to encourage over-compliance.

The accompanying measures to a legally binding target could be more important than the target itself. Even if the target is not accompanied by a penalty regime, the accompanying measures such as an annual carbon budget [84] and strategy review could provide a powerful incentive for action and, crucially, policy coherence across different Government departments and agencies. A further accompanying measure could be a Climate Change Commission, currently foreseen in the revised National Climate Change Strategy as a new body that will "monitor and assess Ireland's progress in addressing climate change and to increase awareness in all sectors of the opportunities and challenges presented by the transition to a low-carbon economy".[85] Such a Commission could play a positive role if it is given adequate resources, mandate and the independence to carry out these tasks.

The drawback of a legislative approach is that the penalties for non-compliance could be difficult to define or enforce, as it is difficult to see how penalties for non-achievement could be applied. On the other hand, a legal limit on Ireland's emissions would be similar to the legally binding cap included in the EU Emissions Trading Scheme (and it could accommodate a national trading scheme) except that it would be for the entire economy, and it is possible to buy additional credits in the EU scheme to fulfil obligations. Another possible disadvantage is that a national target could undermine Ireland's position in EU negotiations on a new "burden-sharing" agreement to define each member state's respective targets towards the overall EU target for 2020, suggesting that the exact figure should be determined only after the EU negotiations.

Policy Options: The most important thing that Government can provide at the outset is predictability. This could be achieved through:

i. Targets and reporting: The adoption as a national objective of an indicative target for 2050 with reference to the indicative EU goal of 60-80% reductions by 2050. Following the adoption of the new EU burden-sharing agreement for commitments up to 2020, and the subsequent definition of a corresponding national target for 2020, we recommend shorter-term (a maximum of five years) interim targets and annual reporting of progress (e.g. via a "carbon budget") alongside the annual fiscal budget.

ii Climate Change Commission: The creation of an appropriately resourced Climate Change

[83] Department of the Taoiseach, *An Agreed Programme for Government*. (Dublin: June 2007).

[84] The Programme for Government foresees a carbon budget (p.19) as a reporting mechanism, although a report by ECOFYS/Friends of the Earth United Kingdom suggests that the carbon budget could act as an instrument for allocating rights to scarce allowances permitted under the national legally binding cap; Alyssa Gilbert and Gemma Reece, *Developing a carbon budget for the UK with opportunities for EU action* (London: ECOFYS/Friends of the Earth, September 2006), p.15.

[85] Department of the Taoiseach, *An Agreed Programme for Government* (Dublin: June 2007).

Commission with the necessary mandate and independence to facilitate a continuous and dynamic review of Ireland's climate performance. The Climate Change Commission should have two main functions: a source of ideas for policies and initiatives, and a monitoring body to oversee Ireland's progress in meeting its short- and long-term targets, drawing on the material generated by the EPA and SEI (*inter alia*). The Commission should be tasked with raising awareness and facilitating links with and across other Government departments and agencies.

Economic and incentive-based instruments and measures

Market-based instruments are particularly appropriate for addressing climate change. This is because of the great potential and range of costs of reducing greenhouse gas emissions, the incentives that such instruments can offer individual actors to reduce emissions, and the benefit of dynamic efficiency, since market-based instruments (unlike technical standards, say) offer a continuous incentive for the adoption of better abatement technologies.[86] In the Irish context, carbon taxation and permit trading are the most often discussed economic instruments.

Domestic carbon taxation

Carbon taxation can correct the market failure presented by many types of energy use by internalising some of the external costs of CO_2 emitted from carbon-intensive energy sources. Carbon taxation is a more effective instrument for reducing energy-sector CO_2 emissions than other kinds of energy taxation because it discriminates against energy sources according to their contribution to greenhouse gas emissions.[87] A 2002 study by ESRI found that a carbon tax of €20/tonne CO_2 in Ireland would reduce projected emissions in 2010 from around 27% above 1990 levels (the business-as-usual projection) to being only 18% above the 1990 level.[88] The abatement achieved by carbon taxes and the effect of the tax on the economy will depend on several factors, including the point of application of the tax and what is done with the revenue.

The new Programme for Government has reinstated the idea of a domestic carbon tax, undertaking to introduce a carbon tax by the end of this administration in 2012. As in 2004, there is evidence to demonstrate that a carbon tax need not be socially regressive: research by the Economic and Social Research Institute (ESRI) showed that the regressive nature of a carbon tax could be countered by a rebate or compensation for low-income households, for instance by increasing the amount of fuel allowances.[89] The longer-term effect of a carbon tax would be to provide incentives for consumers to switch to more energy-efficient heating systems or implement energy-saving measures, such as improving insulation. Measures to support energy-efficiency measures at home (such as window replacement, loft insulation) would not only bring about savings of, on average, 2.6 tonnes of CO_2 per household per year, but also increased warmth and comfort for the houses' inhabitants.[90] Moreover, a carbon tax would generate large revenues, estimated by the ESRI in 2002 at about €860 million, or 1.1% of GDP in 2003.[91] It would also cause a reduction in greenhouse gas

[86] Robert N. Stavins, "Policy Instruments for Climate Change: How Can National Governments Address a Global Problem?", Journal Article 97-11, University of Chicago Legal Forum, January 1997: 293-329 (Chicago:1997).

[87] Ibid.

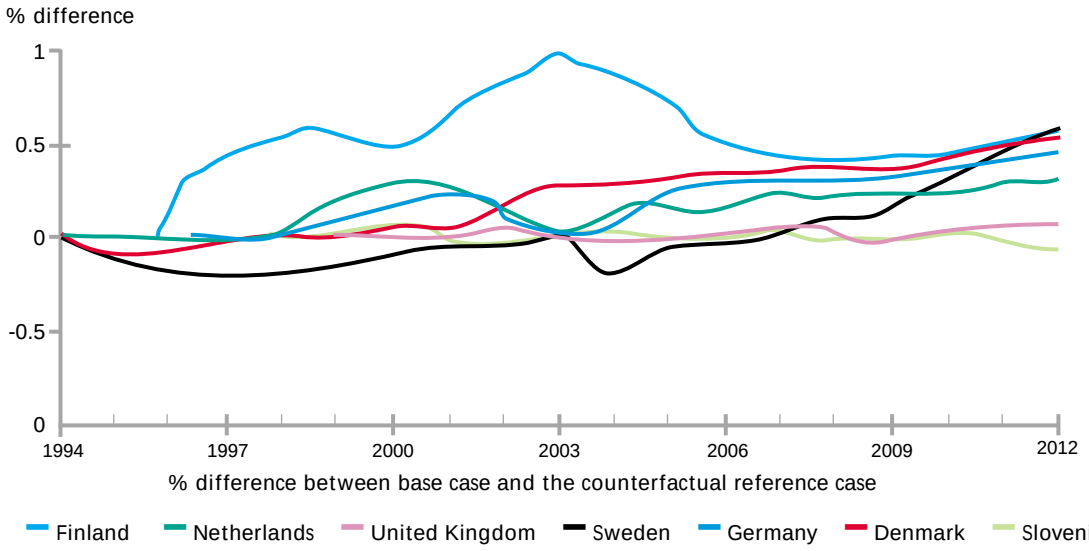
[88] Bergin, Adel, John FitzGerald and Ide Kearney (2002), "The Macro-Economic Effects of Using Fiscal Instruments to Reduce Greenhouse Gas Emissions", Paper at ESRI Energy Policy Research Centre Conference: *The Sky's the Limit: Efficient and Fair Policies on Global Warming* (Dublin: 11 December 2002).

[89] Sue Scott and John Eakins (2004), "Carbon Taxes: Which Households Gain or Lose?", Environmental Protection Agency (Wexford: 2004).

[90] ibid.

[91] Bergin, Adel, John FitzGerald and Ide Kearney (2002), "The Macro-Economic Effects of Using Fiscal Instruments to Reduce Greenhouse Gas Emissions", Paper at ESRI Energy Policy Research Centre Conference: *The Sky's the Limit: Efficient and Fair Policies on Global Warming* (Dublin: 11 December 2002).

Figure 4.2 The Effect of Environmental Tax Reform on GDP



Source: Cambridge Econometrics for European Commission (2007b)

emissions through reduced energy use of around 4.4 million tonnes a year, or about 9% below projected CO_2 emissions in 2010.[92] The effects of a carbon tax would be most pronounced in the electricity-generating sector but least so in the transport sector. Revenues could be used not just to compensate low-income households but also, as proposed by the ESRI, to remove other distorting taxes in general and improve the functioning of the economy. The ESRI suggests that the long-term cost to the Irish economy of a carbon tax, if the revenues were used to reduce income tax or Value Added Tax and increase welfare payments, would be small, at less than 0.2% of GDP a year after 10 years, or might even have a positive effect.[93] Further research would be needed to estimate the effects of imposing a carbon tax on limited parts of the economy, for instance by exempting those parts of the economy that are currently covered by the EU Emissions Trading Scheme.

The evidence from other European countries shows that environmental taxation, of which carbon taxation is one example, can have a positive impact on economic growth and competitiveness. The COMETR research project, funded by the European Commission, found that environmental tax reform implemented in Denmark, Germany, Netherlands, Sweden and Finland had a positive effect on GDP compared to the counterfactual reference case of no environmental tax reform, with a neutral effect in the United Kingdom (see Figure 4.2).[94] As the European Commission points out, competitiveness is not only an economic but also an environmental concern, because the migration of polluting industries to countries with lower standards would not reduce global emissions. The COMETR research project found that in the six EU member states that have carried out green tax reforms, "carbon leakage" (which describes the displacement of emissions from one geographical area to another as a result of policy, without any reduction in global emissions) has been very small and in some cases negative.[95] In so far as Ireland's economic competitors in the European Union

[92] Bergin, Adel, John FitzGerald and Ide Kearney (2002), "The Macro-Economic Effects of Using Fiscal Instruments to Reduce Greenhouse Gas Emissions", Paper at ESRI Energy Policy Research Centre Conference: *The Sky's the Limit: Efficient and Fair Policies on Global Warming* (Dublin: 11 December 2002).

[93] ibid.

[94] Slovenia was included in this study as one of the newly acceded states, but the country had only limited experience of environmental tax reform and its experience data are not comparable to the other study countries.

[95] European Commission, *Competitiveness Effects of Environmental Tax Reform – COMETR*, funded study coordinated by M. Skou Andersen (NERI) (Denmark, 2007). Policy Brief available at: http://www2.dmu.dk/cometr/Partner%20only/Brussels/policy%20brief/ COMETR_ Policy_Brief_Mar_2007.pdf

introduce such fiscal measures, this further diminishes any effects domestic carbon tax might have on Ireland's competitiveness, given that most of Ireland's trading competitors are based within the European Union.

Carbon taxation would indeed have more adverse impacts on individuals and sectors that consume above average amounts of energy or who are very dependent on solid fuels. According to the COMETR project, the most vulnerable sectors to a carbon tax would be basic metal and paper and pulp industries, whereas transport is relatively unaffected. But one of the points of such a tax is to provide a long-term signal that could encourage people, where possible, to make less carbon-intensive lifestyle and investment choices. Another possible disadvantage of carbon taxation is that some sectors – particularly transport – are relatively insensitive to price rises due to low elasticities of demand, potentially leading to increased costs without a reduction in emissions. Even still, a predictable price signal could have an effect on demand in such sectors in the long term, and meanwhile carbon taxation raises revenue that can be invested in mitigation strategies or used for other purposes, such as reducing PRSI (as proposed by the ESRI). The generation of additional revenue is a crucial difference between a carbon tax and high-energy prices caused by external factors (such as a rise in the price of crude oil). The effectiveness of a carbon tax will depend on carefully planned accompanying measures, especially for areas with high emissions and a low sensitivity to price increases.

Policy Options:

iii Domestic carbon tax: We recommend that the Government introduce a revenue-neutral carbon tax or a similarly effective means of pricing carbon across the entire Irish economy as soon as possible, preferably as part of Budget 2009. Domestic carbon taxation should apply to transport fuel but be designed in a way to avoid imposing a double tax on companies that already participate in the EU Emissions Trading Scheme, for instance by exempting those companies from the tax.

iv Promotion of an EU-wide carbon-tax: To allay fears of an adverse impact on Ireland's international competitiveness, the Government should advocate the introduction of an EU-wide carbon tax. Even without cooperation at the EU level, however, the Government should introduce carbon taxation at national level.

User pricing (transport sector)

As mentioned above, the effectiveness of carbon taxation, at least in the short term, will be minimal where the price elasticities of demand are low. This was one of the reasons cited by the Government in 2004 for abandoning the idea of a carbon tax. The most significant example in Ireland's case is transport. Road transport is already heavily taxed in Ireland, as elsewhere in Europe (German excise duty on petrol in 2006 was the equivalent of €275.20/tonne CO_2 equivalent).[96] This is a multiple of carbon trading levels, although it should be noted that transport not only burns fuel but also imposes other external costs of road pollution (including air pollution, road wear, water-course pollution, severance of habitat, not to mention congestion and noise). The high existing price of fuel in Ireland suggests that there is a low elasticity of demand for private motor transport in the short term. An additional carbon tax of, say, €20/tonne CO_2, which would add just 4.22% to the price of petrol (2006 figures), would therefore most likely not have a discernible impact on demand for travel and might bring no short-term benefits (not even additional revenue to Government, since the receipts from a carbon tax should be used to offset other taxes or costs).

[96] Frank Convery and Luke Redmond, "Market and Price Developments in the European Union Emissions Trading Scheme", *Review of Environmental Economics and Policy*, Vol. 1, 1 (Oxford, 2007).

A more effective approach to transport emissions would be to price all modes of transport according to their external social, economic and environmental costs, as recommended in recent reports to the UK and Irish governments.[97] Possible demand-side measures include congestion pricing and road pricing. On the supply side, the appraisal of proposals for transport infrastructure could take into account these external costs in addition to traditional costs and benefits.

Policy options: We recommend that the Government introduce accompanying measures to ensure the internalisation of all external costs in transport infrastructure, especially road transport, as well as providing the necessary incentives and information to motorists to allow a shift to less harmful modes of transport. Specifically, we recommend that:

v Congestion and road pricing: The Government should launch a comprehensive study on the likely costs, benefits (especially in terms of greenhouse-gas emissions) and effects of congestion-pricing schemes in all major Irish cities as well as schemes to charge motorists appropriately for the use of the entire national road network. We also recommend that such a study should review the feasibility of introducing congestion pricing or user charging in the short term, and before the completion of the Transport 21 programme for infrastructure spending. This may be necessary because of the high rate of growth in transport emissions. Experience elsewhere (e.g. London) shows that such schemes can themselves bring about the desired benefits if the revenues collected are used to fund transportation alternatives.

vi Carbon-proofing of transport infrastructure: On the supply side, the appraisal of infrastructure projects such as foreseen under Transport 21 and the new Programme for Government should be subjected to multi-goal cost-benefit analysis to take into account the external costs and benefits of proposed projects including their impact on greenhouse-gas emissions. The impact of this should be to prioritise public transport infrastructure options.

Emissions trading

Emissions trading is an alternative market-based approach to a carbon tax, although the two policies are not mutually exclusive. The benefit of emissions trading is that overall emissions are reduced, in theory, at minimum cost to the economy because each firm can choose whether to reduce its emissions or purchase additional permits, depending on the price. In a cap-and-trade scheme a cap is set across the economy or economic sector, permits are allocated to participating firms according to a division of the overall cap, and firms are obliged to restrain their emissions to their allocated permits or else purchase additional permits. In this way the regulator creates a scarcity that in turn creates a carbon price depending on demand. There are many design options that will affect the performance of an emissions trading scheme, including the method of allocation (e.g. by auctioning or grandfathering), the penalties for non-compliance, the definition of participating entities and the point at which emissions are controlled. The EU Emissions Trading Scheme (see below) controls emissions at a mid-point of the economy – large-scale industrial users of energy. An alternative approach would be to control emissions at the point of energy production ("upstream") or at the point of individual energy consumption ("downstream"). An upstream system with auctioned permits works like a carbon tax, in that the price of additional permits is passed on to consumers, except that the rate of the "tax" is variable depending on demand for fossil-fuel energy. Because there are relatively few entities to control (refineries, fuel importers), an upstream system is relatively cheap and simple to administer. A downstream system provides much more information to individuals, but it is more complex to administer, with higher transaction costs and many more regulated entities.

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[97] The Eddington Transport Study (2006). Available Online: http://www.dft.gov.uk; and Oscar Faber, *Environmental Impact of Irish Transport Growth and Related Sustainable Policies*, Vol. 2: Technical Report (2000). Accessed Online: www.transport.ie

The EU Emissions Trading Scheme

At present, the only emissions-trading scheme for greenhouse gases in Ireland is the EU Emissions Trading Scheme. This scheme began operating in 2005 and controls emissions from large-scale fixed-source emitters, such as large industrial units and power-generating stations. It covers about 45% of EU greenhouse gas emissions (29% of Irish emissions) but omits major emitting sectors like transport and agriculture. The current trading scheme runs until 2012 and proposals for the design of the post-2012 were made by the Commission in January 2008. This provides an opportunity to address the flaws that arise from the scheme's method of allocating permits mainly by grandparenting (given to firms for free based on their historical performance).[98] Granting permits for free instead of requiring firms to buy them on the market was intended as a way of generating the political support for the scheme, but it has led to some perverse outcomes. First, grandparenting can reward firms with poor environmental records, since they still have low-cost abatement opportunities that other firms may have already exploited, although this issue can be resolved by benchmarking allocations against an appropriate performance standard. Second, allocation for free creates an incentive for firms to lobby for the most generous possible allocation. Over-generous allocation in the EU Emissions Trading Scheme may have caused considerable volatility in the permit price: the sharp fall in the price of permits from €29.90 in April 2006 to €12 in May 2006, triggered by the release of data showing a surplus in the market, was ultimately due to overly generous allocations by some EU member states to their polluting industries.[99] The continuing decline in the price of permits to the current level of €0.10 (September 2007) is a further reflection of the extent of over-allocation in the pilot phase, although the European Commission seems determined not to repeat the mistake and has reduced many member states' proposed allocations for the trading period 2008-2012.[100] Such volatility undermines the benefit of the long-term price signal provided by a carbon market. Third, grandparenting creates something close to a property right that firms will not want to relinquish in the future. The experience of milk quotas and taxi and liquor licences in Ireland shows how politically difficult it can be to change a system in which government-created scarcity increases the value of permits and thereby provides an incentive to the permit holder to resist socially beneficial change to the permit system. Fourth, freely allocated permits that can be sold, or where their value can be recouped through raising prices to consumers, provide an effective subsidy to emitting firms. This is the case in the power generation sector, where firms are able to pass through prices to consumers.[101]

A further potential flaw of the EU Emissions Trading Scheme is the likely inclusion of aviation and maritime transport in the scheme, which, as long as allocation is based largely on grandfathering, could actually lead to minimal reduction in greenhouse gas emissions while subsidising air travel. This is because the resulting increase in airfares would be relatively small. Given the value of emission permits, granting emission permits to airlines for free based on their historical emissions would in effect be a subsidy to the airline industry worth billions of euros every year.[102] For air travel some other instruments will need to be considered, e.g. an integrated EU air traffic control system. The proposals of January 2008 identify aviation as "normal industry", and it is therefore proposed that this sector would be subject to an incremental increase in the proportion of permits auctioned with

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98 During the pilot phase, member states are allowed to auction up to 5% of their total allowance allocation. Only Ireland, Denmark, Hungary and Lithuania have exercised this option to any extent (Convery & Redmond 2007). Ireland auctioned 1% of its allocations under the first National Allocation Plan. Despite the apparent success of this exercise, only 0.5% of Ireland's allocations are being auctioned under the second National Allocation Plan.

99 Frank Convery and Luke Redmond, "Market and Price Developments in the European Union Emissions Trading Scheme", *Review of Environmental Economics and Policy*, Vol. 1, 1 (Oxford, 2007).

100 For more information please see: www.euets.com

101 John FitzGerald and Richard Tol (2007), "Europe's airline emissions plan is a flight of fancy", *Financial Times*, 18 January 2007.

102 Ibid.

the goal of full auctioning by 2020. The amendments proposed for the post-2012 operation of the scheme are outlined more fully in Chapter 2.

Policy option: The EU Emissions Trading Scheme is regarded as a policy success and will remain a major plank of EU and national climate policy. We recommend:

vii Allocation by auctioning: The Government should move towards a system of allocation of emissions permits in the EU Emissions Trading Scheme by auctioning to the maximum extent permitted under EU rules and advocate a move towards total auctioning in EU negotiations. Auctioning could impose costs and competitiveness constraints on small companies, but is appropriate for companies that are able to pass through prices to consumers, particularly the power generation sector. The proposal from the European Commission to use, post 2012, 100% auctioning for sectors like power, which can pass through prices and benchmarking for those exposed to international competition, is welcome and should be supported.

Individual carbon trading

Individual carbon trading provides a form of emissions trading applied at the level of the individual: the ultimate expression of a downstream approach to a cap-and-trade emissions trading scheme. The general idea of individual carbon trading is that everyone is given a limited allowance to cause CO_2 emissions, thereby allowing global emissions to be controlled while giving people an incentive – through the price signal and the ability to sell any unused emission permits – to reduce their emissions through their everyday consumer decisions. Users would be given an initial allowance, with the information stored centrally and perhaps on an individual credit card, and they would be required to retire equivalent credits whenever they make a carbon-emitting purchase, such as for petrol. The overall cap could be tightened over time and the price of individual emission permits would rise according to the increase in demand.

Individual carbon trading is a voguish idea in the United Kingdom and was enthusiastically endorsed in 2006 by the then UK environment minister, David Miliband.[103] Several models have been proposed with various design approaches to the practical issues posed by individual carbon trading, including tradable energy quotas, domestic tradable quotas and personal carbon allowances.[104] There are many uncertainties related to the political acceptability and economic impacts of such a scheme and to its administrative complexity.

"Cap and Share" is a comparable approach to individual carbon trading but with a more upstream focus. Cap and Share is a proposal developed by the Irish-based think tank Feasta in which, once the emissions cap is set, permits are auctioned to fossil-fuel suppliers and the revenues returned directly to all adult residents on an equal basis.[105] Once the cap is chosen (by the political process informed by science), the amount is divided equally among adult residents. Each resident receives an annual "entitlement" to an equal share of the overall cap. The resident can sell the entitlement to fossil-fuel suppliers, which are in turn obliged to buy entitlements equivalent to the emissions from the fuels supplied. Unlike the individual carbon trading schemes outlined above, in Cap and Share the resident is not obliged to purchase additional entitlements if his or her annual activities cause additional emissions. Rather, the system causes the scarcity to lead to higher fuel prices (since the suppliers will pass on the cost of fuel to consumers), with the result that the average users sell

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103 Speech by the Rt Hon. David Miliband MP, "The great stink: towards an environmental contract" (19 July 2006). Available Online: www.defra.gov.uk/

104 Simon Roberts and Joshua Thumin (2006), "A Rough Guide to Individual Carbon Trading: The ideas, the issues and the next steps", Department for Environment Food and Rural Affairs (London:, 2006).

105 Feasta, *The great emissions rights give-away* (Dublin: 2007).

their entitlement for the same amount as their annual energy bills rise. Those who consume less energy than average will be better off, and those who consume more energy than the average will be worse off. In this way the system acts like a carbon tax with a variable rate, with the revenues recycled directly to consumers.

According to its proponents, the Cap and Share would be effective, simple to administer and politically acceptable. Because fossil-fuel importers or refiners are small in number and are currently covered by the excise duty regime, they can be easily monitored, so administration costs would be low. Fossil-fuel importers will then pass on the additional cost of buying permits to consumers in the form of higher fuel prices. All consumers are incentivised to use less and, although this effect may be small in the short-term if elasticities of demand are low (see above), the longer-term effect may be strong if the annual cap is seen to be enforceable and increasingly restrictive in a predictable way. The scheme could be politically acceptable because the revenue goes directly to residents and not to the government. One criticism of the Cap and Share proposal is that recycling the revenues directly to individuals is inefficient compared to using the revenues to reduce PRSI (social insurance) contributions, which act like a tax on labour.[106] There is also the risk that the scheme could allow rent-seeking behaviour if fuel suppliers are able to hoard fuel and sell it for a profit during times of scarcity. Finally, any possible transaction costs should be factored into the design of the scheme: the experience of the all-island electricity market shows that transaction costs can generate large and unforeseen expense that could undermine the efficiency of the scheme. In terms of environmental effectiveness, one area where Cap and Share (and other individual carbon trading schemes) could be particularly suitable is for the transport sector, where carbon taxes are likely to be relatively ineffective as well as politically unpopular in reducing emissions.

Policy Option:

viii Consider an individual carbon trading scheme: Carbon-rationing schemes like individual carbon trading should be explored further to ascertain their possible role in the policy mix. We recommend that the Government give serious consideration to the introduction of a scheme of individual carbon trading, focusing especially on reducing emissions from the transport sector. This should involve analysis of the possible effects on the economy and the likely costs and benefits of such a scheme compared to other policy instruments. If the analysis indicates that individual carbon trading could play a positive role, the Government should move towards introducing a system within its lifetime (i.e. before 2012). In the meantime, an individual carbon trading scheme could be preceded by more sensitive pricing (e.g. differential prices for peak and off-peak electricity) and standardised information for consumers on the carbon content of their energy and fuel bills.

International flexible mechanisms[107]

Project mechanisms provide a flexible way for countries or companies to meet their emissions targets by allowing them to use credits from a project that occurs elsewhere. The Kyoto Protocol allows the use of two project mechanisms: Joint Implementation (JI), projects undertaken jointly by industrialised countries, and the Clean Development Mechanism (CDM), projects funded by developed countries but executed in developing countries. The revised National Climate Change Strategy foresees the purchase of up to €270 million worth of credits from the Kyoto Protocol's flexible mechanisms towards the national target: these may include credits from CDM and JI projects. The EU Emissions Trading Scheme allows entities to purchase a limited amount of credits from the project mechanisms.

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[106] Bergin, Adel, John FitzGerald and Ide Kearney (2002), "The Macro-Economic Effects of Using Fiscal Instruments to Reduce Greenhouse Gas Emissions", Paper at ESRI Energy Policy Research Centre Conference: *The Sky's the Limit: Efficient and Fair Policies on Global Warming* (Dublin: 11 December 2002).

[107] See Appendix, Occasional Paper 4.

The advantage of the project mechanisms is that they reduce abatement costs by providing firms with additional choice and flexibility in reducing emissions. Developing countries stand to benefit from the transfer of technology that accompanies some projects. There are serious disadvantages associated with project mechanisms, however, especially relating to the uncertainty of reductions from certain project types and the disproportionate location of carbon-reducing projects in large developing countries like China. The *Financial Times* found that many projects taking place under the Kyoto Protocol's project mechanisms were not "additional": carbon credits were simply providing additional revenues to projects that would have happened anyway.[108] This problem is particularly acute for voluntary offset projects, which are not governed by the Kyoto Protocol, but even official CDM projects can provide uncertain benefits. The European Union has excluded credits from forestry, land use and land-use change from the EU Emissions Trading Scheme due to doubts about the contribution of forestry projects to sustainable development and uncertainty about the permanence of carbon sequestration in forestry projects. Credits from nuclear power are similarly excluded from the scheme.[109]

In the Irish context we assume that the flexible mechanisms can play a role but there is a need to circumscribe their use. Since lower-cost abatement opportunities may exist abroad, restricting mitigation to domestic action could raise costs to controlled sectors. But this may not be optimal for society as a whole because money spent on credits from abroad is lost to Ireland, as are any secondary benefits that would have accrued from emissions reductions at home (e.g. reduced air pollution from reduced consumption of fossil fuels). There are likely to be low-cost abatement opportunities in Ireland that current policies do not bring about. The principle of "supplementarity", i.e. a preference for domestic abatement over the international flexible mechanisms, is enshrined in the Kyoto Protocol;[110] it is also reiterated in the EU Directives governing the EU Emissions Trading Scheme, which set out limits on the extent to which credits from the Kyoto Protocol's flexible mechanisms can be used in the scheme.[111] On the other hand, restricting abatement to domestic measures robs third countries of the benefits of project mechanisms, e.g. technology transfer. A more targeted use of the project mechanisms could help resolve these issues: the majority of project funding goes to just a few countries (e.g. China and India) and is dominated by large projects (e.g. the elimination of industrial greenhouse gases), but discriminating in favour of best-practice projects can help ensure that the benefits of investment and technology transfer are shared among more developing countries and a range of socially beneficial project types. Although discrimination would raise the price of allowances, this could be seen as a desirable outcome since one of the most basic objectives of the Government's future climate policy should be to raise the price of carbon across the economy.

Policy Option:

ix Limited use of the Kyoto Protocol's flexible mechanisms: We recommend that the Government define a cap on the extent to which the flexible mechanisms can be used towards the national target: an arbitrary limit could prescribe that a maximum of some percentage (e.g. 10%) of the distance to target could be met from credits from the flexible mechanisms.

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[108] Fiona Harvey, "Beware the carbon offsetting cowboys", in the *Financial Times* (26 April 2007).

[109] European Union, "Directive 2004/101/EC of the European Parliament and of the Council of 27 October 2004 amending Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading within the Community, in respect of the Kyoto Protocol's project mechanisms", *Official Journal of the European Union* (Brussels: 2004).

[110] Article 6.1 (d): "The acquisition of emission reduction units [from project mechanisms] shall be supplemental to domestic actions"; Article 17: "Any such trading shall be supplemental to domestic actions for the purpose of meeting quantified emission limitation and reduction commitments". There is no current legal definition or guidance to what "supplemental" means in practice, but logic suggests that it means that at least half of the abatement effort should be based on domestic efforts.

[111] "The plan shall specify the maximum amount of CERs and ERUs which may be used by operators in the Community scheme as a percentage of the allocation of the allowances to each installation. The percentage shall be consistent with the member state's supplementarity obligations under the Kyoto Protocol and decisions adopted pursuant to the UNFCCC or the Kyoto Protocol." Directive 2004/101/EC amending Directive 2003/87/EC, quoted in Grian (2005).

Although this could limit the State's political options to meet its international obligations and possibly also raise the costs of compliance, Ireland would benefit from the low-cost opportunities identified, ancillary benefits and the economic benefit of spending the money at home that would otherwise have been spent abroad.

x Targeted use of the project mechanisms: We recommend that the Government define a positive list of countries and project types that are considered eligible. This would help prevent the funding of projects with questionable environmental and social returns. Although Ireland does not have the capacity to monitor potential projects individually, the Government could discriminate in favour of credits from projects that are endorsed by a reputable independent best-practice methodology such as the NGO-backed Gold Standard (www.goldstandard.org). We consider that it is appropriate for Government to discriminate in favour of certain types of projects even if this means excluding projects that would be deemed acceptable by the UN bodies.

Domestic projects

Another way of approaching the use of projects to offset emissions elsewhere is to look at projects that take place at home. A voluntary offset scheme could provide a worthwhile means for Government departments and agencies as well as individuals to reduce their nominal carbon emissions. We welcome the provision in the Programme for Government to offset all official air travel, although the beneficiaries should be expanded to include other kinds of projects beyond "urban forests" (as currently proposed) and should not be restricted to Ireland. We consider that funding domestic projects is potentially a better use of public money than purchasing international credits where they are not necessarily linked to verifiable emission reductions.

A domestic offsetting scheme could provide a further innovative way of reducing emissions while generating funding for initiatives that contribute to the decarbonisation of the Irish economy. Under a domestic offsetting scheme the Government could reward companies for activities taking place in Ireland that reduce emissions by allocating equivalent carbon permits, which the companies can then sell. A scheme in New Zealand provides funding for initiatives taking place in New Zealand as long as the eligible projects are "additional", i.e. would not be economically viable without the transfer of carbon credits. Such a scheme could provide a revenue stream for Irish projects in agriculture, the renewable energy sector and other areas not covered by the EU Emissions Trading Scheme.

In addition, public funds could be made available through grants (e.g. administered by Sustainable Energy Ireland), to direct investment in energy efficiency, renewable energy and low carbon emission projects, as well as providing a source of capital made available to banks and lending institutions to subsidise low-interest loans to companies that are seeking finance for projects to deliver low carbon or renewable energy in the State. There is provision for a domestic offsetting in the EU Emissions Trading Proposal of January 2008.

Policy option:

xi Voluntary offset scheme for official travel: The Government should support the development of a voluntary offset scheme by defining suitable funds into which Government agencies and individuals could pay on a voluntary basis to offset some of the carbon emissions from their daily activities, especially official travel.

xii Domestic carbon offsetting scheme: The Government should consider a scheme to make funds available to emission-reducing projects that take place in Ireland but would not otherwise be economically viable.

Subsidies

Subsidies are a commonly applied economic instrument by governments to attempt to secure a particular outcome by incentivising favoured technologies or practices. The feed-in tariff for electricity generation (REFIT, which was introduced in May 2006 but has not yet come into force) should help to promote wind power in Ireland. Carefully designed subsidies can succeed in reducing greenhouse gas emissions if this is the intended outcome, but there are examples of perverse subsidies such as the requirement to produce electricity from burning peat (one of the most carbon-intensive methods of electricity generation). Other perverse incentives from subsidies include the subsidy on public transport through a rebated tax on its fuel rather than on what should be encouraged, passenger numbers and aviation benefits from a preferential and poorly targeted tax treatment.[112]

Policy option:

xiii Smart subsidies and incentives: We recommend that the Government adopt a hierarchy of acceptability criteria for climate-change subsidies. Such subsidies should address a known and quantifiable market failure, they should be time-bound and goal-oriented, and they should not distort the market by providing an arbitrary advantage to some market participants over others.

Research policy

Research is a major area for state subsidies in Ireland, attracting € 8.2 billion of funding in the 2007-2013 National Development Plan. Subsidies for research and development can accelerate the development of technologies, but there is a risk that subsidies can be misdirected or lead to inefficiencies. Nevertheless, government support for research and development in renewable technology is necessary in certain areas like the energy sector because of uncertainty in such sectors and the fact that research may be under-resourced because the gains may not be captured by those who invest in the research.[113] The formation of the Irish Energy Research Council in 2006 establishes a strategy for research in the energy area, but Ireland has historically spent less per capita on research and development of renewable energy than its OECD peers. Current policy is intended to develop a more competitive contribution from indigenous and, in particular, renewable energy sources as well as improvements in energy efficiency in transport, energy-supply systems, buildings and industry.[114] An example might be ocean energy from waves or tides, which is abundant around the island of Ireland and, because it is predictable, could provide a backup source of energy to support wind power.[115] Ireland should be well informed and look to be an early adopter of new technologies being developed elsewhere.

Policy option:

xiv Alignment of R&D with climate policy: We recommend that the Government undertake a review of the state research and development budget foreseen under the National Development Plan to maximise the synergies with Ireland's climate-change goals. We recommend that Government continue to promote research across a broad range of technologies. The proposed Climate Change Commission could play a role in reviewing current research funding on climate and suggest changes if necessary.

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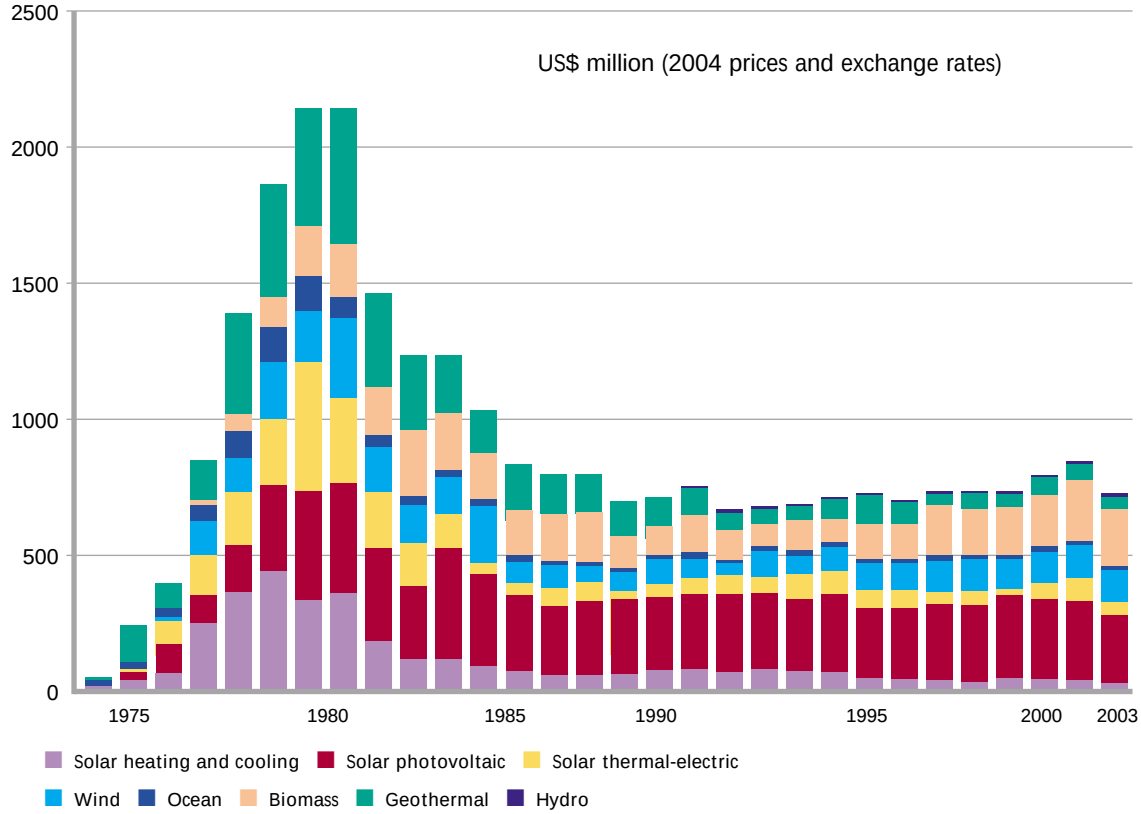
112 Scott (2006).

113 Martin Howley, Fergal O'Leary and Dr. Brian Ó Gallachóir, *Energy in Ireland 1990 - 2004: Trends, issues, forecasts and indicators* (Dublin: Sustainable Energy Ireland, January 2006).

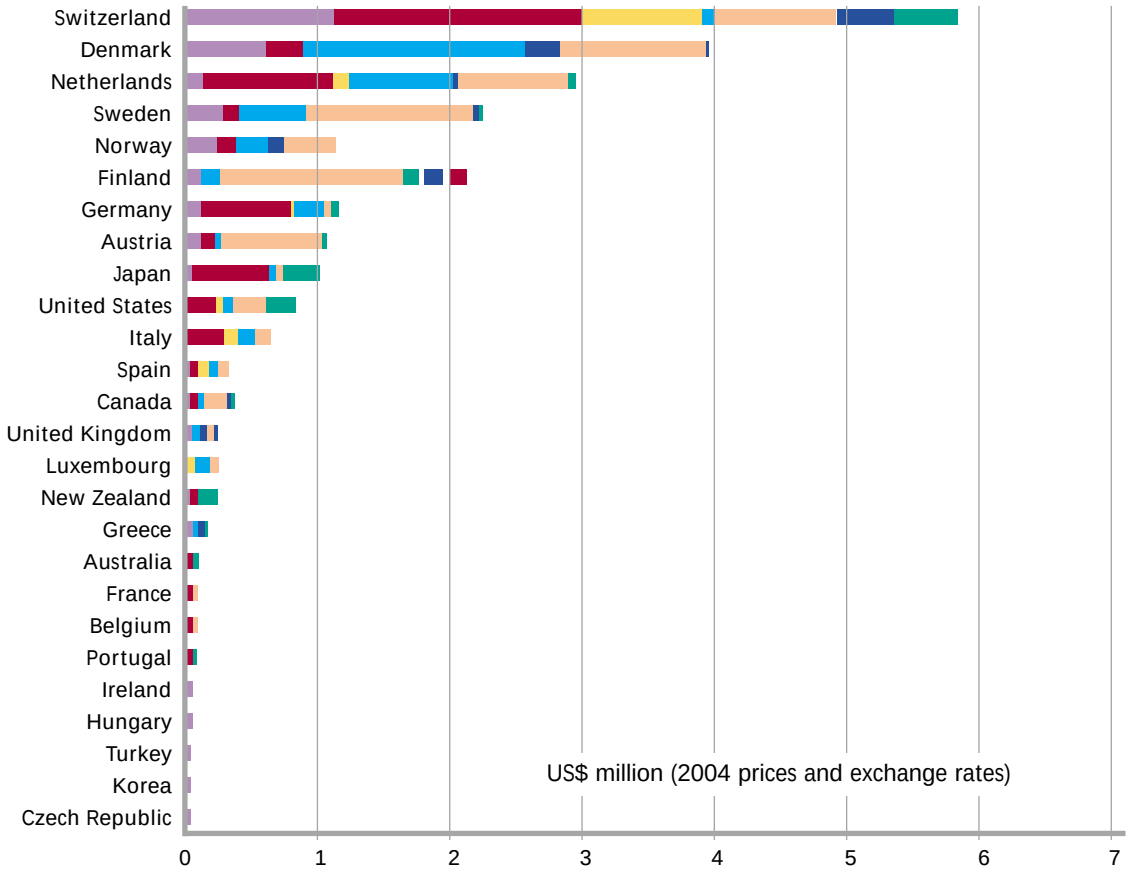
114 Government of Ireland 2006, 160.

115 SEI 2006, 10.

Figure 4.3 IEA member government budgets for total renewable energy R&D annual investments for 1974–2003



Investment *per capita*, averaged between 1990 and 2003



Source: Sims et al. (2007), 314, reproduced from the International Energy Agency

Behavioural instruments and measures

Regulatory and incentive-based measures such as pricing carbon will have a large impact on Ireland's greenhouse gas emissions, but there is also a role for accompanying measures to influence individual behaviour. There is much scope for behavioural measures in the area of energy consumption. Such savings are thought to be possible because many opportunities for reduced consumption remain hidden or otherwise unexploited. Reduced demand in Ireland will be essential if Ireland is to contribute to this overall EU target, given that Irish energy consumption is projected to rise at an average rate of almost 3% per annum until 2020.[116]

Energy efficiency and demand side management

Energy efficiency provides much scope for reducing emissions due to the fact that at least 20 per cent of energy in the European Union is wasted.[117] The European Commission has defined an Action Plan with about 75 measures that can be taken to increase energy efficiency in appliances, buildings, electricity generation and the transport sector.[118] Ireland should exploit these measures aggressively as among the lowest-cost opportunities for reducing emissions. The efficiency of appliances can be increased by labelling; although Ireland is a technology taker and therefore cannot influence the design of mass-produced appliances, the Government could mandate minimum standards (complying with Internal Market rules) for many consumer devices, e.g. with regard to standby modes. The energy saving potential of buildings in the European Union is estimated at 28%; there is particular scope for savings in the public sector, where users of buildings do not always have the incentive to use their energy efficiently. In addition to the Buildings Directive (which came into force in Ireland in 2007 and mandates energy savings in buildings above 1000sqm), Ireland could unilaterally impose higher standards for all buildings, regardless of size, and provide incentives for the development of passive houses, which rely on very good insulation levels and passive heating and mechanical ventilation rather than traditional heating systems; the recent introduction of higher standards in Irish building regulations is a welcome step in this direction. Ireland could introduce measures to raise the efficiency of *energy transformation*, for instance by promoting Combined Heat and Power and district-heating schemes in urban areas.

Policy option:

xv Early action on energy efficiency: We recommend that the Government proactively adopt the measures outlined in the European Commission's Action Plan on Energy Efficiency and seek to build on these measures wherever possible, and consistent with EU Internal Market rules.

Education and awareness measures

Many of the energy-efficiency measures outlined in the European Commission's Action Plan seek to raise awareness about the role that individuals can play in reducing energy consumption. Besides energy labelling, informational tools include education and training plans and programmes for energy managers in industry and utilities. Schools and universities have a role to play not only as focal points for education on efficiency but also as practitioners in pilot schemes. The public sector also has a large role to play, given that the Government is the State's largest single landlord and tenant through its occupation of public buildings and its provision of social housing.

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116 Howley et al. 2006

117 European Commission COM (2006) 545, *Action Plan for Energy Efficiency: Realising the Potential* (Brussels: 2006).

118 Ibid.

Policy Option:

xvi Education and awareness: Government should provide incentives and funding for bottom-up measures to improve energy efficiency through education and awareness, particularly in schools, universities and public buildings.

Spatial and urban planning

Spatial planning and its consistent, effective implementation is a crucial policy area to address because of the long-term impact that settlement patterns will have on the trajectory of our greenhouse gas emissions. To date in Ireland there has not been sufficient coordination either at the policy formation or implementation level between land-use and transport development, despite many strategic studies that focus on one or the other.[119] The result of Ireland's permissive planning regime has been the haphazard development of rural areas increasingly distant from their nominal urban centres, which in turn has locked a growing proportion of the population into energy-intensive commuting patterns. The European Environment Agency notes a strong correlation between population density and energy consumption and found that cities with high experiences of urban sprawl also had high emissions of CO_2 compared to more densely populated cities.[120] Car-borne transportation was identified as a major factor. Any attempt to move away from the current laissez-faire approach to planning in Ireland is likely to be controversial, given the strong preference for dispersed one-off housing in the countryside and the perceived unattractiveness of high-density alternatives to suburban housing, and as evidenced by the negative reaction of local politicians to attempts by the national government to intervene in planning policy.

Policy options:

xvii National debate on spatial planning: We recommend that the Government facilitate a national debate on spatial planning in an attempt to connect local and national land-use planning to transport planning. We believe that the perceived problems of political unpopularity could be resolved by a frank debate about the costs of our current trajectory, not just in terms of our greenhouse gas emissions but also the severe impacts that urban sprawl imposes on the quality of life in terms of personal health, social fragmentation and the destruction of Ireland's habitats.

xviii Strong national institutions for transport and land-use planning: We recommend that Government set up the necessary national authorities to carry out modelling and research for an evidence-based transport and land-use policy and to guide a more sustainable form of spatial development in an integrated way, including through the upgrading of the National Spatial Strategy and regional planning guidelines.

Technical instruments and measures

The use of direct government intervention through technical measures – such as regulations mandating appliance efficiency levels or the use of specific technologies – is often a cruder instrument compared to incentive-based measures. The state may be guided by political preferences rather than questions of economic efficiency or effectiveness when it chooses a particular technology as a response to climate change; governments are often poor predictors of technologies, simply because they are not omniscient. Technological developments would benefit from a guaranteed price of emissions, as technology has been bedevilled by uncertain carbon price up until

[119] The Irish Planning Institute noted four decades of successive studies that focused alternatively, but not simultaneously, on land-use and transport studies: the 1967 Myles Wright study on land use, the 1971 Dublin Transportation Study, the 1985-88 ERDO Strategy on land use, the 1994 Dublin Transport Initiative, the 1998 Strategy Planning Guidelines for land use, and the 2000 Platform for Change strategy on transport.

[120] European Environment Agency (2006), *Urban Sprawl in Europe: The Ignored Challenge*. EEA Report 10/2006, (Copenhagen: 2006).

now.[121] Nevertheless, there are many cases that call for direct government intervention or a mixture of instruments rather than leaving things to the market, especially in cases of clear market failure. This section focuses on the energy sector, where outcomes are partly dependent on political considerations and the complexity of the regulatory/market environment, and where targeted intervention through technical instruments and measures could have a beneficial outcome.

Electricity generation from renewable sources

The Programme for Government foresees that at least one third of electricity consumed in Ireland will be generated from renewable sources by 2020.[122] This is both an ambitious target and a minimum achievement if Ireland is going to succeed in reducing its overall emissions. There is a critical need for political predictability in this area because of the long investment horizon of the sector: generating stations typically have a lifespan of about 20 years and distribution networks have a lifespan of about 45 years.[123]

Ireland has enormous and largely untapped resources of renewable energy. For example, a 1997 study estimated that wind power could generate around 345TWh per year, about 19 times the current electricity production of the ESB system.[124] In the short-term, however, the potential of renewable energy will not be realised without government support. Many new renewable energy technologies are relatively expensive because they are in their infancy. The structure of the electricity grid itself also imposes barriers to the wider deployment of renewable electricity. Irish electricity is structured around a number of large base-load plant, mainly combined-cycle gas turbine. Such plant has high capital costs, runs continuously at high output and is well suited for providing the electricity market with a guaranteed minimum supply, but it is inefficient when operated at part load, and it is expensive to start up and shut down and therefore inflexible and unresponsive to fluctuating demands. According to some estimates, there is more than double the required amount of base-load plant in Ireland to satisfy minimum system demand.[125] This inappropriate generation mix has developed in response to rather crude market incentives rather than strategic planning.

The government could facilitate high penetration of wind energy (e.g. 30%) by encouraging the deployment of open cycle gas turbine stations, which have a relatively low capital cost and provide the flexibility to balance the energy system when the wind drops.[126] The most important and long-term challenge, however, will be to reorient the grid itself to allow the accommodation of greatly increased amounts of dispersed, often small, generators of electricity from renewable energy sources.[127] "Embedded" or "distributed" generation is electricity generated in small-scale units that are connected to regional electricity distribution networks. Properly designed, a grid based on embedded generation could reduce greenhouse gases through improved efficiency and the accommodation of electricity from renewable sources while bringing additional benefits of improved security of supply (through fuel diversity and a more flexible grid that is less prone to blackouts).[128] In Ireland there is much potential for new technologies such as modular combined cycle gas turbine,

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121 Based on Sue Scott's submission to IIEA Climate Change Working group.

122 Government of Ireland 2007, 16

123 Deloitte & Touche (2005), *Review of the Irish Electricity Sector* (Dublin: 2005).

124 ESBI/ETSU EU Altener Report, *Total Renewable Energy Resource in Ireland* (Brussels: 1997).

125 O'Connor, Dave, *Generation Mix – Securing Security of Supply*, presentation to IWEA Annual Conference (Galway: 2006).

126 Sue Scott and John Eakins, *Carbon Taxes: Which Households Gain or Lose?*, produced by The Economic and Social Research Institute for the Environmental Protection Agency, (Wexford: 2004).

127 The Brattle Group, *A Study on Renewable Energy in the New Irish Electricity Market*, Report prepared for Sustainable Energy Ireland, (Dublin: 2004).

128 Goodbody Economic Consultants, *Assessment of the key competitiveness issues and policy requirements facing the Irish energy market* (Dublin: 2002).

open cycle gas turbine, combined heat and power (large-scale, mini and micro) and fuel cells to be included in a national system of distributed generation. Microgeneration, which includes such technologies as domestic solar panels, brings embedded generation closest to the point of use. Combined Heat and Power (CHP, or the simultaneous production of electricity and usable heat; also known as cogeneration) would likewise benefit from a restructured grid. Though not necessarily based on renewable energy sources, CHP could also reduce greenhouse gas emissions by improving the efficiency of electricity conversion. The creation of a flexible electricity grid that accommodates major penetration of embedded generation will not happen without government intervention, however. For instance, it is often impossible for technical reasons to connect microgeneration and small-scale electricity generation to the electricity network.

Policy option:

xix Reorientation of the national grid to accommodate wide-spread renewable and micro-generated electricity: We recommend that the Government and the regulatory authorities provide the necessary political and technical direction to effect a reorientation of the national electricity grid, in such a way that it will be able to accommodate widespread penetration of small-scale and intermittent sources of electricity. This is not to choose the specific technologies but rather to provide an environment in which many different kinds of technologies can compete. Such intervention is justified because of the potential benefits and due to the national importance of the grid infrastructure. We also recommend that the regulatory authorities develop a strategy to ensure that the grid can accommodate a large-scale deployment of micro-generation when it proves economic to do so. Short-term measures could include the introduction of a simplified protocol for connection to the grid and the introduction of smart metering, which would also promote energy efficiency by encouraging consumers to regulate their electricity consumption according to its price. Additional investment in interconnectors will also be necessary to hedge against variability in output and to allow Ireland to export as well as import electricity.

Nuclear energy (domestic and imported)

At present it is highly unlikely that a nuclear power station will be built in Ireland in the short term. This is because there is strong political opposition to the use of nuclear power, as reflected in the draft Programme for Government's assertion that "nuclear power is neither sustainable nor an answer to Ireland's energy needs. Nuclear power fails on grounds of environmental risk and long-term economic costs." This political position could conceivably change if important stakeholders became convinced of the need for nuclear power due to its perceived effects on greenhouse gas emissions or (more commonly cited) security of supply: on 19 June 2007 the Minister for Communications, Eamon Ryan, indicated his openness to a debate around the role of nuclear power (although he does not himself believe it is appropriate), the Irish Business and Employers' Confederation (IBEC) has called for a debate on nuclear power, and a study commissioned by Forfás suggested ways in which nuclear power could play a role in Ireland's energy security. Critics of Ireland's stance also point out that the Ireland-UK electricity interconnector means that Ireland inevitably imports electricity that was generated from nuclear power. For reasons of investor security and the risk (though small) of a radioactive accident, a nuclear power station could not be built without direct government financial support. Given that a nuclear power station takes about ten years to build, and no station has been proposed in Ireland, nuclear power will not play a significant role in Ireland's electricity mix (apart from some imported electricity) for the foreseeable future.

A pertinent objection to nuclear power is that it is the opposite of the kind of plant that is needed for the Irish electricity system. Nuclear power is currently not very economic in units below 700-800 megawatts, so its use would be limited to base-load plant, of which there is already a surfeit in

Ireland (see above).[129] There may also be a trade-off between a centralised system that is made up of a small amount of large generating stations and a more flexible, decentralised system made up of a large amount of small generating stations, many of which would be based on renewable resources like wind or biomass and would be closer to the point of electricity use, as described above. If Ireland makes a political decision to opt for the latter kind of grid, nuclear power could undermine this outcome. Finally, it is necessary to examine nuclear power's opportunity costs. Nuclear power is not currently cost competitive with other forms of electricity (although a 2003 MIT report suggested that nuclear power might be price competitive if the price of carbon rises to about $50-200/ton carbon[130] and generally requires direct or indirect public support. The benefits of spending public money on a nuclear power station should be compared to the gains that could have been achieved by investing this money in energy efficiency or in non–technology specific measures like promoting a decentralised grid that accommodates embedded generation from a variety of different technologies.

Policy option:

xx National debate on nuclear energy: We believe that the current evidence about the risks of nuclear power – particularly its waste problem and its potential effect on a decentralised electricity system – demands a precautionary approach. We therefore recommend that the Government facilitate a focused and time-bound national debate on the possible role that nuclear power could play, including an examination of the effects of nuclear power on energy efficiency and distributed electricity generation, and that nuclear power continue to be excluded from Ireland's domestic electricity generation prior to the conclusion of this debate.

Carbon-intensive electricity generation: coal and peat

Coal produces the highest proportion of greenhouse gases of any electricity plant feedstock (except for peat) and is covered by the EU ETS, which raises prices. The replacement of Moneypoint generating station with a gas-fired station would improve environmental performance, but this option has been rejected by the Government to ensure diversity of energy supply. The environmental impact of coal could be reduced by CO_2 sequestration (also known as carbon capture and storage), a technology that is still far from being cost effective at current carbon prices. Peat is an indigenous source of energy that provides local employment, but its extraction can destroy ecological habitats and it emits even more CO_2 than coal. One solution would be to replace peat – and, eventually, other fuels – with biomass, which would retain the social benefits of local employment that are gained by using peat (in any case less important today, with near-full employment in Ireland) while also boosting the use of a renewable source of energy with fewer environmental impacts.

Policy option:

xxi Transition from carbon-heavy fuels for electricity generation: We recommend that the Government tie the continued use of coal to generate electricity with CO_2 sequestration. As Moneypoint reaches the end of its operating life some time in the coming 15 years it could be replaced by a plant based on coal with carbon capture and sequestration, although the Government's role should be limited to defining an appropriate incentive structure rather than specifying a technology. We recommend that support mechanisms for peat as a plant feedstock in electricity generation be phased out and replaced with incentives for biomass.

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129 Bolger, Conall (2007), *Energy Sector: Issues for Cutting Emissions*, unpublished note for IIEA Climate Change Working Group.

130 Stephen Ansolabehere et al., *The Future of Nuclear Power: An Interdisciplinary MIT Study* (Boston: 2003).

Ireland's optimal policy mix

The near-universal challenge of climate change and the complex and long-term nature of the problem requires a policy approach that is at once dynamic, broadly applied and containing a complementary mixture of short-term actions and long-term goals and targets. The 2007 revised National Climate Change Strategy succeeds in its limited goal of defining how Ireland can meet its legal obligations under the Kyoto Protocol, but it does not attempt to address the much larger task that Ireland must face if we are to contribute to the European Union's goal of reducing emissions by 20-30% below 1990 levels by 2020. We hope that this synthesis report can provide some suggestions for additional measures and instruments that policymakers can and should be examining as a matter of urgency.

A single regulatory instrument will not cause Ireland's greenhouse gases to decline. Government, stakeholders and citizens must contribute to a debate on the best combination of different instruments and measures. In many cases policy instruments can enhance each other. An incentive-based instrument would be improved by the provision of useful information to consumers and businesses. Not all policy approaches are complementary: a purely voluntary approach is not compatible with mandatory standards, although voluntary measures can be a precursor to stricter mandatory standards if the voluntary approach is required to deliver emissions by a certain date. In general, however, our recommended instruments and measures are complementary and, with some exception, could be introduced in tandem.

As a general policy approach, we recommend the following sequencing and prioritisation:

- Political certainty: Government should establish the necessary long-term political certainty to guide investment decisions and other areas of government policy. To this end, the Government should initiate a consensus agreement on Ireland's long-term target and short-term interim targets. Such a consensus should be struck with all- or nearly all-party agreement and should be based on a process of consultation and stakeholder involvement along the lines of the Social Partnership agreements.
- Clearly defined outcomes: Ireland's climate policy should have a hierarchy of clearly defined outcomes. The first outcome should be a reduction in Ireland's emissions (defined through indicative time-bound targets). The second outcome should be the establishment of a price on carbon, the lack of which is at the root of the market failure that climate change represents. A price on carbon would be the most effective way to promote technological and behavioural change. The exact price of carbon is less important, although a price floor (e.g. set by a tax) would provide a guarantee against the possibility of short-term price volatility. Nevertheless, a price on carbon will not be sufficient to drive the decarbonisation of the Irish economy. The third outcome should therefore be complementary measures that deliver carbon reductions in specific sectors of the economy in an efficient and equitable way.
- Transparent and dynamic process: The process by which Ireland reduces its greenhouse gas emissions is as important as the specific policies and instruments chosen. The establishment of a Commission on Climate Change, as foreseen in the draft Programme for Government (p. 12), will be important to oversee the implementation of the national climate-change strategy across all Government departments and agencies. The national strategy should be entirely open to input from stakeholders and the general public and should be accompanied by a regular public reporting method to reveal the emissions performance of individual economic sectors and government departments/policy areas. In this way policies will have to be appraised according to their contribution to Ireland's climate strategy as well as other considerations such as economic efficiency. Another role for the Climate Change Commission would be to galvanise public support for climate change measures across the board.

Part II Working Groups' Analysis

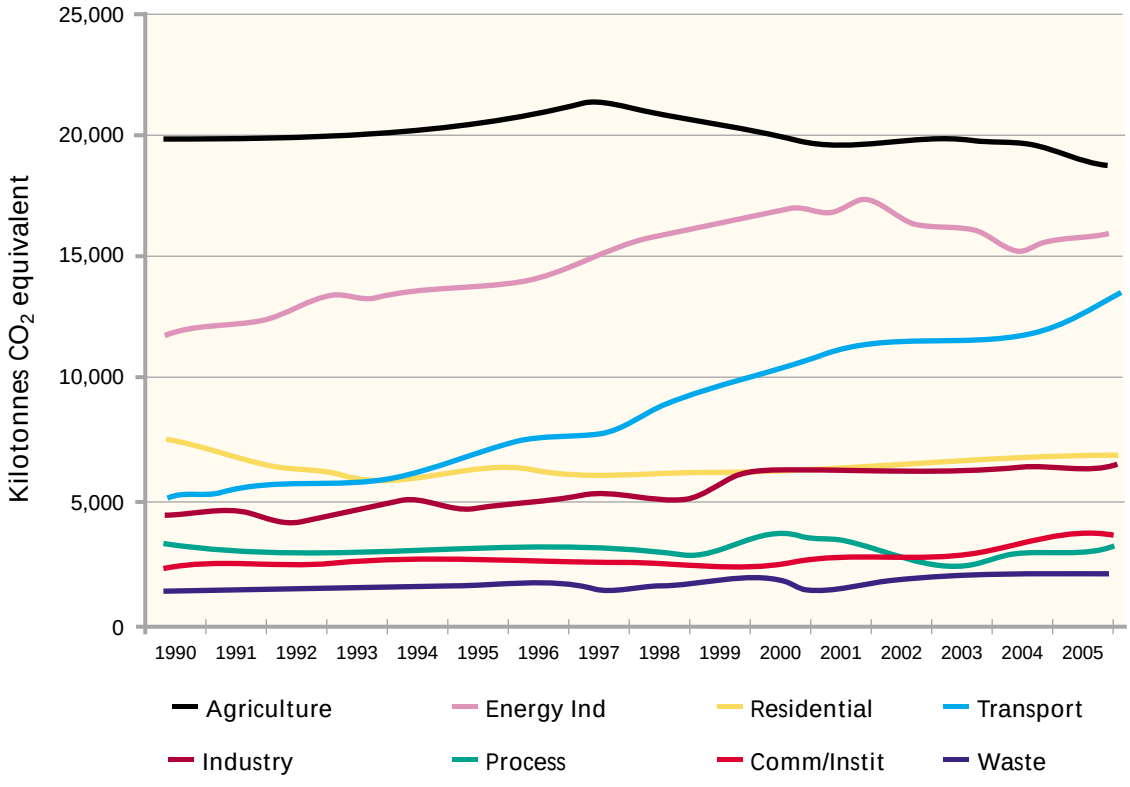
Chapter 5 Sectoral Responses to Climate Change

Introduction

The purpose of this chapter is to determine the potential scale of individual sectoral targets in the context of the EU's medium and long-term emission abatement objectives and to identify how they might be delivered. The chapter also addresses options available to the main economic sectors to meet the challenges presented by Ireland's GHG emissions reductions targets.

Ireland's strong economy performance and growth through the so-called "Celtic Tiger" years is well documented. The level of this performance over the period has placed pressure on the environment. One illustration of this is the rise in the level of CO_2 emissions, as is shown in Figure 5.1. However, it is evident that industry's contribution to aggregate carbon emissions is far less substantial than other sectors including agriculture, energy and transport. This is because the industry sector has changed from being manufacturing-based to one which is now dominated by low-carbon industries primarily in the services sector. The closure of a number of energy intensive processes (steel and ammonia production) has also reduced the sector's GHG emissions.

Figure 5.1 Sectoral CO_2 Emissions in Ireland 1990-2005



Source: http://www.epa.ie/

The political climate has changed fundamentally in the recent past with broad acceptance by global leaders that urgent action is necessary and an increased political will to initiate appropriate responses. These developments have begun to influence in a substantial manner the strategic decisions on climate change being taken by company boards and senior management.

To date, Ireland in common with other member states has committed to delivering a specific GHG emissions reductions target determined at EU level, and decisions on effort sharing across all sectors has been taken by governments. The EU's proposed climate change package fundamentally changes this approach. Under these proposals, the overall GHG emission reduction at EU level is split into a component comprising all installations – powergen utilities and energy-intensive industrial users – covered by the EU ETS and a component covering the rest of the economy in each of the 27 member states, i.e. the "28 member state" proposal. Under this regime installations in the ETS sectors are responsible for delivering the reductions attributed to the ETS scheme (-21% on 2005 emissions) and face severe penalties for non-compliance. Governments, on the other hand, are responsible for delivering the non-ETS reductions in their economy (-10% on average). As with the EU's Kyoto burden-sharing agreement, the new proposals specify that the effort in achieving this average 10% reduction be shared among the member states over the range -20% to +20% of 2005 emissions. As a consequence of its high level of GDP per capita, Ireland has been assigned a reduction objective of -20% for the non-ETS sector. It is also important to bear in mind that policy developments in third countries are progressing and a possibility exists that the higher -30% target will be adopted by the EU. It is also assumed that scientific evidence of climate impacts will drive a requirement to meet the upper range (-80%) of the EU's 2050 indicative reduction target.

The Commission's proposal to exclude sectors covered by the EU ETS Directive from the 2020 effort-sharing agreement and determine the emissions cap for these at EU level removes from consideration by government approximately 32% of national GHG emissions.

In this regard, the climate change policy initiatives contained in the recent Energy White Paper, the revised NCCS, the "Towards 2016" partnership agreement and the Programme for Government may not fully encompass the level of effort required of Ireland under the EU's energy and climate change strategy. Climate policy will rapidly become a dominant consideration in energy, economic, industrial, agriculture, transport, planning development and social policy developments.

It is possible that the price of carbon within the EU, as determined by the ETS, may not fall within government estimates even in the near term for a number of reasons including:

- The possibility to bank allowances from 2008-12 to succeeding periods;
- The auctioning of allowances may coincide with a linear reduction in allowances available to the traded sector;
- The move from a regional to global price for gas through development of significant LNG transport and storage facilities;
- The inclusion of aviation, which is exhibiting massive growth and has no significant abatement options, within the ETS from 2012; and
- The intent of the Commission to severely restrict use of the Kyoto flexible mechanisms.

In this context, and as set out in Chapter 4, recent price projections for carbon to 2012 cover a wide range. The eventual price outcome will be strongly influenced by the cost of fuel switching in the electricity sector from coal to gas. Beyond 2020, it is suggested that the marginal cost of abatement will be determined by the cost of carbon capture and storage (estimated at €50 – €90/tonne).

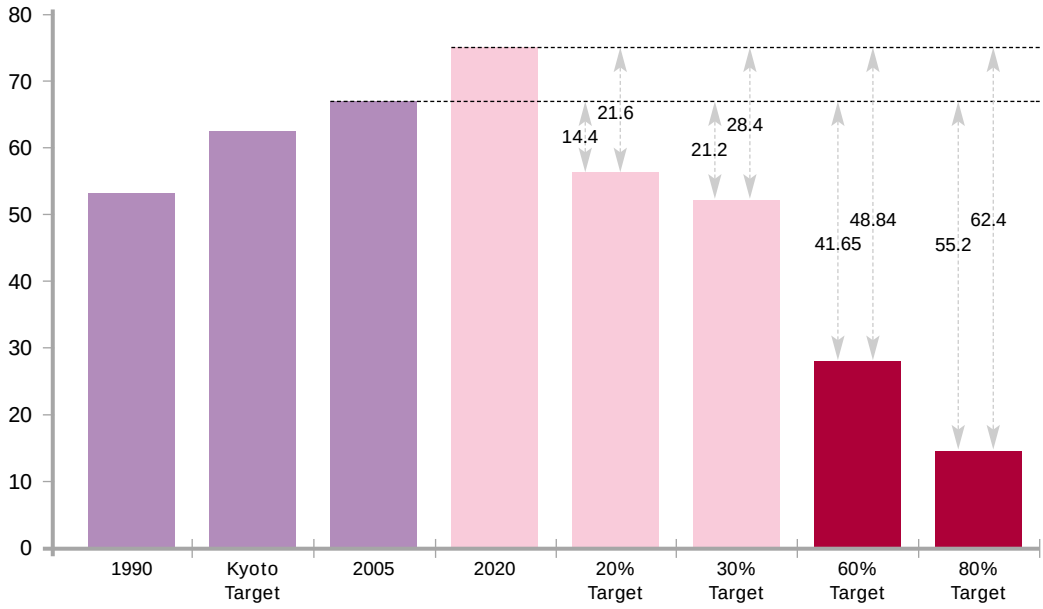
Therefore, recognising the extent of the fundamental changes facing the sectors and implications for costs, it is imperative that a number of principles be explicitly observed if Ireland is to maintain its relative economic competitiveness and level of social well being.

Internalising the cost of carbon will cause the price of products, in particular energy, to rise. The aim of Irish policy should be to contain the increase in such prices to at or below the EU average level. This means for the economic sectors:

- The priority objective is to reduce GHG emissions (in particular in the key policy areas of energy and transport) delivered by
  - Minimising/eliminating GHG emissions on the demand as well as the supply side
  - Utilising upstream and downstream measures
  - Monitoring and measuring the effectiveness of programmes in terms of avoided CO_2 emissions (e.g. energy efficiency, renewable energy, road charging etc.)
- Rigorous application of the principle of least cost to limit loss of competitiveness. This will require:
  - Access to detailed and rigorous statistical and economic information
  - Implementing measures in order of least cost
  - No dilution of abatement measures to serve multiple objectives
- Identifying and exploiting any economic benefit that may derive from early action, particularly in areas where Ireland possesses a natural advantage e.g. ocean energy systems.

To provide some insight into the scale of the challenge and the intensity of the policy responses required, indicative national targets for 2020 and 2050 are set out below.

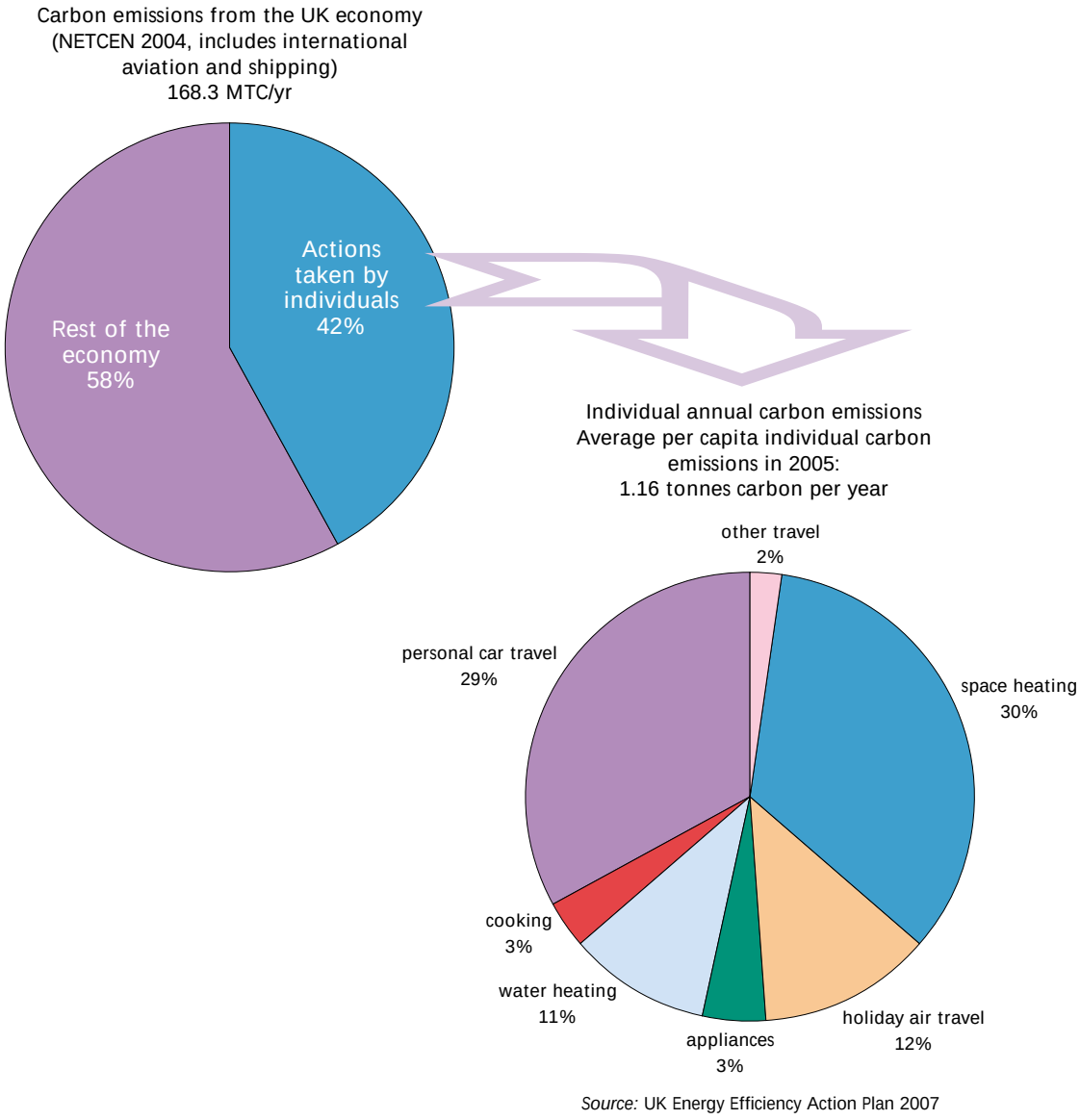
Figure 5.2 Indicative National Targets



Source: "Determining the Share of National GHG emissions", ICF Consulting / Byrne Ó Cléirigh, March 2006

Detailed information on energy use and emissions within the sectors is required both to identify the optimum suite of measures and the order of their implementation and to allow ongoing assessment of their impact. Fig. 5.3 presents the type of analysis such research could provide but which currently cannot be prepared due to the lack of the required data.

Figure 5.3 Carbon dioxide emissions from the UK economy (MtC)



Source: UK Energy Efficiency Action Plan 2007

This provides the context in which the individual sector response options are discussed below.

Contribution of the Sectors

Table 5.1 identifies the contribution of the various sectors to the economy.

Table 5.1 Contribution of the Sectors

	Employment (thousands)	Value of output (€ billion)
Agriculture, Food, Drink and Tobacco	163.4	12 (GVA)
Transport, Storage and Communication	122.4	
Construction	280	36
Energy	12,400	7.2

Source: CSO QNS

The EU ETS Sector: Energy

Introduction

The energy sector falls exclusively within the EU's ETS. Emissions from the EU ETS sector will be required to fall by 21% on 2005 levels by 2020. Individual installations are responsible for compliance with their reduction obligations and face severe penalties for non-compliance. As a consequence of the proposed splitting of GHG emissions reductions targets between the trading and non-trading sectors of the economy, "over-achievement" of emissions reductions in the energy and the traded sector, for example through renewable energy penetration levels in electricity that go beyond government targets, will not contribute to delivery of the government's reduction target. "Over-achievement" will simply facilitate increased emissions reductions elsewhere within the EU as the ETS cap will be fixed and installations EU-wide will seek to maximize use of this cap. In other words, if there were substantial improvements by the traded sector in reducing emissions beyond the limits set at EU level, this benefit would be ring-fenced and shared, not with Ireland's non-traded sector, but with other EU ETS installations.

With this in mind, it is useful to examine the sector in more detail. The energy sector comprises electricity generation, oil refining, gas production and distribution and peat production. Of these, electricity generation accounts for approximately 96% of total GHG and 93% of CO_2 emissions. Ireland's energy supply is described in terms of changes to the total primary energy requirement (TPER), the total amount of energy used within Ireland in a given year. Some 89% of the TPER is imported. In 2006, electricity accounted for one third of Ireland's TPER, with 82.5% of this amount generated from fossil fuel power stations (with natural gas accounting for 45.3% of the fuel mix).[131]

The drivers of energy demand are economic development and population. As a consequence of growth in both these factors the demand for energy has grown by 64.3% between 1990 and 2005. In 2006, overall energy use in Ireland increased by almost 1%, while carbon related energy emissions increased by 0.4%.[132] Notwithstanding this level of growth in demand, energy sector GHG emissions have increased by a more modest 37.7% over the same period due to changes in the fossil fuel mix to less carbon intensive fuels, improved generation efficiency, reduced networks losses and increased penetration of emission-free renewables. Furthermore, the bulk of this growth occurred in the period 1990 to 2001 with effective stabilisation thereafter to date.

Regulatory control of the sector is divided between the Commission for Energy Regulation (CER) and the Environmental Protection Agency (EPA). The CER is responsible for regulating the gas and electricity sector markets to protect consumers and support competition. The EPA regulates emissions from the sector and manages the EU ETS within Ireland. In addition, the independent statutory body Eirgrid manages operation of the electricity transmission system.

The government's Energy White Paper sets out the direction of Ireland's energy policy to 2020.[133] The following key targets were set:

- 20% savings in energy usage by 2020 in line with EU targets, with a further indicative target of 30%;
- 12% of Ireland's thermal energy requirements to come from renewable sources by 2020;

131 F. O'Leary, M. Howley, and B. Ó Gallachóir, *Energy in Transport – Trends and Influencing Factors* (Dublin: SEI, 2007).

132 SEI, *Energy in Ireland 1990-2006* (13 December 2007). Accessed Online: www.sei.ie

133 Department of Communications, Marine and Natural Resources, *Delivering a Sustainable Energy Future for Ireland, Energy Policy Framework 2007-2010*, White Paper (12 March 2007).

- 33% of Ireland's electricity consumption to come from renewable sources by 2020; and
- 10% of Ireland's transport energy requirements to come from renewable sources by 2020.

While the focus of this chapter is on climate change as it affects the energy sector, the debate needs to take account of the increasing importance of the phenomenon of "peak oil" and the policy dependencies between the two issues as they are of vital strategic interest to Ireland.

Current Emissions

Emissions associated with electricity generation in 2006 decreased by 1.8% notwithstanding growth of 6.3% in final electricity consumption. In 2006, each kWh of electricity emitted 601gr of carbon dioxide, a reduction of 5.6% on 2005.[134]

Energy sector historic emissions are presented in the following Table.

Table 5.2 Energy Sector Emissions

	1990 (Mt CO_2-equivalents)	1990 Share (%)	2005 (Mt CO_2-equivalents)	2005 Share (%)	Increase 1990-2005 (%)
Energy sector	11.85	21.4	16.32	23.3	37.7
Total	55.375	-	69.945	-	26.3

Source: NAP 2008-2012

Future Emissions

Prior to the government's decision to increase the contribution of renewable energy in electricity it was projected that power generation emissions in 2012 would be some 18.5 Mt, or 25% of gross national emissions making it the largest category of emitter. Base case electricity demand is modelled by the ERSI and predicts annual demand increases of 3.4% until 2009 and 2.3% thereafter. The government has decided that the fuel contracts for the three peat-fired stations must be fulfilled

Table 5.3 Proposed New Plant

Start Date	Location	MWe	Estimated CO_2 Emissions 2008-12
Q4/2009	Aghada	430 (base load)	4,200,000
Q1/2010	Whitegate	445 (base load)	4,000,000
Q4/2010	Louth	445 (base load)	3,700,000
Q1/2010	Tipperary	98 (mid-merit)	300,000
Q4/2009	Kilkenny	98 (mid-merit)	320,000
Total			12,520,000

[134] SEI, *Energy in Ireland 1990-2006* (13 December 2007). Accessed Online: www.sei.ie

Table 5.4 Proposed Plant Closures

Close Date	Plant	MWe	Estimated RE	Estimated Returns to NE Reserve
Q1/2008	Poolbeg 3	242	412,000	1,648,000
Q1/2009	Great Island 1, 2, 3	54, 54, 108	Possible Sale -516000	-1548000
Q1/2010	Poolbeg 1, 2	109.5, 109.5	535,000	1,070,000
Q1/2010	Marina Steam Turbine	26.8	-	-
Q1/2010	Tarbert 1, 2	54, 54	Possible Sale -112000	-224000
Q1/2011	Tarbert 3, 4	241, 241	Possible Sale -800000	-800000
Total				2,718,000

Source: National Allocation Plan (2008-2012), Table 5.1 and 5.2

effectively making these "must-run" generating units. Another key assumption set out in the NAP is that by 2020 some 33% (and 15% by 2010) of electricity consumption will be from renewables and that capacity on the electricity inter-connector between Northern Ireland and the Republic will increase to 600 MW by 2011.[135] The NAP suggests that there will be plant closures and new plants will come on stream.

Demand for electricity in Ireland has been growing at an average of over 5% per annum over the past decade.[136] There is a strong correlation therefore between economic growth and electricity demand. ICF Consulting accepted the ESB's demand forecast for the period to 2020 which was estimated to be just 2% per annum. This implies that total electricity requirement will rise to 40.1 TWh by 2020 (from 25.7 TWh in 2004).

Current and Planned Sectoral Policies and Measures

Regulatory and incentive-based measures such as pricing carbon will have a large impact on Ireland's GHG emissions, but there is also a role for accompanying measures to influence individual behaviour. Savings from such behavioural measures are thought to be possible because opportunities for reduced consumption remain hidden or are unexploited. Reduced demand in Ireland will be essential if Ireland is to contribute to the overall EU target, given that overall energy consumption is projected to rise at an average rate of almost 3% per annum until 2020.[137]

The principal issue for the energy sector, and in particular the electricity generation component, in the context of the EU's 2050 indicative target is that it must operate by then with net zero GHG emissions. Research and technological developments, for example in photovoltaics, photohydrolysis and energy storage, may allow delivery of low cost energy in the future. As of now, however, the principal means by which a net zero emissions outcome can be achieved in Ireland is through:

135 These targets are based on Ireland's commitment under the RES-E Directive (2001/77/EC).

136 ICF Consulting and Byrne Ó Cléirigh, *Determining the Share of National Greenhouse Gas Emissions for Emissions Trading in Ireland 2008-2012: Report for Public Consultation*, p.14.

137 SEI, *A Study on Renewable Energy in the New Irish Electricity Market* (Dublin: SEI, June 2004), p.24.

- Minimising demand for energy through rigorous efficiency and conservation programmes;
- Maximising the use of renewable technologies, taking account of the economic constraints that apply;
- Application of carbon capture and storage (CCS) to large thermal plants where geophysically secure storage facilities are available;
- Implementing domestic carbon sequestration in soils; and
- Securing integrated "all-islands" regional European electricity and gas markets through strengthened interconnection with the UK and continental Europe.

As noted above, the appropriate mix of these measures and the timing of their introduction should be determined by the interaction of the marginal carbon abatement cost curves for each. To accelerate progress and with a view to minimising the long-term cost of a net zero emissions energy sector, government could:

- Establish a robust statutory framework for economic, energy and related emissions data gathering;
- Impose minimum efficiency requirements for products using energy (solid fuels, oil, gas and electricity);
- Impose energy efficiency requirements on energy supply companies. These could be measured in terms of avoided carbon emissions (rather than kWh saved) as this maximizes the range of energy saving options available and extends them to include general energy conservation;
- Facilitate public and private sector investment in carbon sequestration programmes;
- Focus research and development funding on:
  - Ocean energy technologies, where Ireland has the potential to create a significant competitive advantage;
  - Smart metering;
  - Sustainable biomass and biofuels; and
  - Energy storage systems, to support the penetration of intermittent energy sources;
- Ensure rigorous cap-setting within the EU's emissions trading scheme to support economic uptake of emissions abatement techniques (energy efficiency, renewable technologies, energy storage and carbon capture and storage); and
- Identify appropriate sites to store captured carbon from large point sources.

The Table below indicates the indicative reduction requirement for the energy sector and the possible options to deliver this in terms of the EU's more immediate 2020 target.

Table 5.5 Indicative 2020 Abatement Measures for the Energy Sector

Abatement measures	Indicative required reduction (-20% overall target) (Mt CO_2e)	Indicative required reduction (-30% overall target) (Mt CO_2e)
2020 Projected emissions	20.52	20.52
RES (33%)	3.40	3.40
CHP/Distributed gen.	0.20	0.25
Gas + electricity networks loss reductions	0.15	0.15
End-use efficiency	0.40	0.60
Sequestration (domestic JI)	0.10	0.15
CCS	0.00	0.00
ETS	8.00	9.50
Total of measures	12.25	14.05
Emissions with measures	8.27	6.47
Reduction from sector BAU	-59.7%	-68.5%

Source: Institute of International and European Affairs Climate Change Working Group, 2007

In examining the detail of Table 5.5, the revised NCCS indicates a saving of approximately 3.4 Mt resulting from the new 2020 and revised 2010 renewables targets. It is unlikely that this level of penetration would differ substantially between the 20% or 30% EU reduction targets given its already stretching nature and in the absence of large-scale storage capacities. Significantly improved interconnection with the UK and Northern Ireland and further development of the national networks will be required to deliver this target.[138]

The NCCS indicates a saving of 0.162 Mt by 2010 arising from additional Combined Heat and Power (CHP) penetration. It could be expected that a further increase would be delivered from CHP by 2020. However, this is likely to be modest given the limited potential for large scale CHP nationally and a probable low level of uptake of domestic CHP/micro-generation due to continuing high capital costs. The economics of CHP are only favourable when there is a large heat demand nearby.[139] The increased carbon price driven by a tighter ETS cap would suggest an additional savings increment could be delivered under the 30% reduction scenario.

A modest saving may also be anticipated from further modernization of the gas and electricity networks infrastructures.

There is significant potential for gas and electricity supply companies to reduce their customers' emissions of CO_2 through improving the efficiency with which they use energy products. The design of a mechanism to promote such efficiency will be critical in maximising the savings under this mechanism given the evident barriers that exist. The most common mechanism adopted elsewhere is to place an obligation on supply companies to deliver a specific target, and has proven effective.

[138] This option is addressed in the *All Island Grid Study* published by the Department of Communications, Energy and Natural Resources (January 2008).

[139] ENI, *Ireland's Energy Future*, Final Report (September 2007). This report was prepared by ten UCD engineering students.

More recently it has been identified that expressing this target in terms of carbon savings, rather than energy efficiency improvements, optimises the reductions delivered. The potential savings attributed to this mechanism are conservative.

It is likely that the EU will maintain a restriction on the use of the UN flexibility mechanisms by participants in the ETS. This, together with the limited supply of allowances as a result of a tighter ETS emissions cap, has the potential to direct generators towards domestic offset projects including sequestration (forestry). If allowed, this has the potential to contribute towards reductions in the sector with the amount related to the price of carbon.

It is not anticipated that carbon capture and storage will be technically or commercially available for retrofit to existing generating plant before 2020. On the other hand, there is the opportunity to exploit carbon sequestration in soils through third generation processing of biomass. Consequently, the principal reductions in the energy sector will be delivered through significant intensification of the EU's ETS, which effectively will act as the backstop on the sector's emissions.

Should the Commission's proposal to exclude the traded sector from Ireland's GHG emissions reductions target fail, responsibility for delivering the required reductions from Ireland's energy sector would fall to the Commission. It is likely that significant distortions could arise from differing abatement costs between the domestic and EU ETS sectors.

Renewables

The aim of the Commission's proposal for a Directive on the promotion of the use of energy from renewable sources is to set national renewable energy targets that result in an overall binding target of a 20% share of renewable energy sources in energy consumption in 2020.[140] The proposal is based on a methodology according to which half of the additional effort is shared equally between member states, with the other 50% modulated according to GDP per capita. The proposal will affect the electricity, heating and cooling, and transport sectors, with member states being left the choice as to the mix of contributions these sectors will make to achieve the overall 20% target. Member states have also been given the choice to achieve their targets by supporting the development of renewable energy in other member states and third countries where the development of renewable energy may be cheaper to produce. Ireland's proposed target is 16% of total energy consumed to come from renewables by 2020. This target is broadly in line with the Irish government's own targets for renewables in power generation, heating and cooling, and transport as set out in the 2007 Energy White Paper.

The cost of the EU's renewable package has been estimated by the Commission at €13-18 billion a year when fully implemented. A key assumption is that this level of investment will drive down the price of renewable energy technologies and increase investor confidence.

[140] Proposal for a Directive of the European Parliament and of the Council on the promotion of the use of energy from renewable sources, COM 19 final (23 January 2008).

Additional Energy Policies and Measures

Energy efficiency and demand side management

Energy efficiency is about achieving the same result with less energy. Energy efficiency provides much scope for reducing emissions due to the fact that a 20% reduction in energy use in the EU could be achieved through adoption of technologies currently available.[141] The European Commission's proposed Action Plan identifies a range of measures that can be taken to increase energy efficiency in appliances, buildings, electricity generation and the transport sector. Ireland should exploit these measures aggressively as among the lowest-cost opportunities for reducing emissions.

The first National Energy Efficiency Action Plan seeks to reduce carbon emissions by 9.5 Mt in 2020, with a national cut of 20% in energy demand (with a 33% reduction target for the public sector).[142] The government's (draft) Action Plan is a response to the Energy End-Use Efficiency and Energy Services Directive (2006/32/EC). The proposed targets are as follows:

Table 5.6 Proposed Targets

	Kt CO_2 savings 2020
Business/public sector	2.5
Residential	4.9
Transport	1.4
Electricity supply	0.6

If implemented in full, this Action Plan would have a significant impact on Ireland meeting its post-2012 GHG emissions reductions target. There are grounds for optimism as new indicators (known as ODEX Indicators) suggest that there has been an 8.1% improvement in energy efficiency in Ireland over the period 1992-2005.[143]

In its first assessment of national energy efficiency action plans, the Commission welcomed the government's ambition to achieve higher energy savings targets than those set in the Energy Savings Directive, and specifically cited the proposed 33% cut by 2020 for the public sector.[144]

The proposed EU goal of saving 20% of energy consumption by 2020 through energy efficiency is a crucial part of the overall climate change package. The Commission estimates EU emissions could fall by as much as 800 Mt annually at a saving to consumers of €100 billion.

To address concerns about competitiveness, the Finance Bill 2008 (Section 42) covers a new scheme aimed at supporting business investment in energy-saving equipment. Companies will be allowed to write off the entire cost of designated energy efficiency equipment by way of accelerated capital allowances.[145] The categories include expenditure over €5,000 on building Energy Management Systems, over €3,000 on lighting, and over €1,000 on motors and drives.

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141 European Commission, *Action Plan on Energy Efficiency – Realising the Potential*, COM92006 545 final (October 2006).

142 Department of Communications, Marine and Natural Resources, *First National Energy Efficiency Action Plan for Ireland: 2007-2020* (Dublin: Department of Communications, Marine and Natural Resources, October 2007).

143 SEI, *Energy Efficiency in Ireland* (Dublin: SEI, November 2007).

144 Communication from the Commission to the Council and the European Parliament on a first assessment of national energy efficiency action plans as required by Directive 2006/32/EC on energy end-use efficiency and energy services. COM (2008) final (23 January 2008).

145 This is a pilot scheme that will have to be approved under the new (January 2008) EU State aid rules on environmental protection before the proposed scheme is implemented.

Carbon Capture and Storage

Carbon Capture and Storage (CCS) is an emerging technology that offers the ability to capture carbon realized in power generation. On 10 January 2007, the Commission adopted a Communication on sustainable power generation from fossil fuels, aiming for near-zero emissions from coal after 2020. This was followed in January 2008 with the publication of a proposal for a Directive on the geological storage of carbon dioxide.[146]

A study undertaken by SEI concluded that, if the price of carbon rises, then the use of CCS technology may become viable.[147] SEI has published the results of a feasibility study for the implementation of a wind generation and energy storage facility at Sorne Hill Wind Farm, Buncrana, County Donegal. The analysis showed how such a system could support an uninterrupted supply of wind generated electricity to the national grid and significantly improve the efficiency of the energy produced.

Technical Instruments and Measures

The use of direct government intervention through technical measures – such as regulations mandating appliance efficiency levels or the use of specific technologies – is often a cruder instrument compared to incentive-based measures. The government could be guided by questions of economic efficiency or effectiveness when it chooses a particular technology as a response to climate change. Technological developments would benefit from a guaranteed price of emissions, as technology has been bedevilled by the uncertain carbon price up until now. Nevertheless, there are many cases that call for direct government intervention or a mixture of instruments rather than leaving things to the market, especially in cases of clear market failure.[148]

Microgeneration [149]

Microgeneration is usually used to refer to a power generating unit below 50-100kw. Among the technologies which can be used for power generation are solar photovoltaics, wind turbines, small hydro, active solar water heating, ground source heat pumps, bio-energy, small combined heat and power and hydrogen energy and fuel cells.

Microgeneration could achieve significant CO_2 and efficiency benefits, particularly when considered within a mid- to long-term time horizon. For significant benefits to accrue, microgeneration units would need to be installed in their thousands in Irish homes. This would doubtless require a new approach to energy planning and policy to be achieved.

Current obstacles to widespread deployment include the high cost and the planning system. Costs are, however, likely to fall as market penetration increases and microgeneration could well account for 25-40% of power generated by 2050, reducing overall emissions by approximately 15%.[150]

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146 Proposal for a Directive of the European Parliament and of the Council as to the geological storage of carbon dioxide and amending Council Directives 85/337/EEC, 96/61/EC, Directives 2000/60/EC, 2001/80/EC, 2004/35/EC, 2006/12/EC and regulation (EC) No 1013/2006.

147 Monaghan et al. (ESEI: 2006).

148 S. Scott, *Ireland's Pathway to Kyoto Compliance – A Review of the National Climate Change Strategy* (Dublin: Economic and Social Research Institute, 2006).

1489 See: UK Energy Saving Trust, *Potential for Microgeneration: Study and Analysis* (EST, November 2005).

150 Ibid.

The Domestic Sector: Transport, Building and Construction and Agriculture

Following the Commission's January 2008 proposals on "effort sharing" of emissions reductions targets and the proposed design of the post-2012 EU ETS, Irish government policy will be focused on reducing emissions from the three most significant domestic sectors: transport, residential and construction, and agriculture. As the proposals stand, use of carbon sinks are not permitted and there are severe restrictions on the use of flexible mechanisms. Agriculture and transport together are responsible for 70% of domestic sector emissions.

As the table below demonstrates, a substantial "distance to target" currently exists between what the present policy will deliver in emissions reductions and what will be required of Ireland in the period to 2020.

Table 5.7 Distance to Target

	1990 (Mt CO_2e)	2005 (Mt CO_2e)	2020 (Mt CO_2e)
National Emissions	55.4	70.4	74.1
Non-ETS Target	37.6	48.4	47.4
2020 Target -20%	-		37.7
2020 Target -30%	-		33.2
Allowed Purchases -20%			1.4
Allowed Purchases -30%			3.7
Shortfall -20%			9.3
Shortfall -30%			10.5

Source: Owen Wilson, IIEA Working Group, 2008

The following sections open the debate on where these additional reductions might be found by addressing the three sectors in turn.

Transport

Introduction

The main drivers for growth in the transport sector include increasing population, employment, disposable income, and demand for housing. Thus, dispersed spatial settlement patterns and desire for personal mobility has led to urban sprawl, reliance on private cars and increased long-distance commuting, which results in higher passenger throughput, larger air passenger numbers, and greater freight transportation, particularly by road.

It is anticipated that this will continue to diminish quality of life and social cohesion, irreparably and irreversibly impair the environment, and harm economic competitiveness due to congestion and opportunity cost of travel time. Although it is recognised that transport plays a pivotal role in supporting economic growth, regional development, and social inclusion, nonetheless, it should be the long-term policy goal to strive towards relative and absolute decoupling of economic growth from growth in energy consumption and GHG emissions.

The government published a consultation document on sustainable travel and transport acknowledging that, on a BAU basis, GHG emissions from transport could increase to 19Mt CO_2e by 2020, a 265% increase over 1990 emission levels.[151]

Ireland's Vehicle Fleet

In 1979, the time of the second oil shock, there were some 683,000 vehicles registered in Ireland. There are now some 1.7 million cars registered, with a 50% increase in car ownership since 1990, and a total fleet of some 2.3 million vehicles. Despite this growth, Ireland's car ownership levels – at 507 per 1,000 adults – is below the EU average (of 555/1,000). The number of goods vehicles has also soared, from 61,500 in 1979 to 290,000 today: a five-fold increase. As road transport accounts for 98.3% of freight movements this puts Ireland at the top of the European league for oil dependency in respect of inland freight transportation. Running Ireland's vehicles cost €5.2 billion in 2005, or €100m a week. With soaring oil prices costs, fuel prices have risen by some 15% since then. Yet fuel is much cheaper in Ireland than in some other member states. For example, petrol in the Netherlands is 34% dearer, in the UK it is 27% more expensive and in Germany some 22%. Another interesting feature is the purchase of Sports Utility Vehicles and Multipurpose Vehicles now on the roads, with sales growing more than six times faster than overall car sales between 2002 and 2005. In addition, despite traffic congestion, the average size of car engines has been rising by 0.8% a year and is now at 1,525cc, up from 1,360cc in 1990.

Energy Requirements and GHG Emissions

The Total Final Consumption (TFC) by the transport sector increased by 151% over the period 1990-2005, with an annual average growth rate of 6.3%. Road freight experienced the largest growth in transport energy use since 1990 increasing by 255%.[152] This compares with GDP growth of 150% over the same period, which indicates that there is a close positive correlation between transport

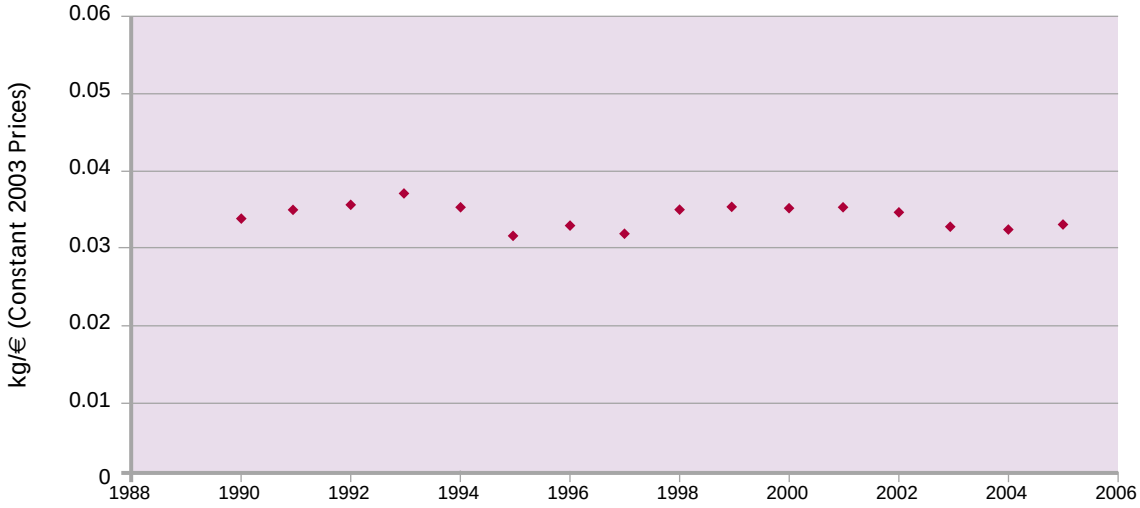
[151] *2020 Vision – Sustainable Travel and Transport*, Public Consultation Document (Dublin: Department of Transport, February 2008).

[152] SEI, *Energy in Transport 2007* (Dublin: SEI, 13 December 2007).

energy use and economic growth. Figure 5.4 shows transport energy intensity i.e. energy consumption as a function of economic growth, in the period 1990-2005.

GHG emissions from the transport sector increased by 160% from 5.182Mt CO_2-equivalents in 1990 to 13.461Mt CO_2-equivalents in 2005, while its sectoral share increased from 9.3% in 1990 to 19.4% in 2005, which illustrates the increasing contribution of transport emissions to total emissions in the economy. This compares with total economy-wide emissions, which increased by 25% from 55.495Mt CO_2-equivalents in 1990 to 69.288Mt CO_2-equivalents in 2005, and the 26% EU-average increase in transport emissions over the same period. There was a 7.2% growth in energy consumption during 2006 and a similar (7.1%) growth in energy related emissions. Transport now accounts for 35% of energy related emissions.[153]

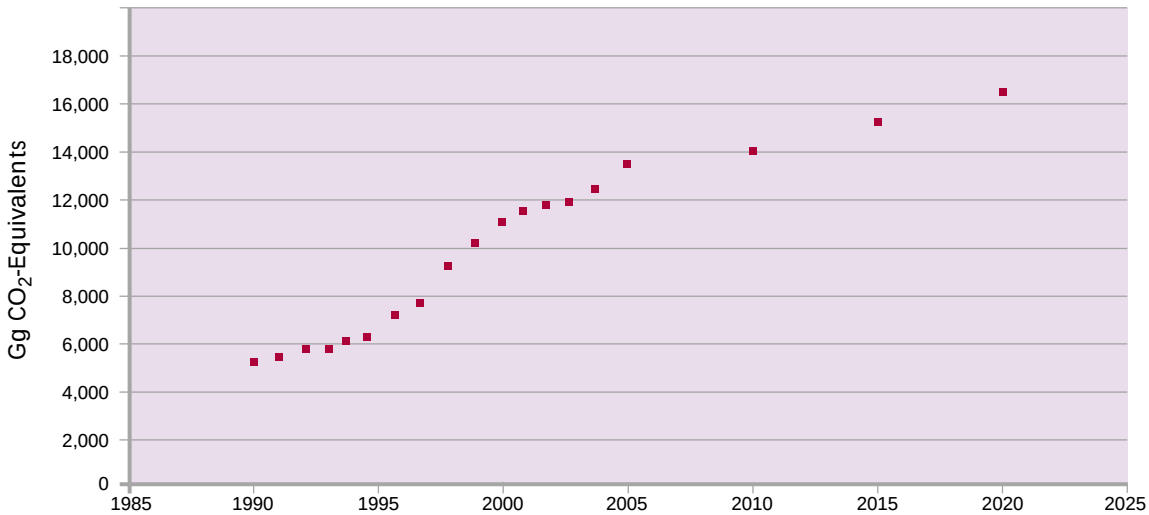
Figure 5.4 Total Transport Energy Intensity 1990-2005



Source: SEI, 2007

Figure 5.5 shows transport GHG emissions from 1990-2020.

Figure 5.5 GHG Emissions from the Transport Sector 1990-2020



Source: SEI, 2007

[153] SEI, *Energy in Transport 2007* (Dublin: SEI, 13 December 2007).

Of total transport-related CO_2 emissions in 2005 in Ireland, road transportation accounted for 96.2%, rail (1.2%), civil aviation (0.8%), navigation (0.4%), and other transportation (1.3%). Transport emissions per capita increased by 108% from 1.45 tonnes per capita in 1990 to 3.02 tonnes per capita in 2005, while Ireland also achieved decoupling of CO_2 emissions intensity of 10% between 1990 and 2003.[154] It has been estimated that aviation energy use in Ireland has doubled between 1995 and 2005.[155]

Transport Emissions Forecast

Irish transport emissions are predicted to be 13.992Mt CO_2-equivalents[156] in the median point of the Kyoto Protocol commitment period 2008-2012, which is 170% above the 1990 baseline figure.[157] Transport emissions in 2020 are predicted to be 16.48Mt CO_2-equivalents in the revised estimates or 218% above the baseline estimate. This is inclusive of existing measures contained in the NCCS such as technology improvements, excise relief for biofuels, Dublin traffic measures, and rebalancing of motor taxes and fuel economy labelling, which are estimated to reduce emissions by 1.07Mt CO_2 equivalents. Additional measures proposed in the NCCS include modal shift through Transport 21, alignment of transport investment with spatial planning, achievement of the 5.75% target in the Biofuels Directive, and efficient-driving awareness campaigns. These measures are estimated to reduce emissions by 1.223Mt CO_2-equivalents by 2010. Thus, inclusive of these additional measures, emissions are predicted to be 12.769Mt CO_2-equivalents in 2010, which is 146% above the 1990 baseline estimate, and 15.257Mt CO_2-equivalents by 2020, or 194% above the baseline estimate. However, in approving the second NAP, the Commission has determined that transport emissions will rise to 18.4Mt by 2020 and has discounted national projections. The Department of Transport estimate the figure could be as high as 19Mt.

Policy Options

The following sections outline potential policy options, in addition to those proposed in the NCCS, which may reduce demand in the transport sector and, consequently GHG emissions. These include regulatory measures, market-based instruments, dissemination of information to affect behavioural change, and land use and spatial planning. Estimates of potential impacts, in terms of emissions or vehicle-kilometre reductions, are provided, where possible. However, it is recognized that the long-term requirement to achieve a zero carbon transport system by 2050 will require, in effect, all new vehicles to be powered by non-carbon based drive systems (advanced batteries and/or hydrogen fuel) from about 2040. This is not a theoretical issue. The State of Israel, for example, has decided that all its vehicles will be electric powered.[158] Technological enhancements such as measures to reduce the rolling resistance of vehicle tyres and the introduction of vehicle tyre pressure monitoring systems will reduce emissions from the transport sector at some stage in the future. As Ireland is a technology taker the only option in this regard is for government to support an EU approach in this direction.

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154 European Conference of Ministers of Transport, *Cutting Transport CO_2 Emissions: What Progress?* (2007), Accessed Online: www.cemt.org

155 F. O'Leary, M. Howley, and B. Ó Gallachóir, *Energy in Transport – Trends and Influencing Factors* (Dublin: SEI, 2007).

156 *Ireland National Climate Change Strategy 2007-2012 – Annex 1* (Dublin: Department of Environment, Heritage and Local Government, 2007). This figure exceeds the initial estimate of 13.029Mt CO2-equivalents for 2008-2012 from the 2006 ICF/Byrne Ó Cléirigh Report. This is because the 2012 estimate of 13.421Mt CO2-equivalents for 2012 is already exceeded.

157 Ibid.

158 Press release from Renault Nissan on the conclusion of a Memorandum of Understanding with Israel (21 January 2008).

Rebalancing of Vehicle Registration Tax (VRT) and Motor Tax [159]

The European Commission presented a proposal for a Directive in July 2005, which recommended that member states restructure both registration tax, which is levied as a percentage of the open market selling price (OMSP) based on engine size, and annual circulation tax so that they are based on CO_2 emissions per passenger-kilometre.[160] The proposal also recommended the eventual abolition of VRT by 2016 with a long lead-in time envisaged to allow member states time to fulfil structural changes to their car tax systems and cover transition costs. A Commission study estimates that such a restructuring of the taxation system would reduce emissions of new passenger cars on average in the EU by 5%.[161]

In the 2007 Irish Budget, a proposed revision of the current VRT and motor tax systems was announced, which would levy VRT and motor taxes on the basis of average CO_2 emissions per passenger-kilometre. The proposal was placed for public consultation in March 2007, in order to attain stakeholder feedback on the environmental benefits as well as to determine the impact on the Exchequer. The new arrangements, which take effect from 1 July 2008, were announced in the 2007 Carbon Budget Statement. These changes will be accompanied by a new mandatory labelling system for cars based on emission levels, which will be similar to the energy rating label in place for white goods. It is anticipated that this proposal will be implemented in some form for all new and pre-owned imported passenger cars purchased in Ireland from 2008. It is estimated that this measure would achieve savings of 0.05Mt CO_2-equivalent,[162] although estimates range from 0.1Mt CO_2-equivalent[163] to 0.26Mt CO_2-equivalent,[164] depending on how the taxation bands are adjusted.

The shifting of Irish VRT and motor taxes to a CO_2 emissions-based system is a welcome change from the current system, which bases vehicle taxes on engine size and vehicle price with no regard to the environmental impact of vehicles and will raise awareness among consumers of the GHG emissions of their vehicles. However, the new tax system could go further and include other vehicle emissions, aside from CO_2. This would provide greater incentives for consumers to purchase low-emitting nitrogen oxides (NOx), particulate matter (PM), carbon monoxide (CO), and hydrocarbons (HC) vehicles, i.e. vehicles already meeting higher Euro standards than currently required by law, as well as low GHG. A significant disadvantage of both the current and proposed VRT and annual circulation tax, however, is that they are levied on car ownership, rather than on car use, and therefore, once they are paid there is no disincentive to drive. Future vehicle tax systems could therefore be based not only on the environmental performance of the vehicle but also on the number of kilometres driven by the vehicle. A timeframe could be agreed for the introduction of distance-based vehicle charges rather than fixed vehicle taxes.

Furthermore, the price signal needs to be transparent and a sufficient incentive provided to encourage consumers to differentiate between different makes and modes of vehicle. Thus, VRT and motor tax could be appropriately punitive for vehicles with emissions greater than the average and munificent for highly efficient vehicles. It is imperative that the taxation system reflects a certain intrinsic inelasticity in vehicle purchase for particular income bands, and reward "good behaviour".

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159 This section was drafted prior to budget 2007.

160 Proposal for a European Council Directive on Passenger Car-Related Taxes, COM 261 (2005).

161 COWI A/S, *Fiscal Measures to Reduce CO_2 Emissions from New Passenger Cars* (Brussels: European Commission's Directorate-General for Environment, January 2002).

162 *Ireland's National Climate Change Strategy 2007-2012*, Table 4.1. (Dublin: Department of Environment, Heritage and Local Government, 2007).

163 From a Personal Communication with Comhar SDC, 2007.

164 *Ireland's Pathway to Kyoto Compliance – Review of the National Climate Change Strategy* (Dublin: Department of the Environment, Heritage and Local Government, 2006).

One potential proposal could be to abolish VRT and motor tax for series production hybrid-electric, flexible fuel, and electric vehicles, which are currently liable for 50% VRT relief, in order to increase their market sales.

Information and Awareness Measures

Good consumer information is necessary to facilitate or strengthen the impact of market-based and regulatory instruments, by allowing consumers to comprehend the climate change implications of their transport choices and act accordingly. Since 2001, member states are required to ensure that new cars are labelled with their CO_2 emissions and fuel economy to assist consumers to purchase more fuel-efficient vehicles.[165]

While vehicle labelling is in place in new car sales rooms in Ireland, unfortunately the label design used is not very transparent for consumers compared with other designs available and, therefore, this measure has not been very effective.[166] There is scope to improve the label design and link it to vehicle taxes in order to raise awareness among consumers regarding the CO_2 emissions of vehicles they purchase. For example, vehicles could be marketed using a clearer labelling system, analogous to energy rating labels on white goods as is already underway in several EU countries such as the UK, Belgium, and the Netherlands. In this context, the Irish annual guide to fuel economy could be updated as a priority.

In addition to the provision of information, government could put in place climate change awareness raising measures so that consumers understand the implications of their driving behaviour on GHG emissions. Furthermore, eco-driving training for private and commercial drivers teaches them to perform in a way that reduces GHG emissions. Manufacturers are beginning to install on-board fuel consumption indicators in vehicles, which can be used to assist efficient driving and incentives could be provided for purchasing vehicles with fuel economy diagnostics.

A national eco-driving awareness campaign could be launched as part of the proposed National Climate Change Awareness Campaign in 2008, which will be responsible for promoting sustainable travel. Eco-driving should also be incorporated into the learner driver education curriculum and training provided for fleet/haulage and public transport operators. It is estimated that this may reduce GHG emissions by 12-15% along a test cycle.

Investment in Transport Infrastructure and Spatial Planning

The current framework for land use and spatial planning in Ireland aims to place the concepts of sustainable development and balanced regional development at the heart of the planning system. This is guided by the National Spatial Strategy (NSS),[167] regional planning guidelines (RPG), promotion of special development zones (SDZ), and consolidated legislation through the 2000 Planning and Development Act, and subsequent amendments. Capital investment provided for under the NDP and Transport 21 is intended to complement the NSS and RPG by providing certainty around key public transport initiatives in the Greater Dublin Area (GDA), the Gateways and the regions. This should facilitate better integration of land-use planning and spatial development and encourage the concentration of development in close proximity to transport infrastructure.

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165 This section was drafted prior to budget 2007.

166 L. Ryan, *Strategies to Reduce Greenhouse Gas Emissions from Irish Transportation* (Dublin: SEI, 2004).

167 *National Spatial Strategy 2002-2020: People, Places and Potential* (Dublin: Department of the Environment, Heritage and Local Government, 2002).

The relationship between land use planning and transport investment could be supported through:

1. Sustainability impact assessment of all major transport infrastructural policies, plans and programmes, including social, environmental, health, and economic impacts resulting from investment in transport infrastructure, based on multi-criteria decision analysis.
2. Consolidation of urban form and the development of "compact cities" through mixed-use, high-density development in close proximity to public transport operations.
3. Promotion of walking and cycling policies in local authority development plans.
4. Restriction on ribbon development, which encourages "induced traffic".
5. Reduce long-distance commuting by developing critical mass, particularly in city-region hinterlands, and improving attractiveness of gateways and hubs, identified in the NSS, to both domestic and international investors.
6. Modelling of the environmental impacts of alternative transport investment decisions under a number of scenarios, taking account of projected population changes and current and potential land use zoning, rather than just alternative transport routes, including a consideration of the impacts of integrated transport systems.

Spatial planning and its consistent, effective implementation is a crucial policy area to address because of the long-term impact that settlement patterns will have on the trajectory of Ireland's GHG emissions. To date, there has been insufficient coordination either at the policy formation or implementation level between land-use and transport development, despite many strategic studies that focus on one or the other.[168] Many rural areas are increasingly distant from their nominal urban centres, which in turn have locked a growing proportion of the population into energy-intensive commuting patterns.

The current Gateway and Hub strategy, which underpins the NSS, has been challenged in favour of a model that would focus capital investment on the Dublin City region and the Dublin-Belfast corridor. [169]

The European Environment Agency notes a strong correlation between population density and energy consumption and found that cities with high experiences of urban sprawl also had high emissions of CO_2 compared to more densely populated cities.[170] Car-borne transportation was identified as a major factor.

Mobility Management

This includes "soft" support measures to reduce car use and influence behavioural change, including car sharing, flexible working, travel blending, personalized travel planning (PTP), workplace travel plans (WTP), and school travel plans (specifically by encouraging all secondary schools in urban areas to use a bus service), which may be applied as a strategic demand management tool or as a site-specific or area-specific measure.

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168 The Irish Planning Institute noted four decades of successive studies that focused alternatively, but not simultaneously, on land-use and transport studies: The 1967 Myles Wright study on land use, the 1971 Dublin Transportation Study, the 1985-88 ERDO Strategy on land use, the 1994 Dublin Transport Initiative, the 1998 Strategy Planning Guidelines for land use, and the 2000 Platform for Change strategy on transport.

169 Report by the Futures Academy at the Dublin Institute of Technology, *Twice the Size – Imagining the Future of Irish Gateways* (January 2008). Accessed Online: www.dit.ie

170 European Environment Agency, *Urban Sprawl in Europe: The Ignored Challenge* (Copenhagen: European Environment Agency, October 2006).

Potential components of mobility management plans may include working with employees/parents of school-children etc., to address perceptions, fears and practical difficulties in overcoming car dependency, establishing databases to assist in ridesharing and developing carpooling schemes, providing shuttle services to nearby rail or bus services and "park and ride", putting in place onsite measures to make cycling and walking safer and more attractive, introducing staggered or flexible working hours so that commuters can avoid peak hours, increasing the use of telecommunications to facilitate home workers, and working with school principals to encourage the greater use of school bus transport.

It is estimated that WTP typically reduce car use by 15-20%, with perhaps higher reductions of 20-25% from plans incorporating measures such as parking management and bus subsidy. The median annual running cost is £47 in the UK per fulltime equivalent employee, which is considerably less than £300-500, which is the annual cost of maintaining a parking space. Cost of travel demand management (TDM) programmes in the US is $8-105 per employee, with an average of $30 per employee. On average, PTP can lead to reductions of 7-15% in car use amongst targeted populations in urban areas, and lower reductions of 2-6% in rural trials. It is estimated that the cost of PTP is £44 per household or £15 per person.[171]

Incentives to promote mobility management could include discounts on public transport, spending on public transport infrastructure, information about public transport, cycle and walking initiatives, centrally coordinated car-sharing schemes, or grants to develop travel plans. All new residential and commercial developments could carry a condition that a WTP be implemented and monitored as an attachment to planning permission. This could be supported by a voluntary or mandatory reduction in the amount of permissible parking spaces at commercial and public institution workspaces.

A pre-condition for the successful roll-out of mobility management plans is that they are proactively supported by employers.

Road Pricing and Congestion Charges

Such an instrument aims to reduce the number of private motor vehicles using roads by charging motorists on a marginal cost basis in an attempt to ease congestion and thereby reducing GHG emissions. Road pricing is a term that refers to the charging for the use of streets and roads. Charging motorists directly for their use usually does this. It can include tolls imposed by the owners of specific roads as well as charges imposed by governments for the use of any roads within some defined zone. Road pricing is predicated on the availability of an adequate provision of public transport as an alternative mode for users.

There are many economic arguments for (marginal) road pricing. It is argued that pricing of roads creates a choice, and choices are fair because individuals and firms are not homogenous. Sometimes individuals and firms have high values of time (e.g. when they are late for an appointment, or when firms have production targets), sometimes they have lower values of time (e.g. when individuals are enjoying the drive or when firms are engaged in goods or services that are not time-bound). The corollary is that making all drivers pay the same tax to receive the same service is not fair if individuals and firms value the service differently. Another argument is that, while road pricing may be unfair to *some* road users, the alternative, i.e. congestion, is unfair to *all* road users since it wastes everyone's resources. The ultimate fairness of road pricing is only determined once the use of any net revenues is taken into account. However, it should be noted that recent data from Forfás and the National Competitiveness Council highlight that average peak-hour speeds in Dublin, at

[171] S. Cairns, L. Sloman, C. Newson, J. Anable, A. Kirkbride, and P. Goodwin, *Smarter Choices – Changing the Way We Travel* – Chapter 5 (London: Department of Transport, 2004).

16.5km/h, are now among the lowest in the EU (28th out of 30 cities) indicating that there is a strong need, on both quality-of-life and business-need/competitiveness perspectives, for an urgent policy response to ease congestion in Irish cities and thereby reduce GHG emissions.

If pricing mechanisms are not applied for rationing infrastructure access or for indivisible public goods such as air and land, then the resulting inefficiencies and misallocation, including intermodal distortions in allocation, will lead to significant societal welfare losses.

Charging schemes may involve charging for crossing a boundary around an urban area (cordon charging), charging for driving within an area (area charge), and charging for use of linear section of infrastructure. Road pricing focuses on distance and incentivizes road users to make journeys influenced by pricing signals throughout their journeys and more efficient use of road capacity. Modelling of a national road-pricing scheme in the UK suggests that it could lead to a modal shift of 3-4% reduction in car traffic and reduce vehicle kilometres by 6%.[172] Modelling of the possible impacts of a national road-pricing scheme in Ireland needs to be undertaken, including reduction in emissions, potential modal shift, and estimate of likely cost.

Congestion has significant implications for competitiveness, with estimates of economic cost ranging from 2%–8% of GDP. The cost of congestion in Ireland was estimated to be €3 billion in 2003, including €600m per annum in Dublin,[173] based on an estimate of 2.5% of GDP. It is proposed that a congestion charge could be imposed, initially in Dublin city centre, followed by other major urban centres, with a possible exemption for hybrids, electric vehicles and flexi-fuelled cars, and a proportionately punitive charge per day for vehicles with low fuel economy. Congestion charging could be introduced as soon as reliable and efficient public transport alternatives are in place, in a way that does not adversely impact on competitiveness.

It is also estimated that, through these demand side management measures, *Transport 21* would achieve a modal share of 44.2% (of motorised transport) for public transport, compared with 35.5% without and 29.7% under a "do minimum" scenario, by 2016. This is based on a demand management assumption of toll management of the M50 (€6), a congestion charge in the city centre (€10), and a €5 destination charge in the metropolitan area outside the city centre.

The effectiveness of carbon taxation, at least in the short term, will be minimal where the price elasticities of demand are low. This was one of the reasons cited by the Government in 2004 for abandoning the idea of a carbon tax. The most significant example in Ireland's case is transport. Road transport is already heavily taxed in Ireland as elsewhere in Europe (German excise duty on petrol in 2006 was the equivalent of €275.20/tonne CO_2 equivalent).[174] This is a multiple of carbon price trading levels, although it should be noted that transport not only burns fuel but also imposes other external costs of road pollution (including air pollution, road wear, water-course pollution, severance of habitat, not to mention congestion and noise). The high existing price of fuel in Ireland suggests that there is a low elasticity of demand for private motor transport in the short term. An additional carbon tax of, say, €20/tonne CO_2, which would add 5.3% to the price of petrol (2007 figures), would therefore most likely not have a discernible impact on demand for travel and might bring no short-term benefits (not even additional revenue to government, since it is envisaged that the receipts from a carbon tax will be used to offset other taxes or costs).

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172 D. Banister and R. Hickman, *Looking Over the Horizon* (London: Department for Transport, 2005).

173 R. Douthwaite, D. Healy, K. Leyden, *Towards a Sustainable Transport System*, presented at Comhar SDC Conference, Dublin (4-6 October, 2006).

174 Frank J. Convery and Luke Redmond, "Market and Price Developments in the European Union Emissions Trading Scheme", in *Review of Environmental Economics and Policy*, Vol. 1 No. 1 (2007).

A more effective approach to transport emissions would be to price all modes of transport according to their external social, economic and environmental costs, as recommended in recent reports to the UK and Irish governments.[175] Possible demand-side measures include congestion pricing and road pricing. On the supply side, the appraisals of proposals for transport infrastructure could take into account these external costs in addition to traditional (financial) costs and benefits. The government could introduce accompanying measures to ensure the internalisation of all external costs in transport infrastructure, especially road transport, as well as providing the necessary incentives and information to motorists to allow a shift to less harmful modes of transport.

The concerns of Irish business with regard to marginal road pricing relate mainly to arguments surrounding "fairness" and whether such charges actually succeed in internalising externalities and result in increased ease of movement for individuals and firms. Ireland's economy relies disproportionately on road transport and road haulage due to historical reasons and infrastructural gaps. Adding a tax to road use could harm businesses, especially SMEs on tight margins that have little choice to switch to alternative modes. On the other hand, it has been argued that roads produce positive externalities that outweigh the opportunity cost of congestion. It has been argued that the cost of the UK congestion charge disproportionately hits low-paid workers whose working hours start at night when public transport is not available and end when the congestion period is in force, indirectly hitting London's service economy. Because of the arguable current lack of choice of viable options to private road transport and haulage, it could be overly punitive to impose such a charge on Irish motorists and businesses, especially given the already high environmental taxes in this sector (VRT, excise duty, etc.). It is important to note, however, that increasing the marginal costs of private transport will increase the economic attractiveness of public transport, freight on rail, etc.

Given that both sides of the debate have advanced good arguments, it is recommended that government carry out a full Regulatory Impact Assessment about the introduction of congestion charges/road pricing.

Workplace Parking Levies

A charge on free workplace parking could be implemented in the form of a workplace parking levy or "benefit in kind" taxation, which would be declared by the employer/employee, for both public and private sector employees, and public subsidies removed for parking. It is estimated that the cost of the levy would vary locally, depending on the local market price for parking. For example, such charges may be in the range of €1,000-€4,500 in city council areas (outside congestion charging zones), €600-€3,600 in other Dublin local authorities, and €350-€900 in hinterland growth towns. Workplace parking levies are not regarded as costly to introduce or administer but difficulties exist such as setting an effective but acceptable level of charge, ensuring all the required spaces are registered, compiling an inventory of spaces, and ensuring local on-street parking controls are in place to prevent transfer from car parks.[176] This measure could be supported by complementary measures such as rewards for employers in the hinterland/growth centres, for example financial support for a travel plan, which would offset the workplace parking levy and provide a more level playing field with employers outside the workplace levy area. Furthermore, incentives could be provided to decommission parking spaces at a certain annual rate, for example Copenhagen decommissions parking spaces at the rate of 2–3% per annum.

It is estimated that travel demand measures, including congestion charges and workplace parking levies, would inter alia reduce congestion in the GDA by 12% in the morning peak hour of

[175] The Eddington Transport Study (2006). Available Online: http://www.dft.gov.uk; and Oscar Faber, *Environmental Impact of Irish Transport Growth and Related Sustainable Policies*, Vol. 2: Technical Report (2000). Accessed Online: www.transport.ie.

[176] Booz Allen Hamilton, *Greater Dublin Area Travel Demand Management Study* (Dublin: Dublin Transportation Office, 2004).

8am–9am; reduce the amount of travel undertaken by car by 5% in peak hour; increase public transport patronage by 19%; increase average morning peak hour bus speeds by 15%; and increase average morning peak hour car speeds by 8%. All of the measures, if implemented, would reduce transport GHG emissions.

Fuel Tourism

"Fuel tourism", which is estimated to account for 10% of petrol sales and 25% of diesel sales in the State, is included in the GHG emissions attributed to the Irish transport sector for the purposes of the Kyoto Protocol. While this practice overstates the level of Ireland's GHG emissions, it understates transport emissions in the UK in particular. Either way the emissions occur and do damage to the environment. This is an accounting issue that the Government might highlight to the UNFCCC with a view to finding a solution whereby national inventories reflect actual emissions levels.

Tax Reform

Subsidies to the transport sector can have a number of environmental impacts, for example, through influencing the environmental performance of vehicles; affecting the transport management decisions about volume and composition of vehicle fleets, load factors and route planning; stimulating modal shift to less environmentally-friendly transport modes; and, inducing additional transport demand by increasing the numbers of trips and distances. This can create a situation where taxpayers subsidise less sustainable modes of transport and operators receive support, which may distort competition, for example in the case of road vs rail freight.[177] It is estimated that transport subsidies are worth €270-€290 billion per annum in the EU-15, although this only includes direct transfers and tax deductions. The argument has been made that many transport activities do not pay the full costs to society.[178] It is vital that subsidies, which create a distortion in competition between private and public operators, be addressed, in order to achieve a minimum level of service in public transport provision. In addition, the effectiveness of subsidies in the form of public service obligation (PSO) levies, which create a distorted price differential, could be reviewed.

Biofuels

Current biofuels policy in Ireland is guided by the EU Directive 2003/30/EC, which stipulates that member states set indicative targets for a minimum proportion of biofuels to be placed on the market, including 2% of all petrol and diesel by 2005 and 5.75% by 2010.[179] The EU has also proposed, as part of the renewable energy Directive, a binding target of 10% biofuels in transport energy by 2020, which is being supported by amendments to the Fuel Quality Directive 98/70/EC.[180]

Member states are allowed to apply a total or partial exemption from taxation for biofuels in accordance with the Biofuels Directive, which aims to:

1. Reduce distortions of competition between member states as a result of divergent taxes on energy products;
2. Reduce distortions between mineral oils and other energy products that have not been subject to Community taxation;

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177 Oscar Faber, Ecotec, ESRI, and Goodbody Economic Consultants, *Study of the Environmental Implications of Irish Transport Growth and of related Sustainable Policies and Measures* (Dublin, 1999).

178 European Environment Agency, *Transport and Environment: On The Way to a New Common Transport Policy*, EEA Technical Report No. 1 (Copenhagen: European Environment Agency, 2007).

179 European Commission Directive 2003/96/EC on Restructuring the Community Framework for the Taxation of Energy Products and Electricity.

180 Commission of the European Communities, *Renewable Energy Road Map – Renewable Energies in the 21st Century: Building a More Sustainable Future*, COM 848 (2006).

3. Increase incentives to use energy efficiently and to reduce dependency on imported energy; and
4. To allow member states to offer tax incentives for reducing emissions.

In 2005, the Department of Communications, Marine and Natural Resources announced a Mineral Oil Tax Relief (MOTR) scheme, which provides for excise relief on biofuels of 44.3 cents per litre for petrol and 36.8 cents per litre for diesel, over a 2-year period. This pilot scheme is estimated to provide excise relief for 16 million litres at a cost of €6 million to the Exchequer. This initial scheme was extended following an announcement in the 2006 Budget of a five-year (2006–2010) biofuels excise relief package, Biofuels MOTR Scheme II. It is expected that, at full capacity in 2008, the Biofuels MOTR Scheme II will allow for 2.2% of transport fuels or 163m litres to be met by biofuels.

The government aims to achieve 5% obligatory fuel blending by 2009 with the additional 0.75% of the target to be achieved through higher blends and the use of 100% pure plant oil (PPO) in captive fleets maintained by local authorities, public and semi-state organizations and haulage companies. Furthermore, the promotion of second-generation biofuels should be a priority and supported by R&D in biotechnology and microbial enzyme development. Domestic policy needs to be directed away from (subsidy) instruments aimed at the deployment of biofuels to R&D demonstration projects. In this context, the scope of the current MOTR might be extended.

Due to rising demand for biofuels, farmers worldwide have an increased economic incentive to grow crops for biofuel production instead of food production. Without political intervention, this could lead to reduced food production and increased food prices. Such impacts on food prices resulting from increased biofuel production may go some way to negate any potential benefits to Ireland and other parts of the EU. Furthermore, the European Commission has been strongly criticised by the OECD in a report issued in September 2007 which warned that subsidies for biofuels produced in Europe and America could disrupt markets without generating significant environmental benefits.

The EU's 10% target for the use of biofuels in transport has been set at the same level in each member state in order to ensure consistency in transport fuel specifications and availability. Biofuels that are imported will have to meet sustainability criteria i.e. they must not be promoted unless they achieve a minimum level of GHG savings and respect a number of requirements in relation to biodiversity. The Commission is anticipating that second-generation biofuels will become commercially available and that the Fuel Quality Directive will be amended to allow for adequate levels of blending.

Higher Standards for Car Emissions

As part of its strategy for reducing carbon emissions from cars, under a European Commission proposal, fuel suppliers will have to reduce GHG emissions caused by the production, transport and use of their products by 10% between 2011 and 2020, with a 1% cut per annum from 2010. The new standards require a reduction in the sulphur content of diesel and gas oil and allow an increase in the content of biofuel in petrol.[181] The new Directive will also raise the volume of biofuels that can be used in petrol; a separate blend with higher oxygen containing additives will be established, containing up to 10% ethanol (5% is currently authorised). The average level of emissions from cars is currently (2006) 163gr CO_2/km. As this target was considered too high, the Commission has proposed that a legally binding target of 120gr CO_2/Km be set for car manufacturers. A similar strategy has been adopted by the US Administration with the proposed requirement to make vehicles 4% more fuel efficient every year for the next decade.

[181] The proposal revises the standards in force under Directive 98/70/EC on the quality of petrol and diesel fuels.

Conclusions

Potential possible policy intervention in the field of transport could, if implemented, reduce carbon emissions from Irish transport, perhaps as part of the Government's forthcoming Sustainable Travel and Transport Action Plan. It is recognized that the current investment programme in public transport infrastructure addresses significant historic under-investment and is required for balanced regional development and to maintain competitiveness in a globalized economy. Therefore, any policy proposals could support and complement the current and proposed investment.

However, sustainable travel policies are needed, which achieve a significant modal shift, decouple transport demand from economic growth, and alleviate pressure on infrastructural bottlenecks and congestion. For the transport sector to evolve along a truly sustainable trajectory, a paradigm shift is required in order to minimize travel and transport and prioritize sustainable modes such as walking and cycling. The optimal approach is to implement cost-effective policies and measures initially, which do not hinder competitiveness, followed by more punitive measures in the long run, as the economy adapts to a low-carbon future.

Table 5.8 Proposed Policy Instruments for the Transport Sector and Emissions Reductions in 2020

Policy Instrument	Annual Mt CO_2-Equivalent Reduction 2020
Rebalancing of VRT and Motor Tax [182]	0.05 [183]
Information and Awareness Measures [184]	0.9 [185]
Land Use and Spatial Planning	0.083 [186]
Mobility Management	0.82 [187]
Technology Improvements	0.48
Dublin Traffic Measures	0.27
Nationwide Road Pricing	0.95 [188]
Carbon Tax	0.32 [189]
10% Biofuels Substitution	1.364 [190]
Carbon Trading	0.298 [191]
Total	5.535
NCCS 2020 Prediction	16.48
2020 Estimate	10.95

Source: IIEA Climate Change Working Group (Sectors)

Table 5.8 summarizes the potential CO_2 emissions reductions, which could be achieved on implementation of the policies and instruments con-

[182] Road transport constituted 96% of total transport emissions in 2005 and this ratio was assumed to apply in 2020.

[183] Assume annual reduction is 0.1Mt (Comhar estimate) and 0.05 already accounted for in NCCS Table 4.1.

[184] Road private car accounted for 45.5% of total emissions (excluding aviation) in 2005.

[185] Based on 12% reduction in emissions from eco-driving.

[186] Department of the Environment Heritage and Local Government, *National Climate Change Strategy 2007-2012* (Dublin: Department of the Environment, Heritage and Local Government, 2007).

[187] Based on 11% reduction in car use (average of 7-15% reduction from implementation of PTP and WTP) and shift to walking and cycling.

[188] Based on 6% reduction in vehicle-kilometres.

[189] Based on a predicted reduction of 0.27Mt CO2-equivalents in 2010 and total of 13.992Mt CO_2-equivalents, which implies a 1.9% reduction.

[190] Based on 10% substitution of carbon-neutral 2nd generation biofuels less MOTR for 2% substitution of 1st generation biofuels.

[191] Based on stabilization at 2005 levels of 13.461Mt CO_2-equivalents by 2010 and then reduction by 3% per annum thereafter.

tained herewith. It is proposed that a roadmap of policy instruments could be implemented with effective, least cost measures introduced initially, followed by more complex instruments, if required. If the policy instruments outlined are implemented, it is estimated that emissions could be reduced to 10.945Mt CO_2-equivalents, which is 111% above the 1990 estimate of 5.182Mt CO_2-equivalents, although it should be noted that reductions are calculated for policies ceteris paribus and their effectiveness may be reduced by a multiplicity of policies.

Building and Construction

Introduction

In 2007, the value of output in the construction industry was almost €37 billion and accounted for some 20% of GDP, or 23% of GNP. The sector has seen phenomenal growth in recent years, with residential construction output (which accounts for around a third of total construction activity) more than doubling from €9.5 billion in 2000 to €24 billion in 2006. The sector is also a major source of job creation with construction employment currently standing at 280,000 with an additional 100,000 people working indirectly in professions and sectors that serve the construction industry. While the residential housing sector is currently going through a period of significant restructuring, the outlook remains relatively optimistic, with other sectors, such as civil engineering (partly linked to NDP infrastructure projects) and the repair, maintenance and improvement (RMI) of private residences expected to show strong growth.

The following Table sets out the key indicators for the sector.

Table 5.9 Construction Forecasts 2006-2008 (€billion) [192]

	2006	2007	2008
New housing	20	18	15.5
New Housing as % GNP	13.3%	11.2%	9.1%
Building	5	6	6.5
Civil engineering	4.5	5.5	6.5
RMI	6.5	7.5	8.5
Total output	36	37	37
Construction output as % GNP	24%	22.9%	21.6%

Source: Institute of International and European Affairs Climate Change Working Group, 2007

Emissions Forecast

Buildings are one of the five main users of energy in Ireland and account for some 34% of TPER. Hence there is considerable interest in introducing measures to improve the energy efficiency of buildings. However, it is claimed that market failure and behavioural barriers are preventing a dramatic improvement in building energy efficiency. [193]

Emissions from the residential sector are projected (in accordance with the ESRI-economy-wide model of energy demand) at some 6.8 Mt on average over the Kyoto period, or 7% below the 1990 base level. This forecast builds in a prediction that household numbers will rise from 1.33 million in 2003 to 1.74 by 2012 and that the population will be 4.55 millions by 2012.[194] However, some 50% of the housing stock pre-dates 1970. Improved thermal performance of new and existing buildings and continued fuel switching from solid fuels to natural gas will help the sector's performance.

An absence of rigorous statistical information prevents a meaningful figure being given for the

[192] New housing refers to public and private residential development. Building refers to new private commercial and industrial development. RMI refers to the repair, maintenance and improvement of buildings (commercial, residential and industrial) and civil engineering.

[193] World Business Council for Sustainable Development, *Energy Efficiency in Buildings Project* (2007). Accessed Online: www.wbcsd.org. The WBCSD is promoting the Positive Energy Building.

[194] Environmental Protection Agency, *Ireland's National Allocation Plan 2008-2012 – As notified to the Commission* (12 July 2006), p.7. Accessed Online: www.ec.europa.eu.

current energy requirements of the construction industry. By way of illustration of the current position, the Action Plan under Article 14(2) of Directive 2006/32/EC notes that energy usage in the residential sector amounted to over 33,425 GWh (final energy consumption) in 2005. Energy usage grew by 27% in the residential sector over the period 1990-2005 with the number of households increasing by 52%. Energy intensity (average energy usage per household) decreased by 16% over the period reflecting an improvement in energy efficiency of the housing stock, much of it due to higher efficiency standards of new housing stock additions. Not all of the improvement in energy efficiency resulted in lower energy usage. Higher standards of heating and comfort levels followed from the deployment of central heating.

Issues

The regulatory framework is a key driver of demand and activity. The regulatory framework in which construction activity takes place is focused on the quality of buildings through the national Building Regulations, health and safety law, environmental impact legislation and public procurement law. From 2007, and on foot of the Energy Performance of Buildings Directive,[195] the Building Regulations require any person who commissions the construction of a new building with a floor area exceeding 1,000m^2 to ensure, before work commences on its construction, that due consideration has been given to the technical, environmental and economic feasibility of installing renewable energy systems in the proposed building, and that the use of such systems has been taken into account, as far as practicable, in the design of that building.

The main actions underway in the residential construction sector centre on a forthcoming strengthening of the energy aspects of the Building Regulations, building on a previous revision in 2002 and on the SEI House of Tomorrow Programme. It is estimated that current and committed actions through the reform of the Building Regulations will result in projected savings of over 13,600 GWh PEE in 2020. The introduction of building energy rating for new (2007) and existing (2009) houses will provide an instrument that can be used to raise awareness of energy performance and stimulate incorporation of such performance into purchase decisions. The pace of building activity, as reflected in the housing stock addition of recent years, contributed to a positive shift in average efficiency. For the same standard of comfort and amenity, a new house today (2007) typically has a 70% lower energy demand for space and water heating than its counterpart built 20 years ago. However, since homes being built now will have a lifetime of at least several decades, it is important to ensure that efficiency performance standards are robust. Building regulations are important in setting the standard and driving performance improvements. At the same time, Building Energy Rating (energy labelling of buildings) will allow everyone to understand relative performance and make appropriate purchase or rental decisions. A typical semi-detached house built today and satisfying the 2005 Regulations would have a Building Energy Rating (BER) of 155 kWh/m^2.year – a C1 house. With the 40% improvement required to meet the 2008 Regulations this would mean it should have a BER of just over 90 kWh/m^2.year – a B1 house. In order to keep pace with Europe, it is envisaged that a further 30% savings in energy and carbon emissions will be required with possible changes in 2011, on top of the energy savings envisaged in the 2008 Regulations. The 2011 house would then need to have a BER of less than 65 kWh/m^2.year to meet the Regulations. This would mean higher levels of insulation with U-Values for the opaque elements being not greater than 0.20 W/m^2.K (though the method of construction should not change too dramatically). Windows would, for example, be limited to 1.50 W/m^2.K, which would mean that double glazed windows with highly insulated glass would be the norm but triple glazing would not be required.

[195] European Commission Directive 2002/91.

The Irish quantity surveyors, Bruce Shaw, has recently carried out a major sustainability cost analysis which has identified an initial extra capital cost of around 6% between conventional office buildings and modern sustainable office buildings. The largest component of the extra cost is in the building façade.[196] As well as environmental gains, there are significant savings in energy costs for occupiers of sustainable office buildings. The difference between a sustainable office with a BER "A" rating and a conventional air-conditioned office could be as much as €20 per square metre. For a 25,000 square metre office, Bruce Shaw calculates a potential saving of €500,000 a year. They also estimate that the extra cost of the new Part L of the Building Regulations will add an extra €4,000 to €5,000 per dwelling (but will provide savings of €350 to €450 per annum). Government estimates are twice this figure.[197]

The new BER has yet to be implemented but is expected to be in place by July 2009. In addition to its impact on the use of more energy efficient materials etc., the BER also means that more robust inspection and monitoring of buildings during construction will be required, ensuring that all relevant legislation has been complied with and that construction products have been properly approved, i.e. shown to be "fit for their intended use". Unless public authorities are resourced and trained as an immediate priority, the probability is that the new BER standards will not be implemented. In such an event, this may affect the credibility of the government's sustainability building strategy, in particular the pace at which government intends to impose a "carbon neutral" requirement on the building and house construction sector.

Progress on energy efficiency depends on people in the building industry being aware of the importance of the issue, and then being able and willing to act on it. A Report by the World Business Council includes the findings of a significant survey (of 1,423 respondents) about professionals' views on sustainable building issues.[198] A considerable number underestimated buildings' contribution to GHG levels; awareness of environmental building issues was relatively high, but only 13% actually got involved in the development of a sustainable building; a significant body of opinion supported the view that developers and financiers are the main barriers to more sustainable approaches in the building value chain. The main conclusion, which admittedly has not been tested by Irish research, was that lack of awareness is not the issue; the main barrier is a lack of in-depth understanding about the impacts of global warming and a lack of leadership from the construction sector.

Unless the planning laws are changed it will not be possible to deploy energy-saving equipment such as solar panels and microgeneration units that require installation on or outside a building. The Minister for the Environment, Heritage and Local Government has signalled that the planning laws will be changed to allow the installation of small renewable units.[199]

The re-establishment of an independent National Institute for Spatial Planning and Construction Research (formerly known as An Foras Forbartha) might be considered, having legally mandated and joint responsibility with the Central Statistics Office for maintaining a reliable National Construction Dataset. New Building Regulations and building practices will require design practitioners to be re-educated, and design school curricula to be upgraded. In addition, the Irish National Accreditation Board (NAB), the National Agrément Board and the National Standards Authority of Ireland (NSAI)

196 For more information on this please refer to www.bruceshaw.ie.

197 Department of the Environment, Heritage and Local Government, *Regulatory Impact Assessment on Building Regulations Part L* (Dublin: Department of the Environment, Heritage and Local Government, December 2007).

198 World Business Council for Sustainable Development, *Energy Efficiency in Buildings Project* (2007). Accessed Online: www.wbcsd.org. The WBCSD is promoting the Positive Energy Building.

199 Statement to the Energy Summit, 6 March 2008.

need to be resourced. Ireland needs to participate actively in the European Standards Organizations and ISO (International Standards Organisation) where new building standards are set.

Opportunities

A report by the World Business Council for Sustainable Development points the way forward for the building and construction sector.[200]

The main driver is the fact that buildings are responsible for upwards of 40% of energy use in most countries and there is an immediate requirement to introduce energy efficiency measures and thereby reduce GHG emissions. The IPCC Fourth Assessment Report estimates that by 2020 carbon emissions from building energy use can be reduced by 29% at no net cost. This drive towards building energy efficiency will be minded of the finding of the International Energy Agency that current trends in energy demand for buildings will stimulate about half of energy supply investments up to 2030.[201]

View of the Construction Industry Federation [202]

The CIF has noted that a tipping point has been reached in relation to the sector's awareness of climate change, sustainable development and environmental issues impacting on the industry. The CIF has recommended to government that there should be a much higher priority attached to achieving energy efficiency through the renovation of Ireland's existing stock of buildings and that the improved energy efficiency in new buildings should be supported through enhanced capital allowances and appropriate tax incentives. The CIF also called for a nationally coordinated policy of supporting innovation in the products and services that will be needed to improve the energy efficiency of households and buildings generally in Ireland. A potential bottleneck identified by CIF is the availability of skilled public servants who will have responsibility for the strict implementation of the Building Regulations and BER standards. Importantly therefore, the construction sector is acutely aware of the challenges of climate change, but specifically that new business opportunities exist.

Carbon Neutral Buildings

All new buildings could achieve an A1 BER by 2012 if the potential for significant energy savings was pursued vigorously. However, the whole concept of energy efficient sustainable design is in its infancy in Ireland and mechanisms need to be put in place to encourage/require the design community to focus far more on energy efficiency when designing new buildings. Large-scale retrofitting of existing buildings should be supported so that the burden of reducing the energy demands of the built environment is shared between new and existing buildings. The government has committed to reviewing the Building Regulations in 2010 with a view to raising efficiency standard from 40% to 60% on current levels. The Minister for the Environment, Heritage and Local Government has already signalled his intention to move to a zero emissions standard, perhaps before 2016. This will require new building products and new processes and a greater awareness among householders and commercial property owners and tenants. There is particular scope for savings in the public sector, where users of buildings do not always have the incentive to use their energy efficiently. In addition to the EU's Buildings Directive, Ireland could consider unilaterally imposing higher standards for all buildings, regardless of size, and provide incentives for the

[200] World Business Council for Sustainable Development, *Energy Efficiency in Buildings Project* (2007). Accessed Online: www.wbcsd.org. The WBCSD is promoting the Positive Energy Building.

[201] International Energy Agency, *World Energy Outlook* (2006), Accessed Online: www.worldenergyoutlook.org.

[202] Construction Industry Federation, Annual Report 2007. Accessed Online: www.cif.ie.

development of passive houses, which rely on good insulation levels and passive heating and mechanical ventilation rather than traditional heating systems; the recent introduction of higher standards in Irish building regulations is a welcome step in this direction.[203]

Ireland could also consider introducing measures to raise the efficiency of energy transformation, for instance by promoting Combined Heat and Power and district-heating schemes in urban areas. With this in mind, the application of intelligent energy efficiency and conservation systems and remote energy management in all building types could be developed in order to support more energy-efficient and energy-saving patterns of building use by occupants.

According to SEI, a combination of the following in the renovation of existing homes will have the following impact:

Table 5.10 Cost of Renovating Existing Homes

Technology	Private NPV (€)	Social NPV (€)	Total quantity (MWh)	Present value over lifetime (€)	Exchequer cost of scheme (€)
Condensing boiler	782	691	107	1892	370
CFL	435	464	6	525	30
Loft insulation	1135	1289	90	1315	60
Cavity wall insulation	930	1006	95	1380	150

Source: SEI

What these figures demonstrate is that the progressive introduction of a Positive Energy Building approach will require significant additional investment. According to SEI, it will cost some €25,000 on average to retrofit a house to the highest energy standards; the cost to the projected housing stock could be some €50 billion over a decade. Measures such as improved thermal insulation properties, lighting control, heat recovery on air handling units, improved BMS, CHP, Biomass boilers will all add to the capital costs of construction. As the regulatory compliance burden gets tighter, companies best positioned to provide these energy-saving construction products will reap the highest rewards.

Tax incentives

There is clear market failure in this sector. Consequently there may be grounds for the introduction of targeted and time-limited incentives to promote the wider use of energy-efficient goods and services. For example, consideration could be given to reducing the rate of VAT on all suitably certified environmental goods that are used in buildings with the aim of improving energy efficiency standards. The installation of smart meters could be encouraged (once the current pilot project is completed) by subsidizing installation costs for households below a certain income threshold. Grant aid for SEI's "House of Tomorrow" Programme could be increased and guaranteed over a five-year period. Through SEI's Houses of Tomorrow Scheme, more than 6,000 houses have or are being constructed with a 40% improvement in energy efficiency. Finally, urgent consideration could be given to an incentive package to encourage households and businesses to retrofit their homes and buildings.

[203] Energy Performance in Buildings Directive 2002/91/EC came into force in Ireland in 2007 and mandates energy savings in buildings above 1000 square metres.

Biomass

The heating of buildings provides opportunities for significant energy savings, and consideration could be given to the provision of support for the installation of biomass heating in both new buildings and existing buildings. This in turn would require multi-agency co-operation within the biomass heating supply chain and perhaps a new taxation regime to support the efficient development of biomass crops in Ireland, and the development of heating systems on an efficient and low-cost basis.

Procurement

One of the keys to achieving the aim of sustainable building is to embed this requirement through revised procurement rules. In the UK for example, the Sustainable Procurement Task Force produced an Action Plan to deliver on the goal set out in the Government's 2005 Sustainable Development Strategy to make the UK a leader in the EU in sustainable procurement by 2009.[204] The refitting of buildings was identified as a priority target.[205] Requiring, through public tenders, higher energy efficiency and building standards for all new public construction and building works could bring about the greening of the construction sector in Ireland.

Improvements in emissions performance from the cement sector

The production and transportation of cement is one of the greatest uses of energy in the construction of buildings. Research and development must be undertaken at an Irish and international level to develop less energy intensive ways of producing cement and new products which can reduce the amount of cement required in the construction of buildings.

Conclusions

The main driver of new business opportunity for the building and construction is climate change. The WBCSD Report concluded that, while acknowledging the timing of market entry carries risk, there would be considerable opportunities for early entrants into the building energy efficiency business. While a lead-in period will be necessary for the construction industry to develop new products and processes in order to meet new standards of building performance and energy efficiency, there is an undisputed trend towards higher standards of sustainability that should not be ignored.

There is no incentive for individual companies to take a risk until there is clear regulatory certainty concerning the government's intentions about the introduction of tougher (and fully enforced) building standards and energy efficiency.

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[204] *Securing the Future – UK Government Sustainable Development Strategy* (Norwich: The Stationery Office, March 2005).

[205] Department for the Environment, Food and Rural Affairs, *Procuring the Future, Sustainable Procurement National Action Plan: Recommendations from the Sustainable Procurement Task Force* (London: Department for the Environment, Food and Rural Affairs, 2006).

Agriculture, Land Use and Forestry

Introduction

The land area of Ireland is 6.9 million hectares, of which 4.3 million hectares is used for agriculture, with a further 710,000 hectares (10.3%) used for forestry. Some 80% (3.4 million hectares) of agricultural land is devoted to grass (silage, hay and pasture), 11% to rough grazing (0.5 million hectares) and 9% to crop production (0.4 million hectares). Beef and milk production currently account for 55% of agricultural output at producer prices. Ireland's livestock numbers include 6.19 million cattle, 4.26 million sheep, and 1.68 million pigs.[206] There are 131,400 farm holdings and the average farm size is 32.3 hectares. In 2006, primary agriculture employed 109,100 people,[207] 5.4% of total employment, whilst (according to the latest available figures) the agri-food sector employed some 163,200 persons or 8.1% of total employment.[208] The agri-food sector accounted for 8% of GVA (at factor cost) and some 9.8% of exports.

Agriculture

While agriculture is a large source of emissions in Ireland, by 2005 this had fallen to 27.6% of total national emissions as a result of a decline in both livestock population and fertilizer use. However, projections for the Kyoto commitment period indicate that agriculture will become the second largest source of emissions, after energy industries. The following Table sets out the quantum of emissions from the sector.

Table 5.11 Agricultural Emissions

	Mt CO_2e					Change on 1990 Base			
Agriculture	1990	2003	2008-12	2015	2020	2003	2008-12	2015	2020
Fuel Combustion	0.739	0.937	0.778	0.729	0.711	27%	5%	-1%	-4%
Enteric Fermentation	9.338	9.204	8.161	7.798	7.798	-1%	-13%	-16%	-16%
Manure Management	2.632	2.586	1.951	2.209	2.209	-2%	-26%	-16%	-16%
Agricultural Soils	7.271	7.348	6.754	6.329	6.329	1%	-7%	-13%	-13%
Total	19.980	20.075	17.644	17.05	17.047	0%	-12%	-15%	-15%

Source: IIEA Climate Change Working Group (Sectors)

By 2012, emissions from the agriculture sector are expected to be 12% below 1990 levels and 15% below 1990 levels from 2015 through to 2020. Emissions from the sector will therefore be 28 percentage points below the national burden sharing target (i.e. 13% above the level of emissions in 1990) set for Ireland under the Kyoto burden sharing agreement.

206 The Irish Farmers' Association, *Statistics as of December 2005*. Accessed Online: www.ifa.ie

207 Persons employed in agriculture are based on the CSO's Quarterly National Household Survey (second quarter 2006). It covers people who identified agriculture as their primary source of income in the week preceding the survey.

208 Agri-food includes primary agriculture, food, drinks and tobacco. Latest figures available are from 2003 and represent the total labour input incl. non-regular workers (AWUs).

Approach to Meeting Emissions Reductions Targets

CAP Reform

The 2000 NCCS acknowledged that, in meeting national targets, achieving reductions in greenhouse gas emissions from the agriculture sector was far more important for Ireland than for other member states.[209] Policy development at EU level, specifically, in the context of the post-Agenda 2000 arrangements, was identified as the most likely vehicle to deliver GHG abatement from the sector. The 2003 Luxembourg CAP reform agreement, which sought to decouple farm payments from production, offered a potential opportunity to significantly reduce greenhouse gas emissions from the sector. Following in-depth analysis of the potential economic and environmental impacts of decoupling and intense consultation with stakeholders, the government eventually decided to opt for full rather than partial decoupling, thus ensuring the maximum projected GHG emissions reductions from the sector. The reduction arises from a projected fall in animal numbers, and an attendant fall in fertiliser associated with the decrease in the size of the national herd.

This decision by government is projected to reduce emissions by 2.4 Mt per annum in the 2008–2012 periods.[210] Significantly, the impact of this element of CAP reform is projected to continue beyond 2012 and will be an important factor in Ireland's post-Kyoto strategy.

The Rural Environment Protection Scheme has, since its inception, provided public goods of exceptional benefit to the environment in terms of water quality and biodiversity. Future schemes (including the 2007–2013 scheme) will also take account of climate change issues. Measures such as the planting of broadleaf trees, for example, and the planting of new hedgerows and the rejuvenation of degraded hedgerows, will contribute to carbon sequestration. Emissions from fertiliser will be reduced through organic farming and measures put in place to encourage greater uptake of nitrogen by soil. The regulations implementing the EU Nitrates Directive will also lead to more efficient use of nitrogenous fertiliser and therefore will reduce greenhouse gas emissions

Energy crops

The Government has recognised that support is required for the production of energy crops throughout their lifecycle. Accordingly, €8 million is being provided through a Bioenergy Scheme for establishment grants to plant miscanthus and willow. The government is providing an additional national top up of €80 per hectare to the existing EU premium, bringing the overall premium to €125 per hectare.

Support for reduced emissions in other sectors

In many cases, policies and measures adopted in the agriculture sector contribute to the reduction of carbon dioxide emissions in other sectors of the economy, such as the electricity, transport and heat sectors, by substituting for fossil fuels and fossil fuel-based products. Crops and forest products, grown for use as energy crops or renewable raw materials, have the potential to contribute to the achievement of multiple policy objectives. This is recognised in the recently published Bioenergy Action Plan for Ireland, which sets out an integrated strategy for the delivery of the benefits of Ireland's potential bioenergy resources.[211] Increased use of bioenergy resources will contribute to the achievement of Ireland's renewable energy targets as set out in the Energy White Paper.

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[209] Compared to its European counterparts, Ireland is atypical in that a very significant proportion of its anthropogenic greenhouse gas emissions originate from the agriculture sector.

[210] Full decoupling came into force on 1 January 2005 and comprises one Single Farm Payment, based on the levels of support paid to farmers in the years 2000, 2001 and 2002, paid once a year to farmers. The payment is independent from production and linked to stringent "Cross Compliance" measures in respect of environmental, food and animal health and welfare requirements.

[211] Report of the Ministerial Task Force on Bioenergy, *Bioenergy Action Plan for Ireland* (Dublin: Department of Communications, Marine and Natural Resources).

Market-based mechanisms may provide scope to deliver additional emissions reductions in the sector and the government has committed to keep them under review in light of developments at EU and international level. For example, the government has committed to work to promote awareness among farmers of the benefits of low emission trailing shoe technology for slurry application, which reduces the need for additional chemical nitrogen. As awareness builds, government will develop mechanisms aimed at increasing the uptake of this technology.

Anaerobic Digestion

Anaerobic digestion of animal manures is a technology that is used in many parts of the world and is seen, in some quarters, as a possible "silver bullet solution" to address emissions from the agriculture sector. However the potential of this technology to deliver emissions reductions in an Irish context remains to be determined. There are a number of financial and technical obstacles to the extensive use of anaerobic digestion. That most cattle manure is already recycled successfully on-farm, as fertiliser, and needs no further processing, further limits scope for farm-scale anaerobic processing. Nevertheless, through the Department of Agriculture and Food's Farm Waste Management Technology Demonstration Scheme, the feasibility and viability of anaerobic digestion will be closely monitored and possibilities for centralised anaerobic digestion will be explored.

Carbon Sequestration and Forestry

The Irish afforestation programme will play an important role in carbon sequestration. Ireland is fortunate to have had, on a per capita basis, one of the most intensive afforestation programmes in the developed world since 1990 during which time some 250,000 hectares have been afforested. Nevertheless, Ireland remains one of the least forested countries in the EU. At the end of the year 2005, the national forest estate stood at just 710,000 hectares or 10% of land area, less than one-third of the EU average.

The 1996 National Forestry Strategy, "Growing for the Future", provided for 20,000 hectares of new afforestation per annum up to 2030. If achieved, these proposals would have increased forest area to 860,000 hectares by 2010 and to over 1.2 million hectares by 2030, almost doubling the area under forest in the State from approximately 10% to 17%. Afforestation rates in the period 1996-2006 averaged 12,800 hectares per annum. However, over the period 2003-2006 this has fallen to an annual average of 9,200 hectares. The shortfall will have an impact on the total amount of carbon that will be sequestered. The recent trends indicate that the rate of afforestation coming into the 2008-2012 period will be approximately 35% below the NCCS assumption of 14,000 hectares per annum and some 55% below the National Forestry Strategy target. The reasons for this performance are complex and include the cost of land; the attractiveness of competing schemes; and the decline in public planting.

It is now forecast that, with the levels of afforestation that have occurred since 1990, the average rate of sequestration in qualifying forests over the Kyoto first commitment period will be 2.074 Mt CO_2 per annum. This figure will increase beyond 2012 as forests mature. Forests begin to sequester carbon approximately five years after planting and this creates a time lag between afforestation and the realization of carbon benefits. The impact of low levels or delayed planting today, therefore, will be that in the long run the substantial carbon sink potential of forests will be less and will be realized later.

Carbon reductions from forestry sequestration will deliver an annual reduction of 2.074 Mt during the commitment period. Apart from the other valuable public benefits delivered by well-managed afforestation, an increase in the area afforested will deliver increased further carbon sequestration. Current policy provides grants to private operators and advantages broadleaf plantation. Without

additional stimulus, it seem unlikely that the target of 17% overall forestry cover by 2030 will be met. All potential options to increase sustainable afforestation should be pursued through the:

- Continuation of 100% establishment grants and 20 year premiums for farmers;
- Ongoing review of the incentives for establishing new forests;
- Adoption of new and innovative measures (such as FEPS) to achieve elevated levels of afforestation;
- Support for measures designed to increase the use of wood for energy;
- Review of the Forestry Acts;
- Utilisation of the national Indicative Forest Strategy; and
- Application of research (e.g. appropriate planting for acid-sensitive areas).

Conclusions

The decoupling of farm payments from production was the most effective means available to Government to achieve GHG emissions reductions from the agriculture sector. Although there are very few other, cost effective, options available to the sector to significantly reduce emissions, improved farming practices, resulting in better utilization of nutrients, have the potential to reduce nitrogen applications (without significant impact on output levels) and in return reduce GHG emissions.

Market-based mechanisms may provide scope to deliver additional emissions reductions in the sector and the government has committed to keep them under review in light of developments at EU and international level.

The cumulative effect of small-scale emissions reductions actions can also deliver effective emissions reductions from the sector. The National Inventory System must be sufficiently flexible to facilitate the inclusion of emissions reductions from such sources.

Recent research has identified dietary manipulation as a strategy with potential to reduce methane emissions from livestock. Research into advanced husbandry techniques may also deliver new emissions reductions options.

To identify and select plant varieties and crop production and management systems that are most suited to bio-fuel production in the Irish context, funding has been allocated to five projects that relate directly to biofuels and energy crops.[212]

The Government has committed to work to promote awareness among farmers of the benefits of low emission trailing shoe technology for slurry spreading, which reduces the need for additional chemical nitrogen and, as a result, consequential nitrous oxide emissions. As awareness builds, the Government should develop mechanisms aimed at increasing the uptake of this technology as its potential to deliver GHG emissions savings is very significant (of the order of 1 Mt).

[212] Under the Research Stimulus Fund Programme operated by the Department of Agriculture and Food.

Part II Working Groups' Analysis

Chapter 6 Impact on Competitiveness

Introduction and Background

Climate change poses considerable challenges for Ireland's competitiveness position in three main ways. First, the policies to which Ireland is a signatory that aim to mitigate and adapt to the impacts of climate change are costly to the enterprise sector, and these pose some concerns to the business community struggling to keep costs competitive in an increasingly globalised economy. Second, the effects of climate change itself may have impacts for Ireland's competitiveness, although many studies predict that Ireland will fare better than many other EU countries in this regard; coastal erosion, land loss and flooding are, however, major concerns with palpable impacts for Irish agriculture and tourism. Third, countries that are seen to be less pro-active in terms of prioritising sustainable development and climate change policy may suffer from reduced levels of foreign direct investment in the environmental and eco-innovation sectors; the converse is also true, of course, and potential opportunities in the environmental goods and services sector are discussed in detail in this chapter. Other chapters in this report deal extensively with climate change on a sectoral basis and measures and instruments that can mitigate climate change. This chapter focuses on the competitiveness issues arising from climate change that face the enterprise sector directly.

From the outset the Kyoto Protocol and the UNFCCC have had to contend with tension between effective action to slow climate change, and maintenance of competitiveness. Competitiveness concerns have been the explicit prime motivation for the withdrawal of the USA and Australia from the Kyoto process. They believed that mitigating CO_2, in the absence of emissions caps for rapidly developing nations such as China, India and Brazil, would be too costly and ineffective. The exclusion of the US and Australia exacerbated the competitiveness problem for nations who had signed Kyoto and who would need to cut emissions to meet their target: namely, the original EU-15, Canada and Japan. Competitiveness concerns have since plagued Canada, the largest trading partner of the United States and the bearer of relatively difficult emissions targets. Such concerns have also been articulated in the climate-related policy debates in the EU where, according to some commentators, they effectively scuttled the European Commission's 1992 proposed Directive on Carbon Tax, and have continued to dog the elaboration and implementation of the EU's Emissions Trading Scheme (ETS). [213]

It is important in any discussion on mitigating the effects of climate change that both the negative and positive impacts on enterprise are considered. In this chapter we will be setting out not just the potential costs to enterprise resulting from implementing policies to tackle climate change but also the opportunities that arise therein.

The importance of maintaining Ireland's competitiveness is underlined in a number of published

[213] A. Cosbey and R. Tarasofsky, *Climate Change, Competitiveness and Trade: A Chatham House Report* (London: The Royal Institute of International Affairs, 2007).

policy documents, which seek to outline the steps Ireland needs to take. The (revised) *National Climate Change Strategy: 2007-2012*, published in April 2007, sets out a revised framework for achieving the necessary greenhouse gas emissions reductions to ensure that Ireland complies with the Kyoto Protocol.

> Through innovation, energy efficiency and more sustainability in our personal choices, we can achieve the necessary lowering of the carbon intensity of our economy without sacrificing competitiveness, economic performance or quality of life.

The White Paper on the Government's Energy Policy Framework 2007-2020 seeks to deliver a sustainable energy future for Ireland. It is set firmly in the global and European context that has put energy security and climate change among the most urgent international challenges.

> Sustained economic growth and population growth also add to the challenges for Irish energy policy. We have however major opportunities to be realised in harnessing the full potential of our renewable and bio-energy resources.

The latest Programme for Government mentions competitiveness in the context of environmental policy as follows:

> We will support the development of environmental technologies in Ireland to achieve a win/win situation of improved competitiveness and environmental performance.

There is also a strong business case for examining environmental policy measures in the context of climate change:

(a) There is a strong case to be made for Ireland paying for the environmental degradation it is causing, based on the grounds of the precautionary principle and the "polluter pays" principle;

(b) The recently agreed Programme for Government has agreed to the introduction of a carbon tax over the lifetime of the Government;

(c) Employing cross-sectoral measures like ETS and carbon taxation may be a more equitable way of collecting environmental tax revenue across all sectors of the economy without adversely affecting large elements of the enterprise sector;

(d) Some multinationals have begun basing their location decisions on countries' perceived "greenness" and their prioritisation of sustainable development;[214]

(e) ETS and carbon taxation are seen as complementary mechanisms in international terms. If enterprises have not committed themselves to achieving emissions reductions through either ETS or negotiated agreements, they could be given a third option, *viz* a carbon tax.

This chapter explores the nature of the concerns over competitiveness, trying to analyse them in a meaningful way and assess the need for concern. It begins by defining the problem, and then surveys some of the literature, including that of the Stern Report, for relevant insights.

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[214] Forfás, 2006.

Defining Competitiveness

In this chapter environmental targets are considered in the context of Ireland's international competitiveness. The National Competitiveness Council defines competitiveness as

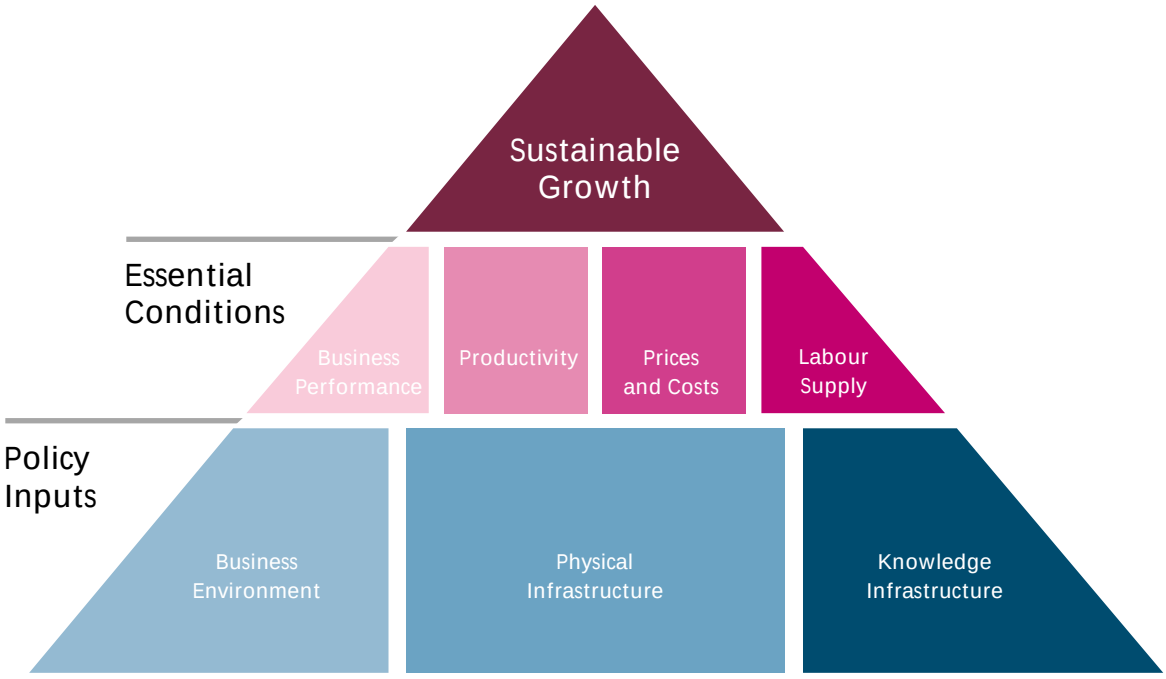
The ability to achieve success in markets leading to better standards of living for all.

However, we also agree with the World Economic Foundation's definition that defines competitiveness as:

The ability of a country to achieve sustained high rates of growth in GDP per capita.

A key difference between the two definitions is that the National Competitiveness Council does not purely describe the success of competitiveness in terms of higher incomes, unlike the World Economic Forum. The National Competitiveness Council has developed the following model to demonstrate the complexity of maintaining sustainable growth in the Irish economy (Figure 6.1). The pyramid differentiates between "essential conditions" and "policy inputs". The former comprise metrics such as strong business performance, good levels of firm productivity, stable and competitive prices and costs, and a flexible and plentiful labour supply. The latter is made up of three main elements: a good business environment, quality physical infrastructure, and high levels of so-called knowledge infrastructure. The Council assesses Ireland's sustainable growth performance in terms of material living standards, quality of life and environmental sustainability. Therefore, competitiveness (in the view of the NCC) is about success in these three areas, not simply economic growth. Environmental policy permeates across several of these areas, but perhaps most particularly in the "business environment" and "prices and costs" areas.

Figure 6.1 National Competitiveness Council "Competitiveness Pyramid"



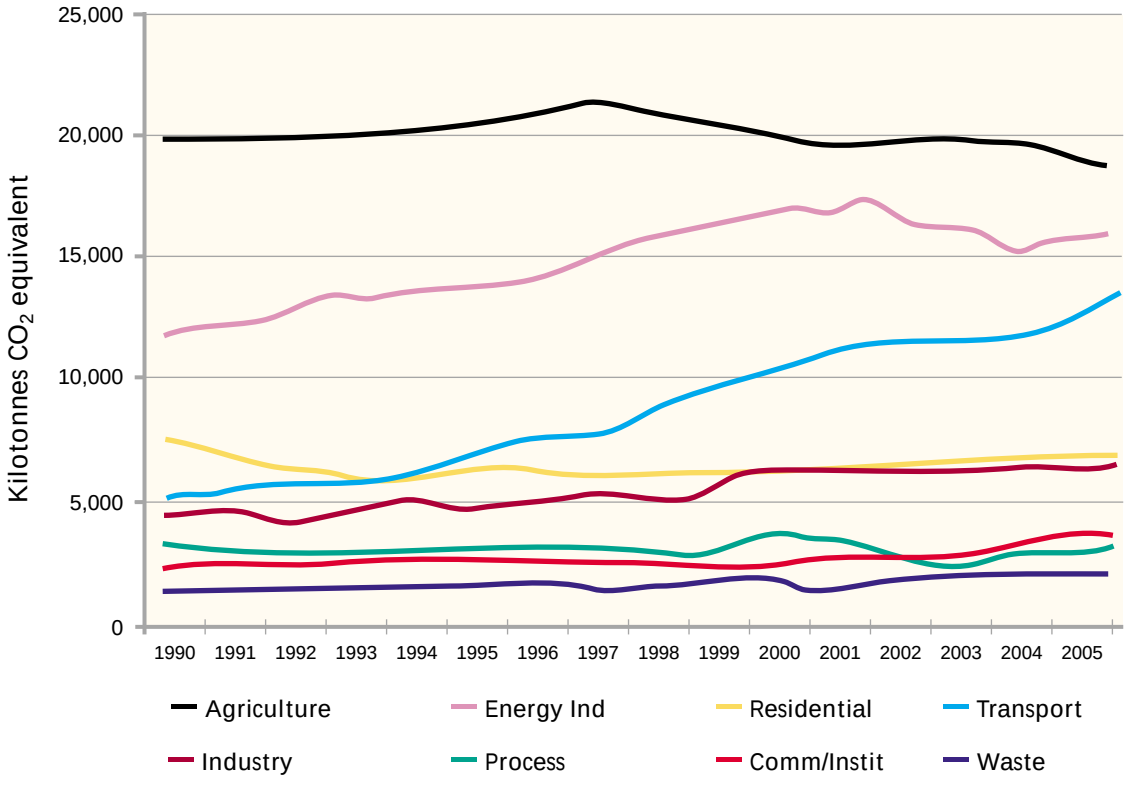
Environmental Sustainability and Competitiveness

Ireland's strong economy performance and growth through the so-called "Celtic Tiger" years is well documented. During this period, Ireland's good economic and competitiveness performance placed pressure on the environment. One illustration of this is the rise in the level of CO_2 emissions during these years, as is shown in Figure 6.2. It is evident that industry's contribution to aggregate CO_2 emissions is far less substantial than the agriculture, energy and transport sectors. This is because the industry sector has changed from being a manufacturing-based sector to one which is now dominated by low-carbon industries primarily in the services sector.

It is important to bear in mind the factors lying behind the increase in Irish CO_2 emissions since 1990. There have been significant increases in population, national income, industrial output, car ownership, house completions, tourist numbers, etc. This leads to the question as to whether it is possible to grow an economy and increase the nation's population while reducing greenhouse gas emissions simultaneously, i.e. to decouple these variables. Evidence suggests that Ireland has done well in managing to increase national income at a far greater rate than the increase in greenhouse gas emissions, but it remains an ongoing issue of key strategic national importance that more is achieved in this regard so that we can reduce pressures on the environment, achieve our binding environmental commitments without damaging economic growth (see Figure 6.3).

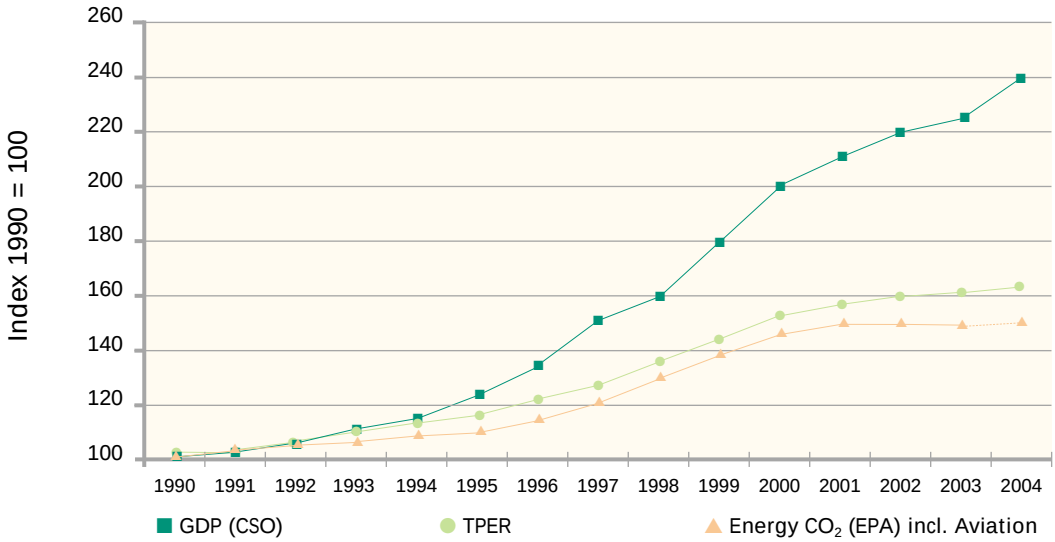
A realistic way of looking at Ireland's present position in relation to environmental sustainability is to benchmark our performance against other developed economies. The following graphs show where there is room for improvement in our performance:

Figure 6.2 Sectoral CO_2 Emissions in Ireland 1990-2005 [215]



[215] Data taken from www.epa.ie

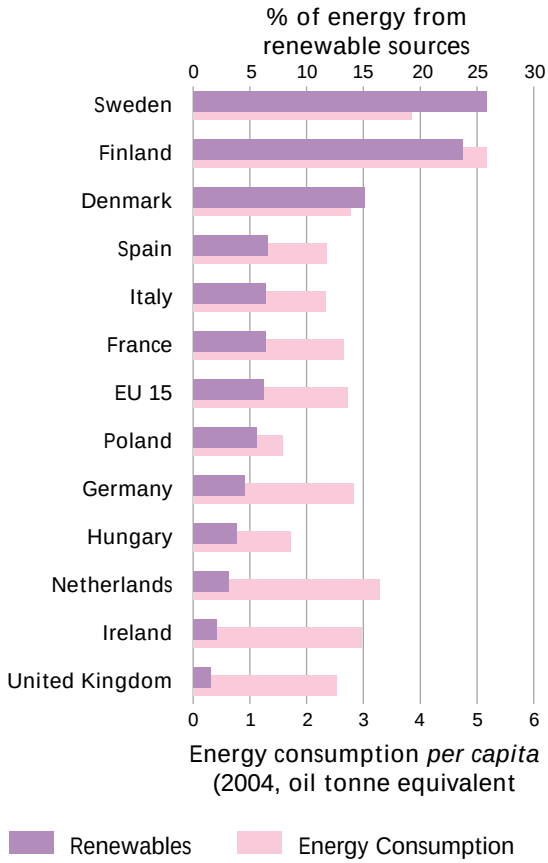
Figure 6.3 Index of Gross Domestic Product, TPER and Energy-Related CO_2 [216]



(a) *Proportion of energy from renewable sources and* per-capita *energy consumption*

This data on OECD countries show that Ireland generates only a small proportion of its energy needs from renewable sources and, although improving, still lags well behind other developed countries, and far behind the EU mean. Data from SEI indicates that the percentage of renewable-sourced energy has risen since 2004 to about 7%.

Figure 6.4 Proportion of Energy from Renewable Sources & Per-Capita Energy Consumption [217]

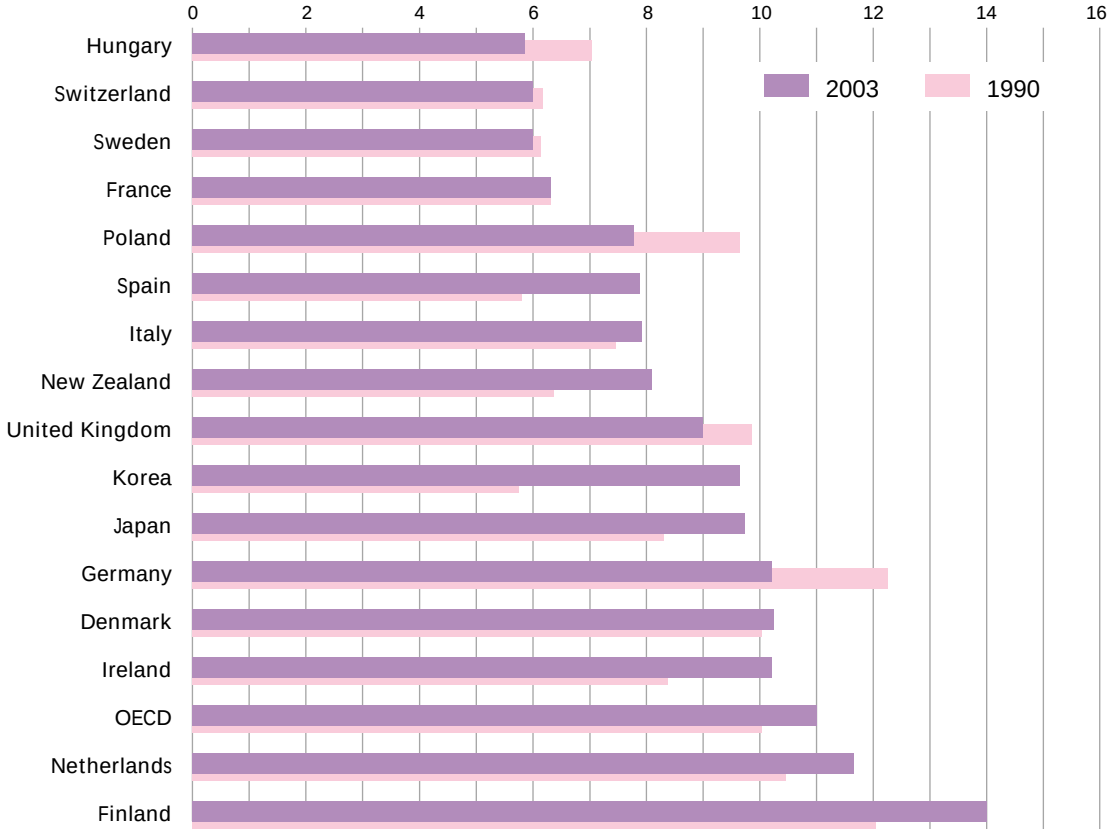


Energy consumption per capita is high in Ireland relative to many other EU countries with only Sweden, Finland and the Netherlands consuming more energy on a per-capita basis. The reasons for this are manifold but include: Ireland's large household size; relatively poor thermal standards in the domestic sector; heavy reliance on private motor transport together with an underdeveloped public transport system; and a continued heavy reliance on energy-intensive agricultural processes.

[216] SEI, *Energy in Ireland 1990 – 2004: Trends, issues, forecasts and indicators* (Dublin: SEI, 2006).

[217] Data taken from the OECD (2004).

Figure 6.5 CO_2 Emissions: 1990 and 2003 [218]



(b) *CO_2 Emissions: 1990 and 2003*

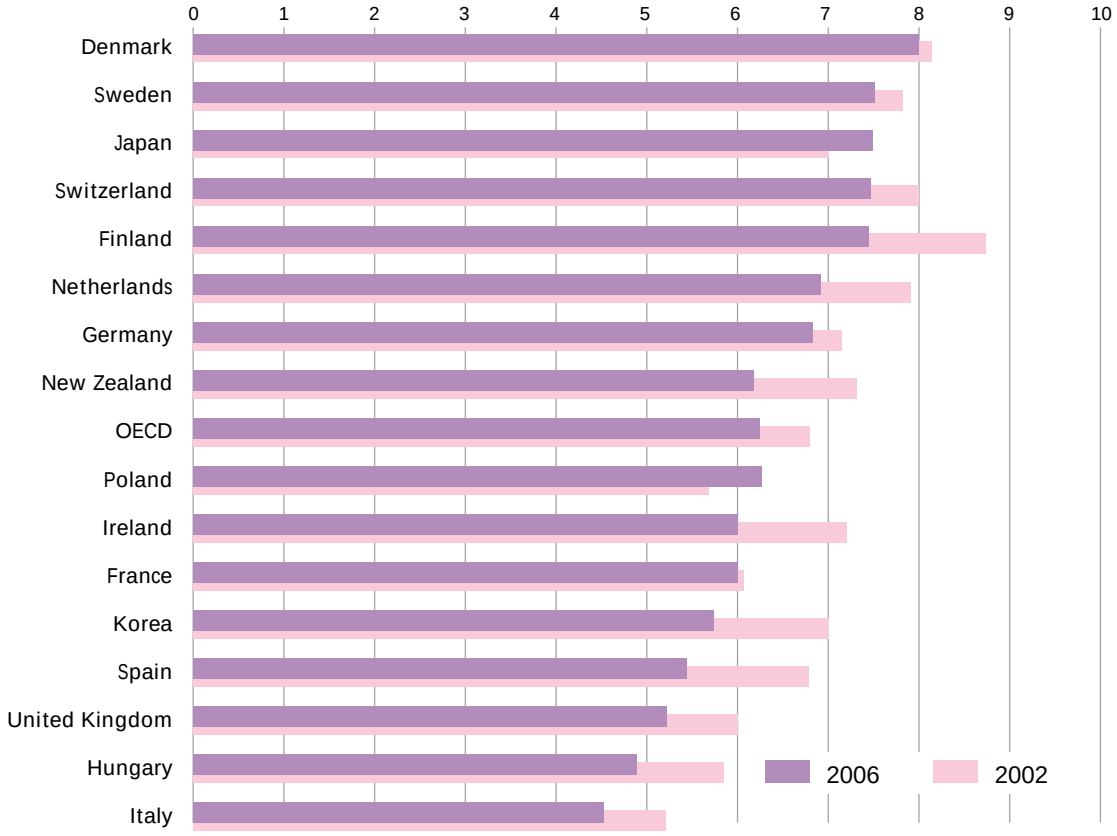
This graph demonstrates that, while Ireland's rate of CO_2 emission per capita is just under the OECD average, our emissions increased through the period of economic growth from 1990 to 2003, although not at a one-for-one rate, i.e. there was decoupling of economic growth and CO_2 emissions during this time period. Despite having emissions of CO_2 below the OECD mean, Ireland's level is above the EU average. Given that per-capita emissions may well underpin the post-Kyoto 2020 EU burden-sharing agreement, this has repercussions for Ireland. The high level of per-capita emissions is due to a number of factors, including, inter alia, our significant agricultural sector, our non-use of nuclear power, fuel tourism between Northern Ireland and the Republic as well as between Continental Europe and the Republic, and a relatively dispersed population. All of these factors make reducing per-capita emissions of CO_2 particularly challenging for Ireland.

(c) *Perceived Prioritisation of Sustainable Development by Firms*

These data, from IMD, are interesting, as they show there is a perception by firms that sustainable development is not prioritised in Ireland and this belief was more commonly found in 2006 than four years prior. This is relevant given that some locational decisions may be based, in part at least, by the perceived "greenness" of a given location and the attendant benefits that this can have for marketing a good or service.

[218] Data taken from the OECD.

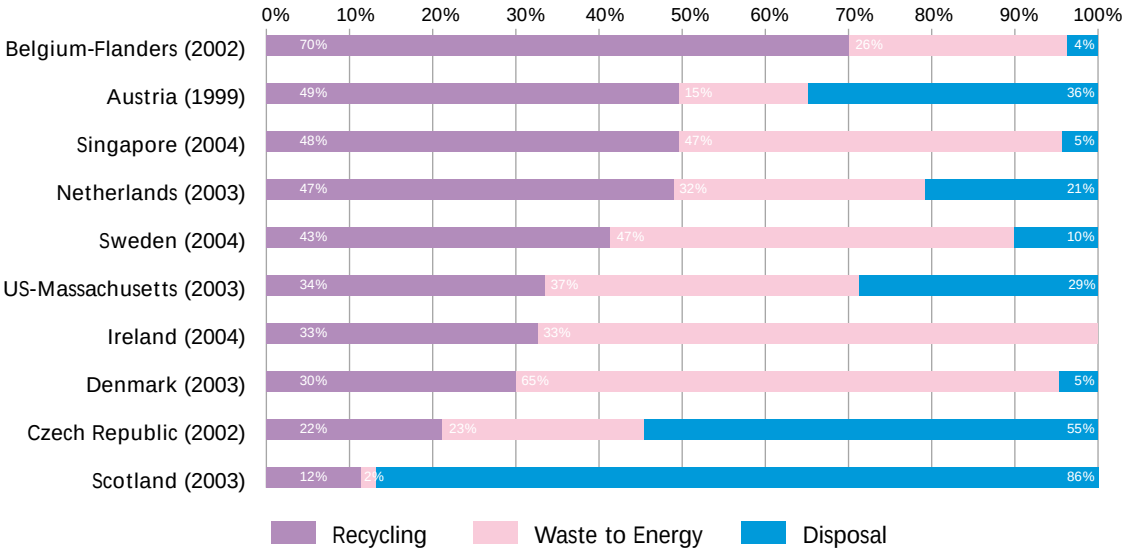
Figure 6.6 Perceived Prioritisation of Sustainable Development by Firms



(d) *Municipal Waste Treatment Performance*

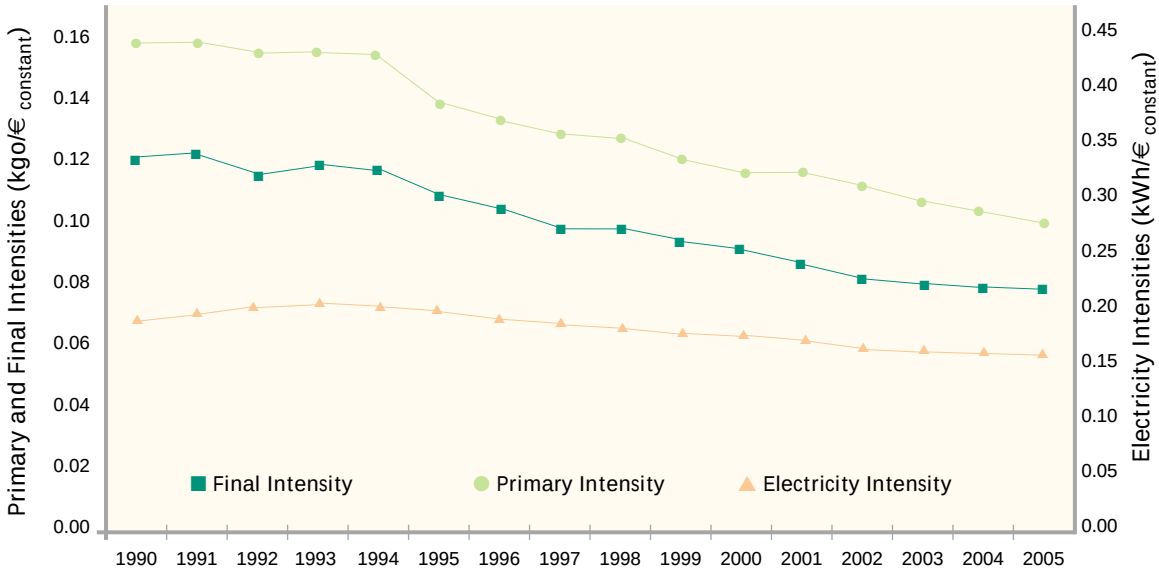
This graph shows the large proportion of municipal waste that goes to landfill sites in Ireland with no waste being converted into energy and a relatively low level of recycling, although the latter has improved dramatically in recent times and continues to do so.

Figure 6.7 Municipal Waste Treatment Performance [219]



[219] Data taken from Forfás.

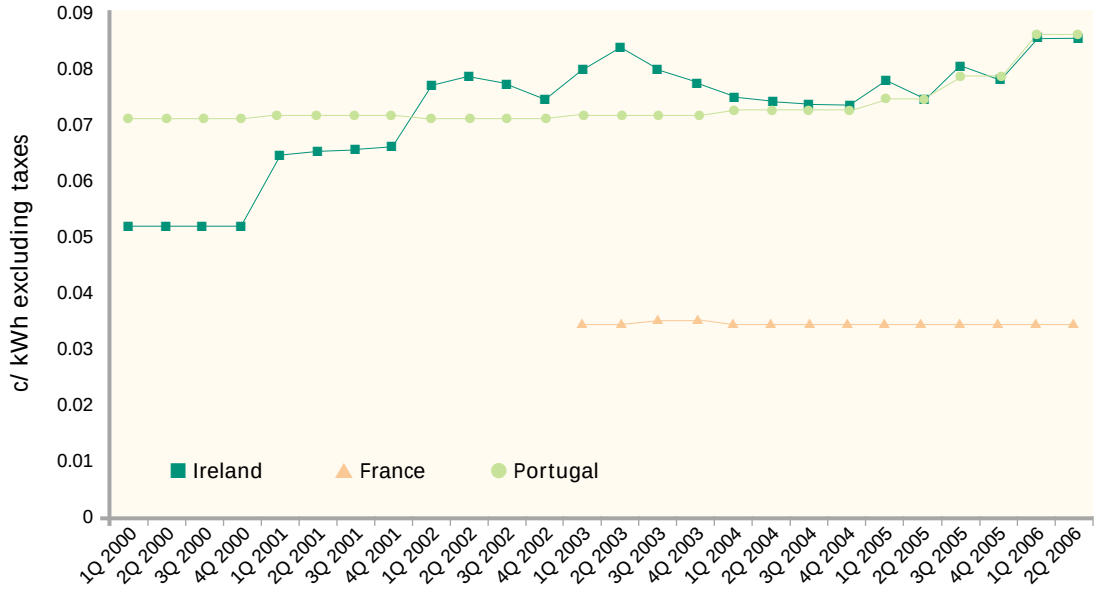
Figure 6.8 Energy Intensity in Ireland, 1990-2005 [220]



(e) *Energy Intensity*

Energy intensity is a measure of the energy efficiency of a nation's economy. It is normally calculated as units of energy per unit of GDP. High energy intensities indicate a high price or cost of converting energy into GDP. Low energy intensity indicates a lower price or cost of converting energy into GDP. Ireland's overall energy intensity rating has improved significantly. Industrial energy intensity between 1990 and 2005 reduced by 54%. The overall energy intensity of the services sector was 17% lower in 2005 than 1990. The intensity of primary, final energy and electricity requirements have been falling since 1990, as illustrated in Figure 6.8. This is due to technological efficiency, choice of fuel mix, economies of scale and changes in the structure of the economy. However, there is further scope for significant improvement and the critical challenge is to ensure that the energy intensity trend remains downward and that energy use is as efficient as possible across all the economic sectors and in all Irish households.

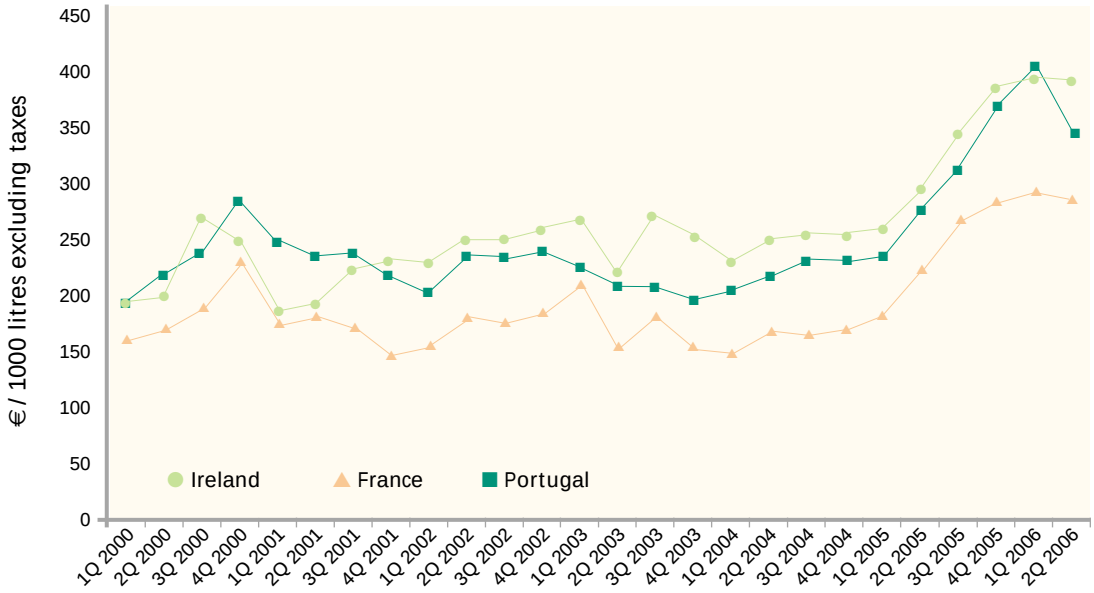
Figure 6.9 Electricity Prices to Industry in Selected Countries [221]



[220] Data taken from SEI, *Energy in Ireland: 1995-2005* (Dublin: SEI, 2007).

[221] Ibid.

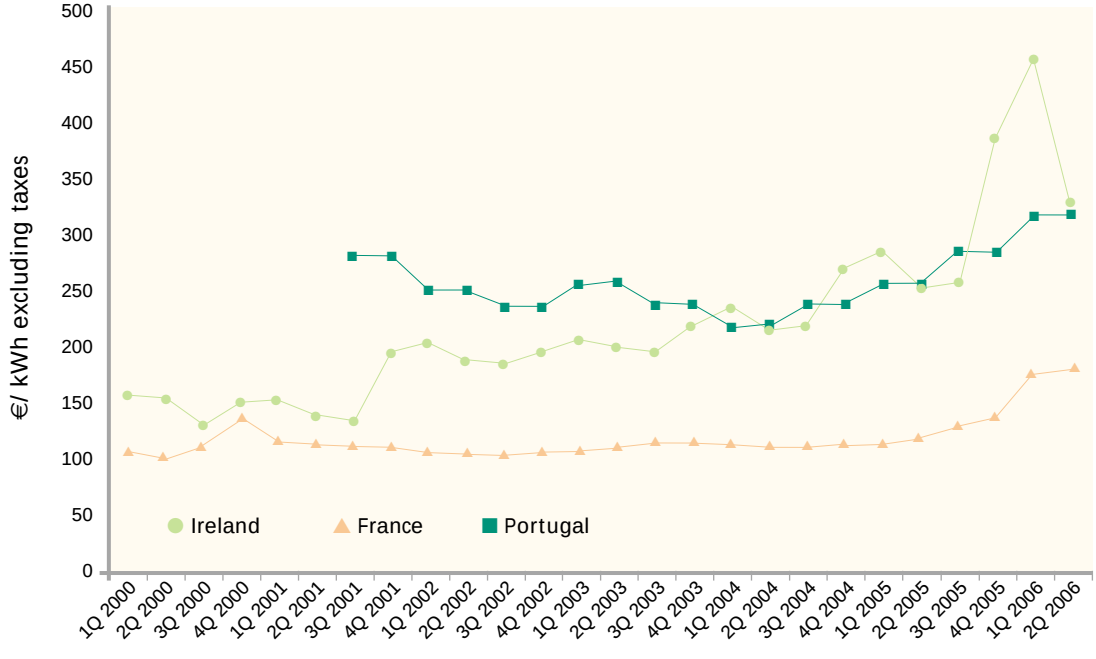
Figure 6.10 Fuel Oil Prices for Industry in Selected Countries [222]



(f) *Cost of Energy to Industry*

Figures 6.9, 6.10 and 6.11 demonstrate the cost of electricity, oil, and natural gas to Irish industry compared with equivalent prices in selected other eurozone countries. Energy is a key driving force behind an economy, so it follows that energy costs will affect cost competitiveness. While the EU has introduced a liberalisation of gas and electricity markets, the effect has not been as deflationary as would have been hoped for. It is also cause for concern that Ireland ranks in the highest quartile of energy costs in the eurozone, despite being placed in the lowest quartile a decade ago.

Figure 6.11 Natural Gas Prices to Industry in Selected Countries [223]



[222] Data taken from SEI, *Energy in Ireland: 1995-2005* (Dublin: SEI, 2007).

[223] Ibid.

Table 6.1 IMD Competitiveness Ranking (2006)

The Top 20 (out of 61) Score 2006	Country/Region	Rank 2005	Rank 2006
100.0	USA	1	1
96.9	Hong Kong	2	2
91.0	Singapore	3	3
90.2	Iceland	4	4
86.0	Denmark	7	5
82.5	Australia	9	6
81.7	Canada	5	7
81.5	Switzerland	8	8
81.5	Luxembourg	10	9
80.9	Finland	6	10
80.6	Ireland	12	11
79.7	Norway	15	12
79.3	Austria	17	13
77.0	Sweden	14	14
75.9	Netherlands	13	15
75.5	Bavaria	18	16
74.2	Japan	21	17
73.0	Taiwan	11	18
71.5	China	31	19
71.4	Estonia	26	20

The challenge is to address these problems while maintaining or improving our competitiveness position. According to the *IMD 2006 World Competitiveness Yearbook* Ireland is placed at 11th place in terms of overall competitiveness. This is a good performance by any standard, but the challenge going forward is to maintain this competitiveness in light of rising costs to industry in Ireland (particularly energy and labour costs) and increasing competition from abroad.

Stern Report on Climate Change

The Stern Review on the Economics of Climate Change discusses the effect of *climate change* and *global warming* on the world economy. Although not the first economic report on global warming, it is significant as the largest and most widely known and discussed report of its kind. Its main conclusions are that 1% of global GDP per annum is required to invest in order to avoid the worst effects of climate change, and that failure to do so could risk global GDP being up to 20% lower than it otherwise might be.

The Stern Review has been criticised by some economists, saying that Stern did not consider costs past 2200; he used an incorrect *discount rate* in his calculations; and that stopping or significantly slowing climate change will require deep emissions cuts everywhere. Other economists have supported Stern's approach, or argued that Stern's estimates are reasonable, even if the method by which he reached them is open to criticism.

The central issue in economic debate over the Stern Review concerned the discounting methodology used to evaluate flows of costs and benefits occurring in the future. There are three main reasons commonly proposed for placing a lower value on consumption occurring in the future rather than in the present:

- consumption levels will be higher in the future, so the marginal utility of additional consumption will be lower;

- future consumption levels are uncertain; and
- future consumption should be discounted simply because it takes place in the future and people generally prefer the present to the future (inherent discounting).

Debate over the Stern Review initially focused on the third of these points. The difference between Stern's estimates and those of others, such as Nordhaus, can largely (though not entirely) be explained by the difference in approach regarding inherent discounting. Stern has been accused of consistently picking the most pessimistic scenario for every choice that one can make. Criticism has also come in the form of claims that he double-counts particularly the risks and he underestimates what development and adaptation will do to impacts.[224] Nordhaus, an economist who has done several studies on the economics of global warming, criticised the Review for its discount rate assumption. The conclusions of the Stern Review were directly opposed to those of the UK House of Lords Economics Committee, both as regards the scientific basis of global warming and as regards the economics of mitigation policies. A number of participants in the Economics Committee inquiry have been prominent among critics of the Stern Review.

Despite this, the key results regarding climate change and competitiveness can be summarised as follows. The transition to a low-carbon economy will bring challenges for competitiveness but also opportunities for growth. The costs of mitigation of around 1% of GDP are small relative to the costs and risks of climate change that will be avoided. However, for some countries and some sectors, the costs will be higher. There may be some impacts on the competitiveness of a small number of internationally traded products and processes. Stern warns about overstating the negative competitiveness concerns and states that such concerns can be reduced or eliminated if countries or sectors act together. Nevertheless, there will be a transition to be managed. For the economy as a whole, there will be benefits from innovation that will offset some of these costs. All economies undergo continuous structural change; the most successful economies are those that have the flexibility and dynamism to embrace the change.

There are also significant new opportunities across a wide range of industries and services. "Markets for low-carbon energy products are likely to be worth at least $500bn per year by 2050, and perhaps much more. Individual companies and countries should position themselves to take advantage of these opportunities. Climate-change policy can help to root out existing inefficiencies. At the company level, implementing climate policies may draw attention to money-saving opportunities. At the economy-wide level, climate-change policy may be a lever for reforming inefficient energy systems and removing distorting energy subsidies, on which governments around the world currently spend around $250bn a year."

Policies on climate change can also help to achieve other objectives, Stern argues. These co-benefits can significantly reduce the overall cost to the economy of reducing greenhouse-gas emissions. If climate policy is designed well, it can, for example, contribute to reducing ill-health and mortality from air pollution, and to preserving forests that contain a significant proportion of the world's biodiversity. National objectives for energy security can also be pursued alongside climate change objectives. Energy efficiency and diversification of energy sources and supplies support energy security, as do clear long-term policy frameworks for investors in power generation. Carbon capture and storage is essential to maintain the role of coal in providing secure and reliable energy for many economies.

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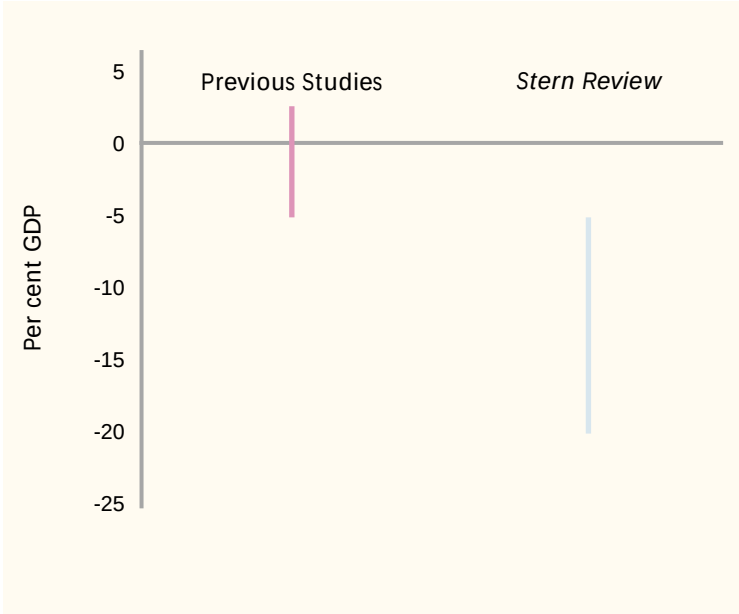
[224] Simon Cox and Richard Vadon, "Running the Rule over Stern's Numbers" (26 January 2007). Accessed Online: www.news.bbc.co.uk

Figure 6.12 Estimates of the Damage Costs of Climate Change: Stern vs Other Published Studies [225]



While acknowledging the contribution Stern has made to the debate, and accepting the broad thrust of its findings, because of the large uncertainty surrounding some of the results of the Stern Report, and the huge variance in its findings compared with most other major, international, peer-reviewed publications on the matter (see Figure 6.12), we believe that care needs to be exercised in interpreting the results of the Stern Report, and that other studies should be taken into account when assessing future economic costs of climate change.

Policy Instruments to Tackle Climate Change

There is a strong case to be made for Ireland paying for the environmental degradation it is causing, based on the grounds of the precautionary principle and the "polluter pays" principle. These principles state:

The "Precautionary Principle" is a moral and political principle, which states that if an action or policy might cause severe or irreversible harm to the public, in the absence of a scientific consensus that harm would not ensue, the burden of proof falls on those who would advocate taking the action.

The "Polluter Pays" Principle is a principle in international environmental law where the polluting party pays for the damage done to the natural environment. It is regarded as a regional custom because of the strong support it has received in most OECD and EU nations.

Given these underlying principles and against a background of maintaining our international competitiveness the impact of the following economic instruments is worth considering with regard to:

- Carbon Energy Taxation
- EU Emissions Trading Scheme
- Sectoral Instruments.

There are of course a range of other instruments, not just economic or fiscal, that can be used to internalise externalities and encourage behavioural change. Potential areas include:

(a) Product policy: introduction of voluntary standards, labelling, certification, energy efficiency in order to promote markets for environmental goods and services;

[225] Adapted from a portion of Figure 1 in Tol and Yohe, "A Review of the Stern Review", in *World Economics* Vol. 7 No.4 (2006), pp 233-50.

(b) Lead markets: encouraging competition, investment and innovation in new technologies;

(c) Creating demand conditions e.g. public procurement;

(d) Resource policy: encouraging sustainable consumption and production;

(e) Trade policy: encouraging the use of domestic raw materials and promoting resource efficiency;

(f) Eliminating environmentally harmful subsidies;

(g) Life-long learning: education to make people more environmentally aware;

(h) Technology leadership, international sectoral benchmarks, and technology transfer;

(i) Investment in R&D;

(j) Energy-efficiency programmes;

(k) Promotion of renewable energy sources, etc.

Much of the above is dealt with in other chapters of this report. This chapter focuses on competitiveness issues as they impact on the enterprise sector and, in this regard, two economic instruments are of particular interest: carbon energy taxation and the EU emissions trading scheme.

(a) *Carbon Energy Taxation*

The Agreed Programme for Government (published June 2007) states:

> *In the context of maintaining a strong economy, (the Government will) investigate fiscal measures to protect and enhance the environment including the introduction of a carbon tax.*

Environmental tax reform covers three main components:

- a shift in the fiscal burden away from labour costs towards environment and natural resource costs (e.g. carbon tax, CO_2-based vehicle road tax);
- an increase in the number of taxes and charges on environmental "bads" and an adaptation of existing schemes to better internalise external environmental costs and cover the costs of environmental services (e.g. landfill levy, plastic bag tax); and
- the removal of tax incentives that give rise to environmental degradation (e.g. tax reliefs for multi-storey carparks, holiday homes, etc.).

There are four main issues for industry regarding environmental taxation:

1. The level/burden of the tax;
2. The ability to pass the burden of the tax on to consumers (the incidence versus the imposition of the tax);
3. The nature of exemptions, rebates and ability to hypothecate revenues; and
4. The timeframe of the introduction and implementation of the tax.

The particular concern for a Minister for Finance, as was stated in TSG Paper 01/22, is to ensure that any measures advanced to promote energy saving do not adversely affect Ireland's international competitiveness, particularly in relation to countries which compete with us and which may have very low taxes or non-existent taxes on energy. This means that it may be unwise for Ireland to be a "first mover" in its introduction of certain environmental policy measures if there is likely to be cost-competitiveness repercussions.

Energy costs as a percentage of gross output vary considerably across industry. According to a 2002 report by Indecon Consultants, some 14% of industry sectors by employment (and excluding electricity, gas and water supply) may be classified as "above-average" energy users i.e. their energy

costs as a percentage of their gross output are between 3% and 10%. Some of the sectors at the top end of this range, however, contain sub-sectors where energy costs exceed 10% of gross output, and substantially more in the case of individual firms. Such firms could be hit hard by the imposition of a carbon energy tax. However, many of these firms are already included in the emissions trading scheme and, as such, should be exempt under proposals for carbon energy taxes to avoid the imposition of double taxation.

Environmental tax measures that are effective in achieving their aim operate where there is an alternative at a lower cost than the tax (e.g. fuel switching to lower carbon fuels), or an alternative to reduce the exposure to the tax (e.g. improving energy efficiency). All other instruments for reducing emissions (e.g. negotiated agreements, regulation, information and awareness programmes) work better when economic instruments for reductions in emissions are also applied. The requirement, therefore, is a taxation and incentives framework that applies across sectors, and is integrated with alternatives, where possible, for decision-makers to reduce emissions. Ireland's specific circumstances (e.g. industrial structure, peripherality) will need to be taken into account in the detailed design of the most cost-efficient options within the Irish tax structure.

Ireland currently collects a considerable proportion of its revenue from environmentally related taxes, especially in the transport sector. If additional environmental taxation is introduced then, in order to minimise the adverse competitiveness impacts, a number of principles should be adopted:

- Lower cost alternatives should be put in place simultaneously;
- Incentives in the area of renewable energy generation should be introduced;
- EU ETS sites should be excluded or partially exempted from the tax as such sites have signed up to emissions ceilings and must pay for additional carbon permits, thereby internalising carbon costs; [226]
- Firms engaged in legally binding negotiated agreements on energy efficiency should be exempted from the tax, as is the case in other member states;
- Carbon taxes must be revenue neutral and revenues from industry should be recycled to industry; and
- Carbon tax must be introduced on a phased basis, commencing at a low level and rising later to allow industry to adjust to the new tax regime and reduce its energy usage.

Taxation measures used in combination with other instruments, in particular emissions trading, need to be implemented with a high degree of care, and it will be necessary to review the impact of taxation (*vis-à-vis* cost competitiveness) and possible revenue-recycling measures for those firms participating in the EU ETS. Strong consideration should be given to exemptions being provided for enterprises engaged in emissions trading, and potentially also those participating in negotiated agreements, and that at least some of the revenue raised should be recycled to industry to avoid adverse cost competitiveness impacts.

Due to the nature of the electricity-generation sector in Ireland, i.e. stronger-than-average concerns around security of supply and imported electricity, it would seem erroneous to apply an input-based carbon tax on this sector, especially as the power-generation sector is already covered under the EU ETS. An output-focused mechanism is preferable. The electricity sector is already a participant in the EU emissions trading scheme, which is a key example of such an output-focused instrument that aims to cap emissions of CO_2.

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[226] Sweden, Denmark, Norway and the UK either exempt ETS sites completely, or pass through between 10% and 20% of the carbon tax to such enterprises.

(b) EU Emissions Trading Scheme

The European Union Emissions Trading Scheme (EU ETS) is the largest multinational, greenhouse gas emissions trading scheme in the world and is a main pillar of EU climate policy. Under the EU ETS, large emitters of carbon dioxide within the EU must monitor and annually report their CO_2 emissions, and they are obliged every year to surrender (give back) an amount of emissions allowances to the government that is equivalent to their CO_2 emissions in that year. The installations may get the allowances for free from the government, or may purchase them from others (installations, traders, governments). If an installation has received more free allowances than it needs, it may sell them to anybody.

In order to make sure that real trading emerges (and that CO_2 emissions are reduced), EU governments must make sure that the total amount of allowances issued to installations is less than the amount that would have been emitted under a business-as-usual scenario. The total quantity to be allocated by each member state is defined in the member state National Allocation Plan (NAP).

The enterprise sector strongly supports ETS as a market mechanism that allows greenhouse gas reductions to be made at least cost. Current discussions on worldwide sectoral agreements have significant potential. Emissions trading will be less important to Ireland as our non-traded sector accounts for 66% of national emissions, well in excess of the 50% EU average. It is, therefore, crucial that Ireland has policies for all sectors of society and is not over-reliant on our small traded sector to meet national targets.

There are two main difficulties with the ETS, as it currently operates, from a competitiveness perspective:

(i) Non-Party Problem

The implementation of the Kyoto Protocol creates an uneven playing field in the sense that firms and sectors in countries that did not sign up to Kyoto (non-signatories like the USA and large developing countries) enjoy an unfair advantage, as they are not subject to carbon constraints. Competitiveness concerns were the explicit prime motivation for the withdrawal of the USA from Kyoto. There is also an additional loss of competitiveness for Signatories resulting in implementing carbon-reducing policy.

(ii) Implementation Problem

Countries within EU ETS may create unfair competitive advantages for domestic industry by the way they implement their Kyoto commitments. This is becoming less of an issue as the European Commission increases the degree of harmonisation of the National Allocation Plans across the EU which will result in tighter allocation methodologies being employed for grandfathered permit allocations.

The addition of the aviation sector could be a very real problem, particularly for Ireland as an island nation with the headquarters of one of Europe's largest carriers. To improve the scope and liquidity of the scheme, we should try and link the EU ETS to other policy measures. It is clear that the likely future allocation methodologies of sectoral benchmarking and auctioning will increase the harmonisation in member states' allocation methodologies and reduce competitive distortions between firms within the EU 27.

Ultimately, there are three key variables that together serve as a useful screen for assessing competitiveness impacts in any given sector:

1. Energy intensity
2. Ability to pass on increased costs to consumers
3. Opportunities for abatement.

(i) *Energy intensity*
The more energy a sector or firm uses in its production process, the more it will be vulnerable to price increases through either carbon taxes or through auctioned permits in the EU ETS. Under any implementation scenario of the ETS, energy prices are likely to increase as permits have to be bought (rather than given for free) from the Government. In aluminium, cement and the co-op (food) sectors, where energy can comprise more than 30% of the cost of production, the potential exposure is palpable.

(ii) *Ability to pass on costs to consumers*
This ability depends on the availability of substitutes, either other goods that satisfy the same needs, or production from foreign firms in the same sector. Transport costs are an important factor here. If these are high, costs are likely to increase as ETS is rolled out further to include aviation. The global nature of the product's market is also an important factor in assessing the competitiveness impacts of ETS. If the product is "perfectly" global, then firms located in ETS-participating countries will face higher production costs. At the firm level, the degree of domestic competition is important. The more monopoly power, the better able a firm is to pass on cost increases to consumers in the form of increased prices. The nature of the product in question also matters. Is it a luxury good that consumers will buy more of when prices fall, or is it a staple that will be bought in steady volumes regardless of price? It is worth noting that the power-generation sector will, from November 2007, be in a situation where it can pass through 100% of the opportunity cost of carbon.[227] This will likely lead to increases in the cost of electricity for Irish consumers.

(iii) *Abatement opportunities*
Firms and sectors where there are unexploited low-cost opportunities for abatement have advantages over those where there is no "low-hanging fruit" (either because it has already been harvested, or because the state of technology is not well advanced). Ireland may have limited opportunities here given the relatively high penetration of energy efficiency in the commercial and industrial sectors.

(c) Sectoral Instrument – the Case of Road Pricing

A number of sectoral instruments can be considered in the context of climate change. One key economic instrument is that of road pricing in the transport sector. Such an instrument aims to reduce the number of private motor vehicles using roads by charging motorists on a marginal cost basis in an attempt to ease congestion and thereby reducing greenhouse gas emissions.

Road pricing is a term that refers to the charging for the use of streets and roads. Charging motorists directly for their use usually does this. It can include tolls imposed by the owners of specific roads as well as charges imposed by governments for the use of any roads within some defined zone.

There are many sound economic arguments for (marginal) road pricing. Pricing of roads creates a choice, and choices are fair because individuals and firms are not homogenous. Sometimes individuals and firms have high values of time (e.g. when they are late for an appointment, or when firms have production targets), sometimes they have lower values of time (e.g. when individuals are enjoying the drive or when firms are engaged in goods or services that are not time-bound). The corollary is that making all drivers pay the same tax to receive the same service isn't fair if individuals and firms value the service differently. Another argument is that, while road pricing may be unfair to some road users, the alternative, i.e. congestion, is unfair to all road users since it wastes everyone's resources. The ultimate fairness of road pricing is only determined once the use of any

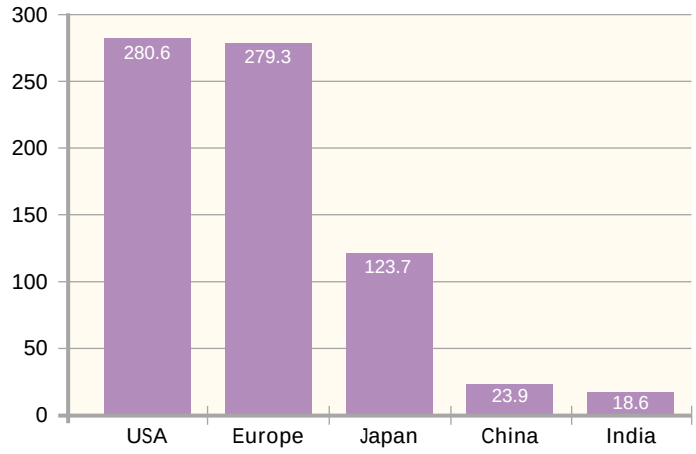
[227] Currently, there is partial pass-through of the price of carbon to consumers.

net revenues is taken into account. However, it should be noted that recent data from Forfás and the NCC (Forfás, 2007) highlight that average peak-hour speeds in Dublin, at 16.5km/h, are now among the lowest in the EU (28th out of 30 cities) indicating that there is a strong need, on both quality-of-life and business-need/competitiveness perspectives, for an urgent policy response to ease congestion in Irish cities, especially Dublin.

The dangers to Irish business with regard to marginal road pricing relate mainly to arguments surrounding "fairness" and whether such charges actually succeed in internalising externalities and result in increased ease of movement for individuals and firms. Ireland's economy relies disproportionately on road transport and road haulage due to historical reasons and infrastructural gaps. Adding a tax to road use could harm businesses, especially SMEs on tight margins that have little choice in switching to alternative modes. Some economic theorists argue that roads produce positive externalities that outweigh the opportunity cost of congestion, i.e. road pricing reduces the overall number of journeys, thus harming business and economic growth. In particular, Steven Norris argues that the cost of the UK congestion charge disproportionately hits low-paid workers whose working hours start at night when public transport is not available and end when the congestion period is in force, indirectly hitting London's service economy. Because of the arguable current lack of choice of viable options to private road transport and haulage, it could be overly punitive to impose such a charge on Irish motorists and businesses, especially given the already high environmental taxes in this sector (VRT, excise duty, etc.). It is important to note, however, that increasing the marginal costs of private transport will increase the economic attractiveness of public transport, freight on rail, etc.

Opportunities from Climate Change

Figure 6.13 Environmental Goods & Services Market by World Trade Area 2004



(i) *Environmental Goods and Services*

According to the OECD definition, the environmental goods and services (EGS) industry consists of activities which produce goods and services to measure, prevent, limit, minimise or correct environmental damage to water, air and soil, as well as problems related to waste, noise and eco-systems.[228] It covers vital, long-established industries such as drinking water supply, waste-water treatment and solid waste management. At the same time, it encompasses newer industries at the leading edge of technological innovation, such as environmental monitoring, renewable energy and "clean" technologies. Such technologies and processes, which minimise pollution and material use, and clean products which are less environmentally damaging are increasingly important, but somewhat more difficult to account for, according to OECD research.

The EGS sector is hugely diverse, dynamic and growing rapidly year on year. The global EGS sector was estimated to be worth €745 billion in 2004, with the EU, US and Japan accounting for around

[228] OECD, *The Environmental Goods and Services Industry: Manual for Data Collection and Analysis* (Paris: OECD, 1999).

94% of the total, as shown in Figure 6.13.[229] The UK alone accounts for 8.2% of the global market. The EGS sector, therefore, fits between the pharmaceutical industry and information technology industry in size (excluding most clean technologies), with an EU market of some €279.3 billion.[230] Research by the UK Government predicts that the global market for the EGS sector will increase by between a third and a half over the coming decade.[231]

An OECD study in 1999 indicated that the USA, German and Japanese industries have the largest shares of most international markets, and have considerable surpluses in environmental trade. Some smaller countries such as Finland and Norway have very internationally-oriented industries, exporting around 50% of their production, but they do not have a large share of the global market. Recently, Australia, Canada and the United Kingdom increased their efforts to expand environmental exports.[232] However, these figures do not appear to have been updated by the OECD. Conservative estimates indicate that employment in the environment industry is growing at a rate of more than 1% of total employment in most OECD countries and a good deal higher in the EU where more stringent environmental regulations and standards set the broad framework as regards demand for environmental goods and services.[233] Over the past decade or so, there has been a paradigm shift in the regulatory focus towards economic instruments, incentives and voluntary agreements which concentrate more on overall environmental performance and give greater flexibility in achieving environmentally satisfactory solutions. This has been coupled with greater emphasis on clean technologies and energy-efficiency products. Both provide new impetus for the enterprise sector.

In terms of markets, there are exciting global opportunities for EGS companies. In the EU, many of the "new" member states require substantial investment in basic environmental infrastructure, such as water supply and waste management. In the developing economies of Asia, South America and non-EU countries of the former Eastern Bloc, the potential is even greater. Many of these markets will require considerable investment in primary environmental services such as clean air, waste management, water and land over the next 10 years, as they continue to industrialise or clean up the legacy of earlier industrialisation. Without doubt, some of the greatest potential opportunities are likely to be found in China and India. The size of the countries and the scale of the challenges mean that these two markets are predicted to have the fastest growing EGS markets.

Potential sub-sectors of interest to Ireland in the EGS sector include:

- Air pollution control;
- Cleaner technologies and processes;
- Environmental consultancy;
- Environmental monitoring, instrumentation and analysis;
- Energy efficiency;
- Energy management and auditing;
- Marine pollution control;
- Noise and vibration control;
- Remediation and reclamation of land;
- Renewable energy;
- Waste management, recovery and recycling; and
- Water supply and wastewater treatment.

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229 UK Centre for Economic and Environmental Development, *Emerging Markets in the Environmental Industries Sector* (London: DTI, 2006).

230 Ibid.

231 Ibid.

232 OECD, *The Environmental Goods and Services Industry: Manual for Data Collection and Analysis* (Paris: OECD, 1999).

233 Data taken from www.oecd.org

Uncertainties regarding both environmental regulations, and in the supply of and demand for new technologies and services, have proved to be significant barriers to the development of the industry. Poorly developed markets, issues of economies of scale, differences in regulatory frameworks from country to country, trade embargoes, technical regulations and specifications which inhibit flexibility and innovation have also posed problems on the supply side. Development of the industry may also be inhibited by financial restraints. This is a principal hurdle for start-ups and small businesses in new areas, which combine a range of (often costly) technologies aimed at providing improved environmental solutions. Pollution control and environmental improvement have been singled out by all OECD countries as important socio-economic objectives, and have therefore received substantial R&D resources. Since about half of global investment in the field comes from government expenditures, government purchasing and procurement has a major impact on the industry in many countries.

While it is important to create the optimal framework conditions and environment conducive to a flourishing environmental goods and services sector in Ireland, attention will need to be paid to state aid implications. Any new scheme to benefit the sector will have to comply with the latest rules on this matter. Such regulations include: the Promotion of Risk Capital Investment in SMEs, the Community Framework on State Aid for R&D and Innovation, and the Guidelines on Regional Investment Aids.

(ii) Other Potential Benefits

There may be some other benefits for Ireland associated with climate change in the areas of agriculture, tourism and health.

(a) *Agriculture*

It has been suggested that a positive effect of global warming would be increased agricultural yields, because of the role of carbon dioxide in photosynthesis which is responsible for significant destruction of several crops. In colder parts of the northern hemisphere (e.g. Iceland) rising temperatures have made possible the widespread sowing of barley, which was untenable twenty years ago. Some of the warming is due to a local (possibly temporary) effect via ocean currents from the Caribbean, which has also affected fish stocks.[234]

While local benefits may be felt in some regions, recent evidence is that global yields will be negatively affected. "Rising atmospheric temperatures, longer droughts and side-effects of both, such as higher levels of ground-level ozone gas, are likely to bring about a substantial reduction in crop yields in the coming decades, large-scale experiments have shown."[235] The region likely to be worst affected is Africa, both because its geography makes it particularly vulnerable, and because 70% of the population relies on rain-fed agriculture for their livelihoods. Tanzania's official report on climate change suggests that the areas that usually get two rainfalls in the year will probably get more, and those that get only one rainy season will get far less. The net result is expected to be that 33% less maize – the country's staple crop – will be grown.[236] It seems likely that the global fall in agricultural yields will put upward pressure on the price of food, particularly in poorer countries, resulting in increased poverty and possible food shortages.

Due to rising demand for biofuels, farmers worldwide have an increased economic incentive to grow crops for biofuel production instead of food production. Without political intervention, this could

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234 Paul Brown, "Frozen Assets", *The Guardian* (30 June 2005).

235 "Climate change poses threat to food supply, scientists say", *The Independent* (27 April 2005).

236 John Vidal, "In the land where life is on hold", *The Guardian* (30 June 2005).

lead to reduced food production and increased food prices. In early 2007 there were a number of reports linking stories as diverse as food riots in Mexico due to rising prices of corn for tortillas and reduced profits at Heineken, the large international brewer, to the increasing use of corn (maize) grown in the US Midwest for bio-ethanol production.[237] Such impacts on food prices resulting from increased biofuel production may go some way to negate any potential benefits to Ireland and other parts of the EU. Furthermore, the European Commission has been strongly criticised by the OECD in a report issued in September 2007 that warned that subsidies for biofuels produced in Europe and America could disrupt markets without generating significant environmental benefits.

(b) *Tourism*
Colder parts of the northern hemisphere, including Ireland, may benefit from an increased numbers of tourists, as traditional holiday hot-spots become too hot. However, there is much uncertainty around this, and the economic benefit of this will likely be more than outweighed by the likely costs of climate change.

(c) *Health*
It seems likely that milder winters in cold parts of the world, including Ireland, could result in fewer cold-related deaths during the winter months. Currently, Ireland has approximately 2,000 excess winter deaths that are attributable to temperature fluctuations.[238] Again, however, this benefit will probably be negated by the increased number of deaths from extreme weather events, including flooding and storms.

Conclusions

According to the International Institute for Sustainable Development (2005),

> Competitiveness concerns are real with potential to cause economic damage .... Even aside from the economic implications for particular sectors, they are potential obstacles to the political acceptability of Kyoto implementation, and deserve significant attention from policy makers.

(a) *EU ETS*
Regarding EU ETS and Kyoto, it is clear that a global agreement where countries and firms faced equivalent effort would remove many competitiveness concerns and would be strongly supported by business. A post-Kyoto deal that paves the way for such an eventuality would significantly lessen many of the competitiveness concerns.

Where the competitiveness impacts of climate change measures are projected to be important (e.g. cement, aluminium, certain food firms), flexibility in the allocation of obligations at national level may help to manage the pain for enterprise. Ultimately, there are three key variables that together serve as a useful screen for assessing competitiveness impacts in any given sector:

- The energy intensity of the sector;
- The ability to pass on increased costs to consumers; and
- The opportunities for abatement at lower marginal cost.

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[237] Kevin Morrison, "Blow for beer as biofuels clean out barley", *Financial Times* (25 February 2007).

[238] JD Healy, *Housing, Fuel Poverty and Health: A Pan-European Analysis* (Ashgate: Aldershot, 2004).

(b) *Carbon tax*

Carbon taxation appears now to be a political reality in Ireland, so how do we manage the burden for enterprise so that it does not adversely impact on economic growth? This chapter argues that a number of principles be adhered to when designing climate change policy instruments, such as the introduction of a CO_2 tax. There are some key points from a competitiveness perspective:

1. The instrument (e.g. carbon tax) should be revenue-neutral to industry and revenue-recycling options should be examined ex ante so that industry is treated fairly and given the opportunity to switch to more low-carbon processes. Given that firms engaged in EU ETS are internalising the costs of carbon, and will do so at an increasing level post-2012 when auctioning of emissions permits becomes the standard allocation methodology, such enterprises should be exempted from carbon taxes or given large rebates.

2. The level/burden of the tax is important, and should ideally be set at a rate that results in a proposed abatement target of emissions reductions (e.g. a 3% reduction in CO_2), or relative to some benchmark based on international carbon tax levels. Alternatively, it could be set to the estimated market value of carbon, enabling the full (market) cost of carbon to be passed on to consumers (where applicable).

3. The ability to pass the burden of the tax or charge on to consumers is important. The more monopoly power there is in a given sector, the more likely the tax or charge will be passed on to consumers. In a perfectly competitive market, some firms may be able to absorb some of the cost themselves through increased process efficiencies, etc., but others may not. In industries where profit margins are tight, some firms may be vulnerable to closure.

4. Consideration needs to be given to the nature of exemptions, rebates and the ability to "ringfence" or hypothecate revenues. Rebates or exemptions outside EU ETS could be tied to legally binding negotiated agreements e.g. IS 393.

5. In order to facilitate proper planning it would be necessary for the government to signal, well in advance, the definitive start date for the tax and the level for the tax in year one and subsequent years. This is because it is evident that industry cannot change its energy requirements with immediate effect. Firms have made decisions about technologies based on previous tax codes and cannot easily or quickly adjust to an increased tax regime. A definitive approximate starting date for the tax should be announced at least two years in advance, and the rates to be applied in each year should be announced at that time. From the perspectives of public and industry acceptability, the tax should be implemented at a time when oil prices are relatively stable and low.

(c) *General conclusions*

As a general point, it is recommended that the National Climate Change Strategy be fully costed and then implemented in the most efficient basis. It could be argued that Ireland currently does not have the institutional arrangements to deliver the Strategy and that a separate Climate Change Office should be established.

The importance of energy efficiency in meeting our Kyoto commitments at least cost while improving our competitiveness should be given priority. Government should accelerate supports and incentives like the Enhanced Capital Allowances Scheme, the Low Carbon Technology Incubator Scheme and the Energy Efficiency Loan scheme, all of which are run by the Carbon Trust covering 15 categories of technology and 13,000 products. They increase the uptake of low-carbon technologies and improve efficiency.

Ireland's energy supply structure, large agricultural sector, rapidly increasing transport sector, and relatively modern and efficient industrial base make the economy more susceptible to loss of competitiveness and more dependent on achieving emissions reductions elsewhere in the EU and globally to protect national competitiveness. In addition, our distance-to-target estimates make it evident that Ireland will be more reliant on overseas Government purchases than most other Kyoto signatories. Restrictions on the use of flexible mechanisms will significantly impact the cost of compliance and competitiveness. Climate change is a global problem and there appears to be no rationale as to why there should be a restriction on the access to both the Joint Implementation and Clean Development Mechanisms, as it is contrary to Kyoto and restricts technology transfer to the developing world. The Head of the UNFCCC made this point.

The expansion and development of North-South and East-West inter-connectors are critical to increase diversity, capacity, security, and reduce peripherality. They will be key enablers in realising the benefits of renewable energy resources by sharing of resources and trading, as well as enhanced system security and reduced system costs.

Efforts must be made to engage with the investment and financial services sector to raise awareness of climate change and to encourage the emergence of a low-carbon technology sector through direct venture capital investment. In this respect, and in others, the UK Carbon Trust should be examined and its usefulness as a model for promoting a low-carbon economy should be considered in Ireland.

It is important to stress that there is potential for endogenous improvements technology know-how resulting from strong environmental regulation that may drive ability to meet Kyoto at low cost.[239] In the medium-term, the enterprise sector must seize the benefits that will arise through opportunities in the environmental goods and services sector, which is forecasted to be a key growth area across the EU and Ireland.

[239] For more information see: M. Porter and C. van der Linde, "Green and Competitive", in the *Harvard Business Review* (September/October 1995), pp120-134. See also Sijm *et al*., "An Assessment of the Incidence of Carbon Leakage and Induced Technological Change due to CO_2 Abatement Measures", in *Netherlands Research Program on Climate Change*, Report 500036 002 (2005).

Part II Working Groups' Analysis

Chapter 7 Scenarios of Economic and Social Consequences

Introduction

This chapter clarifies the potential positive and negative consequences of greenhouse gas mitigation policy to 2020 in Ireland. There is significant uncertainty in the development of this complex issue into the future. The use of scenarios has been established in the literature and by the IPCC as the appropriate technique to elaborate on these issues.[240]

The analysis takes account of the impact of climate change and the challenges for Ireland as set out in earlier chapters. It is recalled that the direct impacts of climate change are already being felt and are potentially severe in the long-term. There are also more immediate short-term consequences of the mitigation policies and measures employed to reduce GHG emissions. The accelerating impacts of climate change are considered in this analysis, and are signalled in the scenarios set out below.

The chapter focuses on the possible positive and negative consequences of mitigation policy to reduce GHG emissions in Ireland to 2020. The economic and social consequences of mitigation policy in Ireland will be dictated by the following:

(i) the starting point and emissions trajectory to 2020

(ii) the target which Ireland receives for 2020

(iii) the development and evolution of the key drivers of this emissions trajectory including policy, economy, technology, demography etc.

(iv) the type and design of mitigation policies that are introduced in the period to 2020.

Included in this analysis are the possible targets and projected emissions trajectories determined from the literature. The development of the key drivers and the types and design of policies have been explored through scenario analysis, expert judgment and literature survey.

A critical gap in knowledge for climate policy-making exists in Ireland with the absence of research on national mitigation potential to 2020. International literature on projected emissions and mitigation has been used in the analysis.
The four principal criteria for evaluating environmental policy instruments are:

(i) environmental effectiveness (positive environmental outcomes such as reducing GHGs)

(ii) cost-effectiveness (a minimum cost to society).

(iii) distributional considerations (includes dimensions such as fairness and equity)

(iv) institutional feasibility (legitimate, accepted, adopted and implemented).[241]

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[240] N. Nakicenovic and R. Swart, *Special Report on Emissions Scenarios* (Cambridge: Cambridge University Press, 2000).

[241] S. Gupta, D. A. Tirpak, N. Burger, J. Gupta, N. Höhne, A. I. Boncheva, G. M. Kanoan, C. Kolstad, J. A. Kruger, A. Michaelowa, S. Murase, J. Pershing, T. Saijo, and A. Sari, "Policies, Instruments and Co-operative Arrangements", in *Climate Change 2007: Mitigation* (Cambridge and New York: Cambridge University Press, 2007).

These establish the three constituents of sustainable development: environment, economy and society. In order to meet environmental objectives while protecting from economic and social consequences it is necessary to analyse policy under multiple criteria. The magnitude of GHG reductions required necessitates the development of strong policy to reduce emissions but efficient policy to limit harmful effects. Alternative definitions of strong policy and efficient policy exist (see the Debate Box, under Scenario 1).

It is prudent that any assessment of consequences also examine positive effects of mitigation policies that are documented in the literature but not always documented in national policy analyses. Potential positive consequences of implementing policies (apart from directly preventing climate change) which often receive less attention include improved air quality, improved energy security, growth in indigenous industry with renewable energies, lower energy costs and increased employment.

The Scenarios Methodology

A scenario analysis was adopted as the appropriate analytical framework. This technique allows the economic and social consequences of climate change mitigation policy in Ireland to be explored in the context of two key issues or "pivotal uncertainties": (i) policy strength and (ii) economic growth. Policy determines what commitment and urgency there is for the development and implementation of mitigation measures to reduce GHG emissions, and is uncertain (targets, commitment, urgency, measures). Economic growth is a key driver of emissions through consumption of goods and services and particularly increasing energy demand, and is also uncertain. Future oil price is also a relevant consideration. Near term policies are crucial in reducing the costs and consequences of reducing GHG emissions globally and nationally.[242] They are also critical to reducing long-term risks of climate change impacts globally and the potential long-term environmental, social and economic upheaval this may entail.

As the future is inherently uncertain, the scenarios produced in this analysis are not predictions of Ireland in 2020. The possibility that any single scenario will occur is highly uncertain.[243] However, they aim to span the likely range of future outcomes, in contrast to single forecasts that have potentially high uncertainty.

The scenarios detail four storylines of development. They have a function in formal rational analysis of consequences; they also have a function as a communication tool through the narratives as an intuitive exercise.[244]

Scenarios allow complex analysis of multiple drivers of development and give structure and meaning to how they evolve over time. Strategic policy can then be designed to deliver desirable outcomes and prevent negative consequences. The scenarios have followed best practice examining drivers, issues, trends, logics and uncertainties developed by group discussion and the relevant literature.

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[242] N. Nakicenovic and R. Swart, Special Report on Emissions Scenarios (Cambridge: Cambridge University Press, 2000); and B.S. Fisher, N. Nakicenovic, K. Alfsen, J. Corfee Morlot, F. de la Chesnaye, J.-Ch. Hourcade, K. Jiang, M. Kainuma, E. La Rovere, A. Matysek, A. Rana, K. Riahi, R. Richels, S. Rose, D. van Vuuren, R. Warren, "Issues related to mitigation in the long-term context" in *Climate Change 2007: Mitigation* (Cambridge: Cambridge University Press, 2007).

[243] N. Nakicenovic and R. Swart, *Special Report on Emissions Scenarios* (Cambridge: Cambridge University Press, 2000).

[244] P.W.F. Van Notten, J. Rotmans, M.B.A van Asselt and D.S. Rothman, "An Updated Scenario Typology", in Futures, Vol. 35 No. 5 (2003), pp 423-443.

In summary, the scenarios are:

- The appropriate technique to examine climate change issues in line with IPCC methodology
- An efficient tool for examining and communicating complex information
- Stories or visions of the future, of how dynamics unfold
- Plausible descriptions of possible future worlds, not predictions
- Not a statement of probabilities; no one scenario is more likely than another
- Neutral, neither good nor bad, but each scenario contains elements of both
- Not a repeat of present dynamics, they reflect change
- Designed to be provocative and challenging, helping us to think differently
- A tool to show where alternative paths might lead us and can be used as early warning
- A tool to help decision-makers to look at long-term consequences of actions
- Analyses of consequences based on the literature.

The Four Scenarios

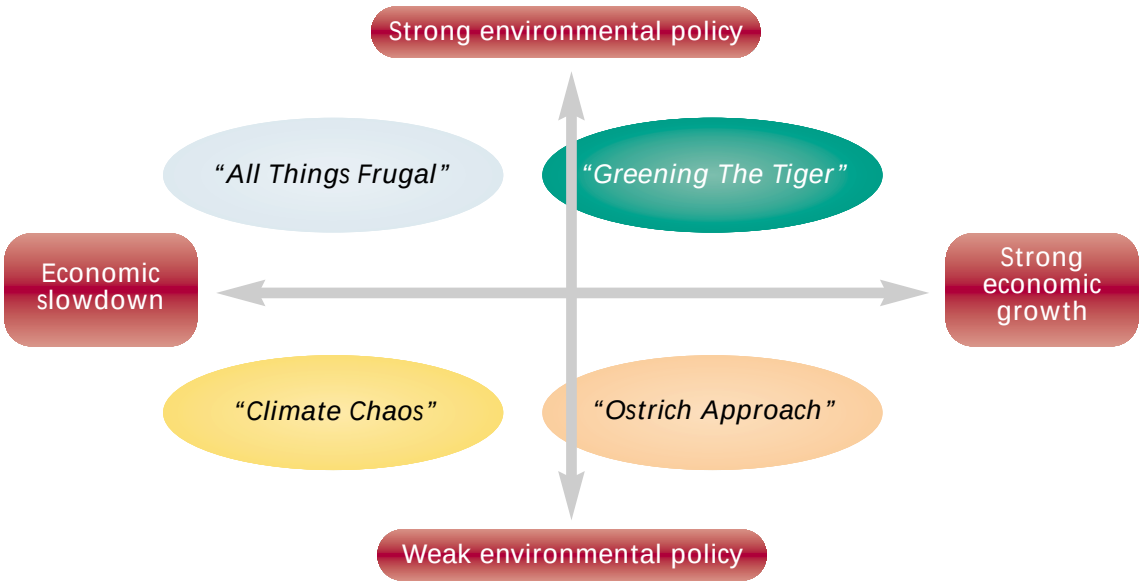
The following four scenarios detail the economic and social consequences of policies to mitigate Irish GHG emissions up to 2020, and some of the possible impacts that could result in the interim. They are augmented by the testing of some headline issues at the end of each scenario.

The scenarios have been constructed using *Environmental Policy* (Sustainability) and *Economic Growth* as the key uncertainties. Environmental policy includes commitment, urgency, efficiency, governance, sustainability, implementation and cooperation at international, EU and national levels. This technique allows the analysis to examine the divergent futures that may unfold.[245]

The four scenarios are now presented in turn, starting with the *Strong Policy* scenarios with fast economic growth, *Greening the Tiger*, and alternatively with economic slowdown, *All Things Frugal*. Next to be discussed is the *Ostrich Approach* scenario in which, despite strong growth, *Weak Policies* are implemented where environmental and social implications have been poorly considered. Finally, the *Climate Chaos* scenario is one where society finds itself in a situation where there is both economic slowdown and weak policy.

[245] Susan A. van't Klooster and Marjolein B.A. van Asselt, "Practising the scenario-axes technique", in *Futures*, Vol. 38 No. 1 (February 2006), pp 15-30.

Figure 7.1 Scenario Matrix



Scenario 1 *Greening the tiger*

In a world of strong economic growth, environmental policy and the pursuit of reduction in GHG emissions are given high priority…

The world of 2020 is one of continued robust economic growth allied to strong environmental policy for sustainability. Concluding in 2009 and ratified in 2011, Kyoto +, the new UN global agreement to further reduce GHG emissions to 2020, sees the EU reap the fruits of its leadership on climate change. The US, China and India step into a dual track system which sees targets applied in 2016 for these three big emitters. The EU's head-start on emissions reductions gives it competitive advantage in a carbon-constrained world, and reinforces the EU's position as a political authority.

The impacts of climate change have prompted continued investment in adaptation measures in developing countries, and driven the transfer of adaptation funds from the rich to the poor nations. The EU's -30% emissions reductions target to 2020 under Kyoto +, although challenging given the powerhouse economy of the bloc, has offered numerous business opportunities to reduce emissions. In this future world the EU's climate strategy is given high priority. It includes a focus on non-CO_2 gases. Aviation and maritime GHG emissions are taxed as part of EU-wide carbon taxes,[246] the EU Energy Efficiency Action Plan and the Renewable Energy Directive are achieved. Integrated policy through a portfolio approach delivers co-benefits on air quality, human health and lower energy demand with consequent economic savings.[247] Europe's market is harnessed in the name of climate protection and sustainable development including multiple technology initiatives. There is an agreed commitment to ensure that policies are implemented in a manner that does not impact unfairly on vulnerable groups.

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246 Bruce, Lee, Haites, and Nordhaus, among others, have advocated a global carbon tax.

247 B.C. O'Neill, "Economics, Natural Science, and the Costs of Global Warming Potentials", in *Climatic Change*, Vol. 58 No. 3 (2003) pp 251-260; and D.J.A. Johansson, U.M. Persson and C. Azar, "The cost of using global warming potentials: Analysing the trade off between CO_2, $CH_4$and N_2O", in *Climatic Change*, Vol. 77 No. 3-4 (2006), pp 291-309.

Ireland's target of reducing emissions by -15% on 1990 levels by 2020, is negotiated in 2010 under the EU-27 burden sharing agreement. Given Ireland's relative wealth it is expected to cut emissions significantly to contribute. The strong commitment to emissions reductions at the EU level encourages Ireland to consider radical measures to make step changes in its GHG emissions reductions. The trend of emissions emerging up to 2012 sees Ireland increase by +26%. The government review conducted in 2008 points to lack of commitment to moving away from business as usual allied to strong economic and population growth as key issues.[248] Ireland's tiger economy roars in the 2010s and creates the conditions for large-scale investments in a range of emissions reductions initiatives. Emphasis is placed on the "integrated portfolio approach" to reduce energy CO_2, but also non-CO_2 gases including those from waste, agriculture CH_4 and N_2O, industrial f-gas substitution and enhancing CO_2 sequestration through reforestation.[249]

Ireland's new institutional framework experiences early confrontation between the social partners on how to engage in this mammoth task, but this continually gives way to a consensus on a range of key measures. Proposed government supports, incentives and regulation are discussed with stakeholders through the new partnership known as the Climate Change Commission. Ireland decides to align itself at the front of the growth in "green industries". Research and development and government supports for new entrepreneurial initiatives are given a high priority, with care to ensure that they are technology neutral. The new commitment to emissions reductions sees "clean" technologies become a concentrated growth area. Cooperation and equitable sharing of the burden across the society and the economy, leads the government's new *Department of Environment and Climate Change* to introduce a carbon tax in common with EU partners. The revenue raised is divided between reducing other taxes and increases in social welfare benefits for those threatened with fuel poverty. Ireland develops networks of suppliers of efficient technology for a range of purposes.

The replacement of the state's heavy car fleet begins with "city mini-cars", many with hybrid engines conforming to low CO_2 profiles demanded by the EU. Domestic renewables such as wind and solar become fashionable "must-haves", while retrofitting of housing with advanced heating systems and insulation is also common. Although these measures take some time to deliver sufficient reductions in emissions, the "National Wind Initiative" of 2010 sees Ireland's electricity consumption from renewables rise well above the target of 33% by 2020, with surplus electricity exported to Northern Ireland and the UK via the first "super-grid" connections.

The EU ETS sees allocations auctioned instead of the old "grandfathering system" and is successful throughout the EU in reducing emissions at least cost.[250] Ireland is no different in favouring market mechanisms; industries are lauded for their achievements under ETS and negotiated agreements.

Ireland introduces a new programme to up-skill its workforce for the new world of the 21st century. Significant programmes in the universities, the Institutes of Technology, FÁS and the schools seek to re-train and up-skill employees for Ireland's new economy. Awareness around climate change becomes a political priority. Key programmes target civil society to promote commitment and cooperation from individual behaviour in the home to worker behaviour in the office and on the

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248 UNFCCC, *Report on the in-depth review of the third national communication of Ireland* (Bonn: UNFCCC Secretariat, 2005).

249 K. Simeonova and H. Diaz-Bone, "Integrated climate-change strategies of industrialised countries", in *Energy,* Volume 30, Issue 14 (November 2005), pp 2537-2557; and S. Gupta, D. A. Tirpak, N. Burger, J. Gupta, N. Höhne, A. I. Boncheva, G. M. Kanoan, C. Kolstad, J. A. Kruger, A. Michaelowa, S. Murase, J. Pershing, T. Saijo, and A. Sari, "Policies, Instruments and Co-operative Arrangements", in *Climate Change 2007: Mitigation* (Cambridge and New York: Cambridge University Press, 2007).

250 C. Hepburn, K. Neuhoff, M. Grubb, F. Matthes, and M. Tse, "Auctioning of EU ETS Phase II allowances: why and how?", in *Climate Policy*, Vol. 6 No. 1 (2006), pp 137-160; and J. FitzGerald, "An expensive way to combat global warming: reform needed in the EU emissions trading regime", in *Quarterly Economic Commentary* (Dublin: Spring, Economic and Social Research Institute, 2004).

factory floor. This successful campaign leads to a high awareness in Ireland and contributes significantly to gains in energy efficiency and large reductions in the emissions intensity of the economy. Investments in community facilities and the targeting of marginalised groups are a priority in this world. The "walking-distance" rule becomes popular for spatial planning and development in many communities, to place amenities in close proximity to residential areas.[251]

Ireland's burgeoning tax coffers permit the government to invest in large-scale infrastructure projects particularly on transport but also power generation. The Minister for the Environment cooperates with the Minister for Transport and announces a new transport programme in 2011, which sees inter-city rail enhanced for both freight and passengers. The aim is to shift transport from road to rail. In our cities "flexibility and mobility" are the new buzz words as additional Luas tram and Metro lines cross Dublin and bicycles are made available on street corners for public use, to which the public warm very quickly.

The range of measures brought in and the cohesion across society sees Ireland significantly reduce its GHG growth from what it would otherwise have been. But in 2020 Ireland has not met its ambitious target and emissions credits are required due to its continued economic and allied population growth.

"Greening the Tiger"– some headline consequences

Social

1. *Tax burden*
   The tax burden is lower. Lower income taxes and labour taxes are balanced against raised fossil fuel taxes according to carbon content.

2. *Fuel poverty*
   Fuel poverty is almost eliminated under this scenario as policy commitment coincides with ample resources. Resources are used to upgrade housing stock and reduce carbon footprint.

3. *Social infrastructure*
   Public transport, communications technology and high density planning guidelines lead to long-term changes in emissions through integrated sustainable development policies. Infrastructure and quality of life improve, with targeting of child-minding facilities and reducing commuting. Ireland's housing is upgraded, with state supports.

Economic

1. *Industry and multinationals*
   Ireland's multinational base is largely intact despite international competition, as competitiveness is maintained. Indigenous industry grows and FDI is maintained. Carbon management and policies for sustainability minimise the cost of GHG abatement for industry while reducing GHG emissions.

2. *Inflation*
   Inflation is an ever-present threat.

3. *Carbon Price*
   International frameworks facilitate expansion in carbon trade. Market price is high as the strong regime forces those failing to meet ETS requirements to purchase credits.

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[251] D. Stewart, "Smart Growth in Ireland: From Rhetoric to Reality", in *Progress in Irish Urban Studies*, Vol. 1 Issue 2 (2005), pp 21-30.

Expert Opinion: Carbon Tax — Sue Scott, ESRI

A revenue-neutral carbon tax means raising taxes on polluting carbon and reducing other taxes. Taxes on income and labour have a tendency to discourage work while taxes on pollution discourage pollution. Therefore, raising the same amount of revenue but via more pollution taxes and lower labour taxes helps make the economy more efficient while lowering pollution. Aggregate taxes do not rise but the important point is that they are raised in a smart manner. The carbon tax helps reduce emissions because it means that people are no longer insulated from the damage they do to the global society. Furthermore by allowing freedom in the type of action taken to reduce emissions, carbon taxes leave individuals to take actions that are best (i.e. cheapest) in their particular circumstances. Thus the cost overall of achieving the reductions is minimised. However, there is no question that a carbon tax on its own hurts the poor more than the rich: the poor spend a higher share of their weekly budget on energy; they use fuels that are high emitters of carbon dioxide; and they cannot easily change their heating equipment. Fortunately, the revenues from carbon taxes can be considerable – they could be used to compensate low-income households several times over. Without imposing a significant additional administrative burden, two instruments, the Fuel Allowance under the social welfare system and the income tax system, can be used for compensation. The point made here is that ample revenue would be available for compensation and there would no longer be an excuse for delaying home enhancements to help low-income households.[252]

Debate: Strong policies or efficient policies?

Tough targets are often advocated accompanied by calls for subsidies to help people to cut their emissions of CO_2. But such "strong policy" is not the same as the best policy as it is likely to cost the nation more than if carbon taxes were used instead. The disadvantages of subsidies compared to taxes are outlined here under three heads: Distributional Harm (who gains/loses), Administration (costs of time and bother), and Total Costs (cheap options missed):

1. *Distributional Harm* – Subsidies require revenue to be raised in order to pay for them, which means raising taxes on people, regardless of whether or not they are making strides to reduce their emissions. In that sense the revenue is raised indiscriminately pollution-wise, and polluters can still "use up" the valuable atmosphere for free. Worse unfairness occurs in the emissions trading scheme in which free permits amount to gifts to shareholders. Such increases in company assets will, like a rise in high street property values, be reflected in selling prices. A carbon tax, by contrast, automatically provides revenue to cushion its own social effects as well as reduce other taxes.

2. *Administration* – Subsidies and emissions trading are administratively demanding. The authorities have to set up the schemes, define and administer rules, and follow up with monitoring, verifying and policing. For their part, the public spend more time investigating whether they qualify for the subsidy and going through administrative hoops than on looking into the options for reducing emissions. By contrast, carbon taxes can be introduced easily by extending excise taxes and existing cash fuel allowances, with minimum officialdom and bother.

3. *Total Costs* – Per tonne, the cost of reducing CO_2 emissions can range from cheap to prohibitive. Numerous options face each individual decision-maker. Obviously, selecting the cheapest abatement options reduces the total cost of climate policy. Governments are not especially good at picking technologies and are evidently tempted to subsidise expedient but costly options. As an example, reducing CO_2 by traffic management can be relatively cheap, starting at about €75 per tonne abated, but substitution of fuels by European bio-fuels costs upwards of as much as €229 per tonne abated. Yet it is this latter option that has received large subsidies. By contrast, home upgrades can bring in CO_2 reductions at much smaller and even negative costs. Carbon taxes reflect environmental damage and promote correct individual choice in a technology-neutral manner. More investments become worthwhile (up to the point where the cost of investing in abatement is equal to higher savings due to the tax-augmented fuel bill; calculated Net Present Value goes to zero at higher levels of abatement). An added boon of carbon taxes is the stable cost of emissions, which encourages investment to develop technology.

The virtuous pay less tax, funds are available to protect the vulnerable and the national cost of climate policy is reduced by not insulating people from the effects of their actions.

[252] S. Scott and J. John, *Carbon Taxes: Which Households Gain or Lose?* (Wexford: Environmental Protection Agency, 2004).

Scenario 2 *All Things Frugal*

A high priority placed on environmental policy and sustainability has been maintained in a world of economic slowdown…

The world of 2020 has seen an economic slowdown that has spread across the globe, with a strong governance commitment to environmental sustainability through strong environmental policy and significantly reducing GHG emissions. The US recession of 2010 started with sudden drops in the commodities market, fear spread across the financial markets of Europe and Asia leading eventually to worldwide recession. Despite this outcome, the potential for catastrophic impacts of climate change and the successive droughts and famine in sub-Saharan Africa focused the world's attention. Urgent commitment and global cooperation in GHG policy is aimed at ensuring climate change does not turn the economic slump into an inescapable spiral. In this frugal scenario the EU's climate strategy is given high priority in tandem with economic development goals. Aviation GHG emissions are included in the ETS in a widening of ETS coverage, the EU Energy Efficiency Action Plan and the Renewable Energy directive are achieved.[253] Sustainable development policy integrates economic concerns with environmental and social protection. This delivers co-benefits on efficient use of natural resources, improvements in air and water quality, reductions in ozone depleting gases and improvements in energy and food security.[254] Human health benefits while lower energy demand leads to savings on energy expenditure.

The world's major GHG emitters agreed Kyoto II in 2010 and are pursuing a total cut in emissions of -20% by 2020 for the "Annex I" parties, the developed countries. The European Union strategy on climate change is based on cooperation within and between sectors. No one sector of the economy is willing to take the burden of reducing emissions unequally. Equity principles are strong in this world. The EU has had to negotiate commitments very carefully between the different actors. Common but differentiated responsibilities are subject to much debate in a world with less financial flexibility.

The EU target under Kyoto II of a -30% reduction in emissions by 2020 was subject to difficult political negotiations to establish member state targets. Ireland has tried to ensure an achievable target given its poor starting point in 2012, agreeing to -11% on 1990 and, as the public finances have shrunk with the loss of some key multinationals from the industrial base. Ireland's development is focused on supporting the competitiveness of indigenous industry and ensuring Ireland's economy is managed for Ireland. Energy costs have risen dramatically as the premium on carbon has increased, and oil and gas costs have grown due to supply constraints. Renewable energies such as wind, biomass, wave and tidal are favoured in reducing GHG emissions and oil dependency, but private sector funding is scarcer than in the world of 2007. Ireland has tried to minimise the impact of price increases, particularly on its most vulnerable groups. More families are caught in a potential poverty spiral with higher unemployment rates. The government is concerned about fuel poverty and uses a funding initiative on energy efficiency and insulation. A programme for district heating

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253 John FitzGerald and Richard S.J. Tol, *Airline Emissions of Carbon Dioxide in the European Trading System* (Dublin: Economic and Social Research Institute, 2007).

254 S. Gupta, D. A. Tirpak, N. Burger, J. Gupta, N. Höhne, A. I. Boncheva, G. M. Kanoan, C. Kolstad, J. A. Kruger, A. Michaelowa, S. Murase, J. Pershing, T. Saijo, and A. Sari, "Policies, Instruments and Co-operative Arrangements", in *Climate Change 2007: Mitigation* (Cambridge and New York: Cambridge University Press, 2007); and European Commission Directorate-General Research, *Towards future challenges of agriculture research in Europe: Report of Foresight*, Report presented in Brussels (26-27 June 2007).

and domestic renewables such as solar, ground source heat pumps and wood-pellet boilers is also rolled out in local authority refurbishments. Otherwise the government's tightened purse strings have led to less opportunity for social investment. The social welfare system has become highly targeted to meet the demands of rising unemployment levels. Means testing is the modus operandi, and there is difficulty funding universal welfare. State borrowing has been significantly increased to meet the shortfall.

The commitment and urgency behind GHG emissions policy have been bolstered by the social partnership. This has taken centre stage particularly on climate change, as Business and Environmental and Community NGOs have been included in successful participation. The policies of Ireland on GHG have sought to discourage the use of the private car, as transport emissions continued to outstrip the growth of the other sectors. A Carbon Tax applied in 2010 has priced SUVs and luxury cars out of the market for all but the most wealthy of citizens. Public transport has been expanded as the most environmentally and economically efficient method of keeping the country moving and the economy turning. The subsidies for bus, tram and rail and the expense of the private car have encouraged a modal switch. The housing market places an increasing premium on development in close proximity to public transport nodes. The housing market collapsed and many buyers demanded an alternative development model. Many of the dispersed pattern settlements of the commuter towns built before 2010 have become urban black spots, with associated problems of crime and deprivation. Biofuel buses are now common in both urban and rural areas. Subsidised by the government, they have become popular recently despite being considered unfashionable in the early years.

Economic frugality and good regulation are the order of the day. This places more of a burden on changing individual behaviour and patterns of consumption. While industry takes its commitments seriously under the ETS and the remainder of the economy reduces its emissions under carbon taxes, the emphasis in policy seeks to give a soft landing to a weakened economic engine. Lower economic activity and reduced population growth dictate that the primary energy requirements of Ireland have dropped. Energy efficiency is particularly favoured by the carbon tax as it reduces the foreign costs of purchasing fuel to the economy. Recognising the lack of public awareness of climate change amongst the populace in 2010, the Department of Education embarked on a comprehensive public awareness programme. Using the media, the education system and bottom-up through community groups, awareness of climate change is greatly enhanced. The marginalised and the vulnerable in Irish society have become quite politicised about the issue of climate change and emissions as the poor feel the brunt of the impacts of alterations in climate. The carbon intensity of the economy has dropped. The restrictions on private transport have been particularly effective as has the carbon tax. A general shrinking means Ireland's GHG emissions are now significantly reduced but not sufficiently to meet the national target and emissions credits are required to meet the shortfall.

"All Things Frugal" – some headline consequences

Social

1. *Tax Burden*
   The tax burden increases across the board as additional tax revenue is required to fund public services. Lower income families are protected, emphasis placed on environmental tax reform.

2. *Fuel Poverty*
   Fuel poverty is reduced as carbon tax revenue is directed towards vulnerable households. Social inclusion is allied to economic efficiency through energy efficiency, insulation and low/no carbon domestic fuel sources.

3. *Social Infrastructure*
   There is difficulty funding infrastructure projects and private development necessary for sustainable planning to move away from car-dependent, low density development. Incremental change has begun with the new policy direction, but this will be a very long-term process. Infrastructural deficits are funded through borrowing and user charges. Tension between social and environmental objectives leads to creative and efficient outcomes.

Economic

1. *Industry and Multinationals*
   Ireland's multinational base has been reduced with macro conditions of international competition and weak economic growth. Taxes on labour and capital have been increased to fund public services but some of the potential rise has been offset by increasing user charges and carbon tax revenues. The carbon tax applied in this scenario has not adversely affected Irish-based multinationals. Ireland remains relatively competitive with creative taxation.

2. *Inflation*
   Due to low growth, and the strength of policy on the environment being carried through to policy on the economy, prices are not under pressure, except in the event that external conditions make them so.

3. Carbon Price
   International frameworks facilitate expansion in carbon trade. Market price is moderate as the strong regime forces those failing to meet ETS requirements to purchase credits.

Expert Opinion: Fuel Poverty — Charlie Roarty, Energy Action

Ireland has one of the highest incidences of Fuel Poverty in Northern Europe (Homes for the 21st Century Report (Energy Action 1999)). This has been supported by the SEI'S review of Fuel Poverty and Low Income Housing Report 2002, where it highlighted that 227,000 households are in fuel poverty. In 2006, 288,800 households received fuel benefit payments from the Department of Social and Family Affairs. Increasing fuel prices over the last two years has no doubt contributed to increases in the fuel poor.

Under a low growth and strong policy, there must be an optimal investment on reducing or eliminating fuel poverty in Ireland.

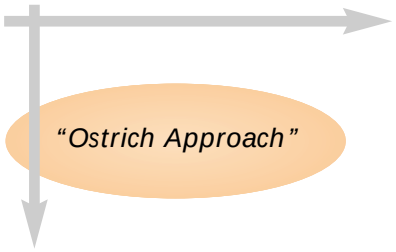
The impact of improving the insulation standards and a central heating programme would be to raise temperatures, reduce fuel costs and reduce GHG emissions. For the residents this improved energy performance would translate into an improved quality of life through more affordable fuel bills and warmer homes.

It would also give higher energy rating scores representing a bonus to the occupants.

It is recommended that an energy advice programme should be initiated to follow closely behind the installation of the new central heating and insulation package.

Scenario 3 *Ostrich Approach*

The world of 2020 is enjoying a consistent level of robust economic growth. Environmental policy and climate change have been given less urgency and commitment…



A robust world economy has continued to grow at rates experienced in the first decade of the century. The all-consuming pursuit of continuing economic growth has all but wiped climate change from the political and public consciousness. The world's big emitters have refused to take on all but the most meaningless of reduction targets in Kyoto +. The EU has endeavoured to remain committed to reducing its emissions by -20% by 2020. The impacts of climate change have been obvious in Europe, agricultural yields have dropped particularly on continental Europe and the winter ski season is now almost non-existent. There was difficulty in agreeing targets under burden-sharing at the EU level. Ireland's strong economy was a focus of the 12 accession states in negotiations, leading to a reduction target of -7% on 1990 being imposed in 2010 for Ireland. Ireland was faced with a mammoth task in reducing GHG emissions that stood at +29% in 2010.[255]

This world of individualism erodes EU solidarity and cohesion. The EU's climate strategy to 2020 is given less urgency. Aviation and maritime GHG emissions significantly increase and are outside of regulatory control. The EU Energy Efficiency Action Plan and the Renewable Energy directive are not fully achieved. Sustainable development is second best to economic growth. Air quality and water quality have worsened with transport and dispersed settlement a significant culprit. Energy and food security risks have increased but are off the political radar.

The impacts of climate change are particularly evident in Africa and Asia. There are now an estimated 100 million refugees and internally displaced persons from drought, crop failure and flooding (UNU EHS proposes that there will be 50 million by 2010). The humanitarian crises of East Africa have resulted in anarchic regional conflicts and the EU is under significant pressure to increase its refugee intake. Ireland now accepts 20,000 annually putting a strain on social services and health care.

Much of the target is imposed on SMEs and agriculture, which are already heavily burdened by higher energy prices. Equity across the economy and society is not a concern. The government begins the squeeze and assumes the economy is robust enough to lose a few of the weaker players of 2020. This causes uproar among lobby groups, who have as yet failed to coerce the EU to take action due to weakened political clout. The principle of supplementarity has been weakly applied and Ireland's main answer to Kyoto + is to buy credits rather than reduce emissions domestically. This is highly costly. The strong global economy has also raised the carbon market price from what it would otherwise have been, despite the weaker international regime. With Ireland's emissions significantly increasing, emissions credits are set to cost the taxpayer a considerable sum.

Strong economic growth has been facilitated by an economically defined immigration policy, where employers have control over work permits. Population growth has been driven by the influx of migrant workers. Pay and conditions for the unskilled, both migrant and indigenous, have deteriorated. A widening gap of inequality has arisen in Irish society where there is little incentive and little interest in protecting lower income groups. Social inclusion is not a priority of the centre

[255] NCCS and ICF Consulting and Byrne Ó Cléirigh, *Determining Ireland's Share of National Greenhouse Gas Emissions for Emissions Trading in Ireland 2008-2012* (Dublin: Department of the Environment Heritage and Local Government, March 2006).

right government of the 2010s. Low-income families and individuals experience fuel poverty from rising energy prices and poor insulation standards. Rising insurance costs have placed many in vulnerable communities in acute hardship after flooding events, as insurance is unaffordable for lower income groups. The strong economy has given the people little reason to be concerned with social issues or the protection of the climate for that matter. Respect for the law and others in the community have deteriorated in a society without cohesion.

Businesses have benefited from the ETS and a free-rider effect in negotiated agreements takes hold with all carrot and no stick for industry. Weak climate change policy on emissions, and weak regulation in general have led to a toothless strategy unfolding to 2020. Government policy prioritises sustained economic growth above sustainable development, and environmental and social policies are seen as secondary concerns rather than core. Despite this, strong economic growth has encouraged some initial shift towards more efficient and cleaner technology due to the economic benefits that accrue from investing in efficient technology, although this appears to be the preserve of the wealthy. A strong tax base has enabled the government to provide grants for industry and households to modernise, retro-fit and refurbish. These schemes are largely inadequate and ineffective as the policy and regulatory environment, through lack of commitment, fails to target resources towards the most effective outcomes and only the rich can avail of them. Many new cleaner technologies remain out of reach of those on the average wage due to the failure to incentivise. Although these schemes are costly initiatives, the health of exchequer finances ensures there is little concern and wasted expenditure is ignored.

Transport emissions have rocketed in this Ireland, as have emissions from the power-generation sector. Low-density development and one-off housing sprawls outwards from Ireland's urban centres.[256] The commuting times of the populace increase as Ireland sees more urban sprawl and car dependency. At international level, the gap between developed and developing countries is striking. Biofuels sold to the rich nations from developing countries, such as Burma/Myanmar and Indonesia, have enriched the few at the expense of the many. Small farmers have been removed from the land and consequent impacts on food supplies have been serious.[257] The case of the Least Developed Countries (LDCs) is a canary in the coalmine in the world of 2020. The impacts of climate change have ravaged many developing countries and the first test cases to sue the wealthiest countries for impacts are being lodged.[258] The worst emitters are being targeted: Ireland, the US and Australia (some of the highest GHG emitters per capita in 2020 as in 2007) are currently being sued by an alliance from Africa for the famines and droughts attributed to anthropogenic climate change by ground-breaking research published in 2014 by NASA/ Hadley Centre on detection and attribution.

"Ostrich Approach" – some headline consequences

Social

1. *Tax Burden*
   The tax burden sees low tax on high earners and moderate tax on low earners. There is no environmental tax reform, and the failure to reduce GHG emissions has necessitated the purchase by the Carbon Fund of significant amounts of emissions credits.

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256 D. Stewart, "Smart Growth in Ireland: From Rhetoric to Reality", in *Progress in Irish Urban Studies*, Vol. 1, Issue 2 (2005), pp 21-30; and European Environment Agency, *Urban Sprawl in Europe: The Ignored Challenge* (Copenhagen: European Environment Agency, 2006). Although controversial given the social issues at stake, one-off housing is strongly associated in the literature with increasing GHGs (see also Chapter 5, section on transport).

257 European Commission Directorate-General Research, *Towards future challenges of agriculture research in Europe: Report of Foresight*, Report Presented in Brussels (26-27 June 2007).

258 Joseph Smith and David Shearman, *Climate Change Litigation: Analysing the law, scientific evidence and impacts on the environment, health & property* (Adelaide, Australia: Presidian Legal Publishings, 2006).

2. *Fuel Poverty*
   Income gaps widen, and fuel poverty increases. Marginalised communities are experiencing increased hardship.

3. Social Infrastructure
   Weak policy and regulation and the weak integration of policy leads to a failure to include sustainable development or climate change in policy-making. Infrastructure developments and spatial planning are conservative, short-termist and favour expansion and growth rather than innovation. Road and airport infrastructure is expanded, public transport and rail is maligned. Urban planning continues low density and rural planning sees sprawling development.

Economic

1. *Industry and Multinationals*
   Ireland's multinational base is healthy as a favourable tax regime and strong economic growth give a favourable environment for continuing FDI. The buoyant global economy is blind to imminent and unfolding risks from the impact of climate change and poor policy choices on GHG emissions. Energy intensive industries stay away as Ireland has high-energy costs and a poor GHG profile. Ireland's competitiveness is relatively strong despite some signals of increased costs including energy.

2. *Inflation*
   The threat of inflation is constant.

3. Carbon Price
   The carbon price signal is relatively weak as it can be absorbed by healthy industry profits. Fossil fuel and energy intensive industries including cement, aluminum and power generation could suffer the cost of purchasing emissions credits except that weak environmental policy has led to over-allocation in allocation plans.

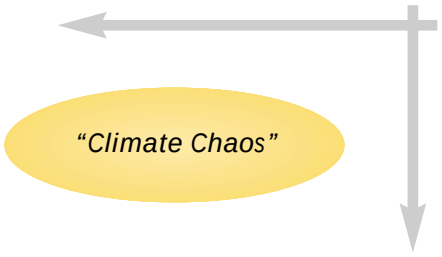
Expert Opinion: The Role of Social Consensus — Noel Cahill, NESC

This scenario is characterised by the absence of a strategy that commands sufficient commitment to secure significant reductions in greenhouse gas emissions. Reducing emissions requires wide-ranging changes that need the support of many actors in the economy and society: businesses, employees, unions, citizens, NGOs, farmers and coordinated action by many government departments and agencies. Political consensus would also be helpful in achieving the changes required. It is possible to draw comparisons between this scenario and the situation that existed in Ireland in the first half of the 1980s. At that time there were pronounced economic and social problems and a lack of agreement among the social partners and among political parties on how to tackle these problems. The national debt grew rapidly, unemployment increased and economic growth was weak. Eventually in 1987 there was agreement among the social partners and across political parties on an agreed strategy to tackle these issues.

If Ireland finds itself in this "ostrich approach" scenario this could reflect the lack of consensus to address Ireland's climate change obligations in a meaningful way. Without such consensus, the effective implementation of and compliance with a government strategy is less likely to be achieved. This arises in many areas, including enhancing energy efficiency, developing renewables and achieving reduced reliance on cars as a means of transport. For example, it is possible to invest in public transport infrastructure but, without widespread commitment to the goal of reducing car usage, it is difficult to achieve a new transport model. In a similar way to the fact that social consensus helped to tackle the economic and fiscal problems in 1987, there is potential for agreement among stakeholders on an approach to reduce emissions to help ensure that the ostrich approach scenario does not materialise. Agreement on an over-arching diagnosis would make it easier to find agreement on the numerous individual measures that constitute an effective strategy and to develop a consistent approach.

Scenario 4 *Climate Chaos*

The world of 2020 has experienced an economic slowdown. A low priority has been placed on environmental policy and climate change, and targets and policy commitments are weak…



The world of 2020 is a world where the individual must fight for survival. Economic slowdown has deflected attention away from policy urgency on climate change and the environment. The rot set in with a series of economic shocks in 2009. A terrorist attack on the Al Ghawar oil field in Saudi Arabia was followed by a succession of hurricanes in the Gulf of Mexico knocking out a large portion of global oil production in one month. Oil prices doubled in weeks to $150/barrel, for a short period. The housing markets in the US, Spain and Ireland simultaneously collapsed with investors becoming jittery, and the insurance market went into a panic with rising payouts. The summer heatwave of 2009 in China left the country's industry and urban populations crippled due to water shortages. The reality of climate change has become all too apparent. The environmental movement in China has rapidly become powerful as people have searched for answers and have asked why both China and the US are failing to take climate change seriously? The lack of urgency and cooperation at the global level has led to weakened targets under Kyoto II. The weakened economies of some of the major emitters have focused attention away from climate change and "long term" issues despite the obvious immediacy from accelerating global impacts.

Despite the failure to establish an effective and adequate successor to Kyoto I, the EU's independent target of reducing emissions by -20% by 2020 stands as an example to the rest of the world. However, in this chaotic scenario the EU's climate strategy is given less priority. Aviation and maritime GHG emissions are not tackled, the EU Energy Efficiency Action Plan and the Renewable Energy directive are not fully achieved. Economic realities in 2020 override a focus on integrated long-term sustainable development policy. Despite low growth, air quality deteriorates as the use of cheap coal and road transport expands. Energy and food security become serious concerns.

Despite this the EU's pursuit of energy efficiency leads to improvements in a world of rising energy costs, which have given its industries a small competitive advantage. Within this Ireland's target for reducing emissions is limiting emissions to 100% of 1990 levels by 2020. Burden-sharing has proven difficult at EU level as has negotiating sectoral equity at the national level, as the scramble for scarce resources sees everyone pushing for a bigger emissions allowance. The ETS is not functioning well at the EU level as all member states have been representing purely national interests in their Allocation Plans. Ireland has not placed much emphasis politically on reaching its target, despite the government receiving significant opposition from well-organised campaign groups and heavy criticism from Europe.

The Ireland of 2020 is a materialist society, where inequality has deepened. Industry has shown little interest in expanding its attempts to reduce emissions given the failure to tackle the "non-trading" sectors of the economy including transport, consumers and residential. The general public in Ireland has become acutely aware of the impacts of climate change on developing countries, but the culture is of the individual and ethical arguments offer little incentive to adjust behaviour in the absence of effective measures. High-energy prices have succeeded in modifying behaviour to a degree, though with unnecessary hardship. Despite a world with leaner finances, the lifestyle of profligate consumption is the mode du jour. In effect there is little incentive in Ireland to act on climate change. Meanwhile low-income families have a bitter pill to swallow. Unemployment and energy

prices increase while the average wage and state supports decrease and more people experience fuel poverty. There is a distinct lack of dynamic research in relevant areas. Energy technology has concentrated on "keeping it cheap", coal is favoured in the power generation sector. In 2020 Ireland's emissions have not significantly reduced and emissions credits are required to meet a considerable distance to target. The reduction that has been achieved has arisen by economic contraction and high-energy prices imposed from abroad rather than an effective climate strategy.

"Climate Chaos" – some headline consequences

Social

1. *Tax burden*
   The tax burden has increased to levels experienced in the Ireland of the 1980s. Taxes are indiscriminate and tax evasion is rife. Taxes flow towards purchase of emissions credits.

2. *Fuel Poverty*
   Fuel poverty increases as government programmes are curtailed and unemployment and poverty increase.

3. *Social infrastructure*
   Infrastructure developments continue to reinforce an unsustainable reliance on road transport and general low resource efficiency in areas such as waste management. Successive national development plans have favoured near-term decision-making, plugging the gap. Car dependency and low-density development are prevalent. Policy and regulation provide little incentive for the private sector to evolve and public finances are lean. Public transport is creaking.

Economic

1. *Industry and Multinationals*
   The Ireland of 2020 finds it increasingly difficult to attract and retain multinationals. The poor economic environment allied to high energy costs and increases in taxation have seen Ireland become a much less desirable destination for multinationals in a contracting global economy. Ireland's competitiveness has taken a hammering. A freefall starting with the loss of several key multinationals has been exacerbated by higher energy costs and increased taxation.

2. *Inflation*
   Increasing consumer prices and relatively static incomes are driving inflation upwards.

3. *Carbon Price*
   The carbon price signal is weak with the stumbling ETS and poor adherence to industry carbon reduction at the global level. The trade in Ireland is continuing with industry failing to meet its commitments under the National Allocation Plan.

Expert Opinion: Planning and Public Infrastructure — Lorraine Mulligan, SIPTU

Developing sustainable communities with easy access to vital transport and everyday services is a necessary component in a strategy aimed at tackling the development of climate change.

Improving and expanding rail and bus networks would offer a feasible alternative to reliance on motor vehicles, with the additional bonus of shortened commute times and the desired result of cuts in carbon emissions. A survey on time-use conducted by the ESRI in 2005 reveals that one hour seventeen minutes is spent travelling on an average workday in Ireland, more than the time devoted to activities such as childcare and cleaning. According to the 2002 census, 14.7% of the population travelled more than 18 miles to work, while 10.6% had to travel 8 to 10 miles. Well-designed local planning, which caters to the needs of residents, is essential in easing such travel requirements.

Protracted journey times and distances are, at least partly, the result of parents having to take long detours to access private crèche or nursery schools. Developing an adequate system of childcare would allow households to select options in the near vicinity, thus shrinking their carbon footprint. Currently, there is no comprehensive system of public childcare in Ireland. Moreover, research indicates that the cost of child-minding accounts for a far greater percentage of family income here than in any other European country leaving parents to struggle with private services that are limited in terms of availability and even forcing some – mainly mothers – to withdraw from the labour force.[259]

Ensuring the availability of school, sports and recreational facilities within walking distance of neighbourhoods is also important for minimising carbon output. However, the housing boom of the last decade has been largely characterised by concern to achieve maximum housing output, overlooking the need to incorporate green areas, convenience stores etc. Recent disquiet among parents about a lack of school places for children in certain areas and common recourse to pre-fabricated units for schooling only further highlight deficiencies in planning to date, errors which must be avoided in the future.

Synthesis and Conclusions

Efforts to prevent the worst impacts of climate change require "mitigation policy" to reduce and eventually stabilise GHG emissions. Ireland will experience significant challenges in meeting its 2020 target and there will be both positive and negative economic and social consequences of employing policies to meet this target.

In order to respond to the uncertainty and complexity associated with planning mitigation policy for Ireland, a scenario analysis has been used. The strength of environmental policy and economic growth were established as the key issues or pivotal uncertainties (scenario axes) in determining consequences.

Our analysis based on the scenarios proposed suggests that under all scenarios EU policy pursues significant cuts in emissions of minus 20% to 30% on 1990 by 2020. Ireland will receive a challenging target and have difficulty reaching it. Economic growth (as a key driver of emissions) requires strong policy commitment to mitigation in order to reduce emissions. The timing of policies is crucial as competitive advantage and reduced costs can accrue from early action.

The analysis indicates that committed action is favoured under all scenarios and this is best achieved by pursuing a cooperative approach which involves participation, partnership and cohesion among stakeholders. Application of sustainable development principles (integrating the environmental,

[259] ICTU Executive Report 2005-2007, Section 1, p. 21.

social and economic) as opposed to focusing exclusively on economic growth, helps deliver cost effective and socially responsible emissions reductions.

Energy efficiency, renewable energy, reforestation and f-gas substitution produce benefits under all scenarios and are potentially low-hanging fruit. Training and up-skilling is necessary for the new industries. Green industries, clean technology and revenue neutral carbon taxes are important in strong policy scenarios. Integrated higher density spatial planning and public transport will deliver multiple benefits. Auctioning under the ETS yields improved performance, particularly with a high carbon price.

It is important that solutions consider how social criteria are addressed. The tax burden increases with weak policy and weak economic growth, and declines with strong economic growth. Strong and efficient environmental policy shifts the tax burden onto pollution (emissions) and away from labour. Deterioration in social conditions such as unemployment, incomes and fuel poverty occurs with poorly designed policies and weaker economic growth; social protection becomes difficult. The sensitive and appropriate design of policies and measures is required to protect against negative consequences.

Weaker policy commitment tends to lead to higher emissions and higher costs (emissions credits) and fractious and chaotic approaches to participation and cooperation. This leads to sub-optimal outcomes economically, socially and environmentally. Strain on public services including welfare, education, health and potentially on industry occurs with weak policy commitment and weak economic growth.

The implementation of a carbon tax yields benefits under all scenarios in which it is implemented as long as it is devised with due care for disadvantaged groups. Without appropriate design of policies greater levels of fuel poverty might result. Welfare increases alleviate some of the hardship of fuel poverty and capital improvements are an effective means of reducing the extent of fuel poverty. A revenue neutral carbon tax could be of advantage to the Irish economy and offset the necessity to purchase emissions credits.

Conclusions

Strategic Issues, Options and Implications for Ireland

We need to act. We are putting [together] a lot of targets, a lot of goals, meetings and so on, but nothing is happening. We want more action…

Fatih Birol, Chief Economist, International Energy Agency, *Financial Times*, 9 November 2007

Introduction

In this final chapter, the key issues, three strategic options and the implications of each are set out. It is recalled that the focus of the report is on the period post-2012.

It is evident that there is a clear policy imperative for Ireland to take stringent GHG emissions reductions measures in the period to 2020 and beyond. The world is on the cusp of a paradigm shift, or in the words of the European Commission, a "third industrial revolution". In fifty years, economic activity in developed economies will be sustained and supported in a manner that would be unrecognisable today. The evidence for this assertion is found in the emissions reductions targets that the EU has set for itself – a legally binding aggregate 20-30% emissions reductions on 1990 levels by 2020 and an indicative target of 60-80% emissions reductions by 2050.

Underpinning these emissions reductions objectives is the goal of avoiding "dangerous climate change". The scientific evidence is unequivocal and concludes that significant GHG emissions reductions are essential if the potentially severe impacts of climate change are to be avoided. The economic evidence suggests that the fossil fuel basis for sustaining economic progress can be broken provided a carbon price signal is set to influence behaviour and investment decisions. Continued sustainable growth is possible, and, while the transition to a low carbon economy will not be a painless process, the alternative of business as usual would be more costly in the long run.

The case for taking action is enhanced within the context of global energy trends. Energy developments in China and India are transforming the global energy system by dint of their sheer size and their growing weight in the international trade of fossil fuels. The continued ability of supplier countries to provide fossil fuels to market at acceptable prices is thus increasingly being questioned.

These global developments have clear implications for Ireland. Although Ireland's emissions may be relatively insignificant in the global context, *per capita* greenhouse emissions are high compared to the EU and global averages. More significantly, emissions have been rising at a steady rate since 1990, the Kyoto base year, and Ireland faces a potentially unmanageable distance to target in the post-2012 period.

These are the policy challenges that the IIEA Climate Change Working Group has attempted to address. Findings have been organised in this final chapter into three sections: the first lists the key issues that the Irish government will face in addressing the climate change policy challenge; the second section outlines three broad strategic options which the government might consider in addressing these key issues; and, the final section highlights, in turn, the implications of pursuing each of these three options with reference to the key issues listed in section one. Some brief concluding remarks follow.

Key Issues

The overriding issue for Irish policy-makers is to identify a shared political vision about Ireland's climate change policy through to 2050 and a strategic path compatible with achieving this vision. Six key issues that have been identified within this context are:

1. Delivery of a coherent strategy and programme to implement the climate change policies as set out in the Energy White Paper.

2. Identification of additional measures and instruments to address Ireland's distance to target and in this context consideration of the scale, order and speed of their introduction and the preparation of a revised, strategically focused, evidence-based and fully costed National Climate Change Strategy.

3. Identification of the role the Carbon Fund will play in contributing to meeting Ireland's post-Kyoto commitments.

4. Communication of the threat that climate change presents, and how interested parties – households, consumers, businesses and individuals – can play a role in achieving climate policy objectives once they have been decided.

5. Establishment of mechanisms including, where necessary, new institutional arrangements to secure full and coordinated implementation of the NCCS and to take advantage of the know how and goodwill of the stakeholders involved in climate change policy-making.

6. Encouragement of appropriately incentivised large-scale private sector investment in support of:
   i) R&D in respect of climate change mitigation projects;
   ii) meeting Ireland's renewables target; and
   iii) the products and services needed to deliver national energy efficiency targets.

Strategic Options

Three strategic options can be identified for Ireland in the post-2012 period. In respect of each option it is assumed that Ireland will endeavour to meet its legal commitments to reduce GHG emissions under the EU's burden sharing arrangements. The essential differences between the options is the level of political ambition; the degree of commitment underpinning delivery of measures and instruments, including recourse to the Carbon Fund; the extent to which domestic mitigation measures are deployed; the scope of measures and instruments to secure the full and timely implementation of targets; the pace of delivery; and, the degree to which climate change is approached by government and stakeholders collectively as a matter of strategic national interest.

1. BUSINESS AS USUAL: "Minimum Compliance"
   Attempt to stay on the existing emissions trajectory and not implement any major changes to the current climate change strategy. Short-term considerations would be prioritised with heavy reliance on the Carbon Fund at the expense of effective domestic abatement measures. No long-term vision would be articulated. It is acknowledged that, to some extent, the government has moved from this path in recent times.

2. PROACTIVE COMPLIANCE: "Accept our Responsibilities"
   Attempt to implement a package of new initiatives designed to significantly alter Ireland's emissions trajectory within a long-term policy framework, bringing emissions into line at the earliest possible date with what will be required of all developed countries in the post-2012 period. Ireland would need to move toward a more sustainable model of economic development with the objective of relying primarily on domestic measures to deliver emissions reductions, with the Carbon Fund playing a secondary role. The implementation of a series of policy options currently being considered or implemented by other member states would be included in the post-2012 NCCS. As a general orientation, this strategic option would be driven by the need to proactively comply with GHG emissions reductions targets set at EU level.

3. TOWARDS CARBON NEUTRALITY: "Step up to the Plate"
   Attempt to implement a GHG emissions reductions strategy and programme at a pace which would place Ireland in a leadership position internationally. Ireland would need to adopt targets comparable with or exceeding the most ambitious emissions reductions targets at international level for 2050 and would also need to implement not only the majority of policies that would be required in the Proactive Option but also additional radical policies.

   Ireland would be required to move swiftly toward a more sustainable pattern of development and the link between economic activity and fossil fuels would need to be broken much sooner than might be envisaged in the proactive scenario. In the Ireland of 2050, this strategy would result in carbon neutral power generation, transport and residential and construction sectors, leaving the agricultural sector some room for flexibility.

Implications

1 Business As Usual Option

This option would not require the adoption of a long-term emissions reductions target. Rather, interim targets would continue to be established as a result of effort-sharing negotiations at EU level. Emissions, however, would likely continue on an upward trajectory, rising to as high as 30-40% above the 1990 baseline level by 2020. No overall coherent strategy for achieving targets or dividing the effort across sectors post-2012 would emerge.

In terms of the key issues:

- Existing measures may not be implemented fully. For example, targets for renewables in power generation may not be fully met, possibly as a result of impediments in the planning process or insufficient resources allocation to grid development. Energy efficiency targets may also not be fully achieved, perhaps due to opposition to legally binding targets.
- Additional abatement measures might not be introduced and no carbon-price signal would be set for sectors of the economy outside the EU ETS. No carbon tax would be considered. Nor would additional sector specific measures be introduced such as increasing efficiency targets for homes. Government would not support the introduction of auctioning of permits as the allocation methodology within the EU ETS.
- There would remain an insufficient awareness and understanding by the public and business of the dangers presented by climate change or what might be done to reduce emissions, improve efficiency and reduce costs.
- The Carbon Fund would be used to the greatest extent possible under EU and international law, implying potentially significant costs to the taxpayer.
- New institutions or mechanisms would not be developed to deliver climate change policy.
- A revised long-term climate change policy would not be considered.

Ireland's distance to target might prove to be unmanageable by 2020. Economic activity would remain largely dependent on fossil fuels and Ireland would remain completely unprepared for the transition to a low carbon economy and remain exposed to the vagaries of global energy markets. Poor spatial and transport planning could reduce Ireland's attractiveness as a destination for FDI. Private car use would continue to dominate with negative quality of life implications for many. Negative efficiency and distributional implications of stretching to reach imposed targets in an uncoordinated and ad hoc manner might also arise.

2 Proactive Compliance Option

Under this option, measures and instruments would be best designed and implemented within the context of a long-term climate strategy to 2050. A revised, comprehensive, evidence-based and fully costed long-term NCCS would be required if this strategy were chosen. Specific measures and instruments would be put in place to deliver targets and the progress in securing full and timely implementation would be monitored on a regular basis in a transparent manner as part of the annual carbon budget statement.

Adopting a strategic approach spanning four decades could have considerable potential benefits in responding to trends already outlined such as minimal progress on domestic emissions reductions

measures, rising oil prices and higher prices for carbon. Assessing the implications of climate change – where many of the more severe and costly impacts may arise in the future – lends itself to this type of long-term analysis. Furthermore, a lack of coherence arising from electoral cycles and conflicting policy goals could arise from a shorter time horizon being chosen. In the vital power generation sector, investors would benefit from a long-term policy framework.

The first step to achieving this vision would thus be the adoption of a long-term national target, compatible with the lower end of the EU's indicative target – a 60% emissions reduction by 2050 based on 1990 levels, i.e. a 70% reduction in actual 2006 emissions. This target – which is broadly consistent with the government's policy of a 3% annual reduction in GHG emissions – could be supplemented by an interim target for 2030, and additional shorter compliance period targets (no greater than five years). Emissions would need to be less than 1990 levels by 2020, with a much higher share of the compliance burden falling on the domestic mitigation measures than would be the case under the BAU option. Consensus on these targets could be arrived at through the social partnership process, including all environmental bodies, national experts and NGOs, and concluded through an all-party agreement if possible, in order to ensure full stakeholder buy-in.

Achieving Existing Targets

In order for a proactive approach to be pursued, Ireland's effort-sharing target post-2012 would have to be met as a minimum pre-condition.

The following measures might be considered under the proactive approach to achieve existing targets:

- The top priority could be measures to remove barriers, technical, economic and regulatory, to encourage the rapid deployment of renewables in line with the national target for renewables in power generation. Strong top-down signals could be given to regional and local government bodies to create strategic renewable energy zones with the necessary accompanying investment in grid development.
- Secondly, all barriers that may inhibit the full implementation of national energy efficiency targets at domestic, commercial and industrial level could be removed so that, for example, targets such as Building Efficiency Ratings of 60% by 2010 (as outlined in the EU's Energy Efficiency Action Plan) would be achieved.
- Continued close monitoring of levels of subsidies available for power generation in areas where Ireland has a natural advantage, for example on and off shore wind, tidal and wave energy, where investments help achieve national targets for deployment of renewables technologies.
- Smart electricity meters to be piloted with a view to wide diffusion.[260]
- Further research into feasibility and viability of anaerobic digestion.

A coherent, evidence-based and transparent strategy for the implementation of the NCCS targets post-2012 could facilitate the achievement of long-term national climate change policy goals. The failure to develop such a strategy could result in the inability to reach these targets and an increased requirement on the Exchequer to purchase carbon permits on the open market. Significant consequences, including possible sanction by the European Court of Justice for failure to meet legally binding EU targets for GHG emissions reductions and renewables, need to be considered.

[260] A national programme to install a new smart electricity meter in every home with the first phase of 25,000 units to begin in 2008 was announced on 5 November 2007 by the Minister for Communications, Marine and Natural Resources.

Additional Measures and Instruments

The traded sector i.e. operators covered under the EU ETS, accounts for around one-third of Irish GHG emissions. The sector will contribute in a transparent manner to achieving a significant part of Ireland's new distance to target post-2012 under the EU ETS. Powergen companies will pass on the higher costs of generation that will arise as allocations under the EU ETS become tighter. The Proactive Option would mean the government supporting a system of allocation of emissions permits in the EU ETS by auctioning to the maximum extent permitted under EU law. The indication from the European Commission that it will propose the early use of 100% auctioning for the powergen sector, and benchmarking for those exposed to international competition, is welcome and could also be supported by government, as would additional measures to expand auctioning.

The pursuit of a proactive approach implies the consideration of a wider range of additional domestic policy options. Specifically, the distance to target gap would be addressed through the pricing of carbon emissions, the absence of which is at the root of the market failure that climate change represents. As part of a wider environmental tax reform package, setting a price for carbon would be the most effective way to promote technological and behavioural change. An important measure is the introduction as soon as possible of a revenue neutral domestic carbon tax on all fuels purchased by consumers other than participants in the EU ETS. Thus all sectors of the economy would in principle be the subject of the carbon tax. Several design issues that should be considered before the implementation of a domestic carbon tax are set out in Chapter 6. The tax could be implemented at a low level, observed closely for social effects, with revenue recycled to reduce labour taxes, thereby helping industry and preventing a rise in taxes overall (in contrast to hypothecated expenditure of the revenues, which is sometimes advocated).

However, having regard to consumers' response to recent increases in the price of petrol, a carbon tax set at a low rate may not deliver the magnitude of emissions reductions that would be required to achieve Ireland's post-2012 GHG emissions reductions targets. The rate of this tax would need to be set initially, and subsequently kept constantly under review, having regard to the price of carbon permits in the traded sector, global fuel prices, Ireland's emissions performance and Ireland's distance to target.

With the adoption of a proactive approach, it would be likely that government would need to consider the adoption of additional measures and instruments such as:

- Energy efficiency standard for new buildings of 60% improvement by 2010 (as outlined in the Government's Energy Efficiency Action Plan) with immediate development of a strategy to move towards carbon neutrality of all new buildings by 2020.
- Retrofit schemes for households on lower incomes to improve the energy performance of old buildings.
- Facilitating the EU ETS to deliver transition from carbon-intensive fuels for electricity generation: phasing out support mechanisms for peat in electricity generation and their replacement with incentives for biomass.
- A domestic carbon offsetting scheme to make funds available to projects to reduce emissions in Ireland which might not otherwise be economically viable.
- Carbon-proofing of all infrastructure projects through multi-goal cost-benefit analysis to assess their impact on Ireland's GHGs and carbon proofing of National Spatial Strategy and National Development Plan.
- Introduction of workplace parking levies.

- Incentives to promote mobility management including discounts on public transport, information about public transport, cycle and walking initiatives, centrally coordinated car-sharing schemes, or grants to develop travel plans.
- Support for higher emission standards for cars at EU level.
- Abolish VRT and motor tax for series production of hybrid-electric, flexible fuel, and electric vehicles, in order to increase their market sales.
- Provide free parking for electric vehicles in city centres and consideration of other measures to encourage the displacement of engines with electric vehicles.
- Improvement in delivery of existing targets for afforestation with quality assurance with respect to fertiliser use.
- Procurement of low carbon vehicles and rolling stock by the public sector.
- To control transport demand, shift some fixed taxes on motoring towards congestion charging and/or road pricing, possibly before the completion of Transport 21.
- Accelerated delivery of all the public transport elements of Transport 21.
- Expansion of the fuel allowance scheme.

A key factor in determining the timing and scale of domestic effort is the relationship between the marginal cost of abatement in various sectors and the price of carbon in order for cheaper options to be availed of. Further research on this issue is urgently required.

There is clear evidence to hand that the introduction of climate change measures and instruments is likely to disproportionately affect low-income households. Therefore, distributional, as well as spatial and socio-economic consequences of various measures need to be considered very carefully within the context of other policy objectives and demographic trends.

The Role of the Carbon Fund

Those in favour of using the Carbon Fund argue that buying CDM and JI credits reduces the cost of compliance with Kyoto targets for the Exchequer (and taxpayers). Furthermore, Ireland's partner countries in the developing world would benefit from such an approach. It may, however, be in line with the proactive approach to consider a cap on Ireland's use of flexible mechanisms in order to ensure that a greater share of emissions reductions occurs domestically. This is on the basis that the long-term benefit of structural changes in energy provision will outweigh the short-term excess costs of domestic measures over the price of carbon credits. Cheap domestic measures would be financially rewarding as a carbon price is established. Should a cap be considered in spite of the inefficiencies involved, it would be prudent not to choose an arbitrary figure in advance of the conclusion of an agreement on effort sharing post-2012 as a difficult distance to target might well necessitate a significant role for Ireland's Carbon fund. Furthermore, preference in the purchase of credits could be given to NGO-backed gold standard credits in order to maximise environmental and social returns on such purchases. The design and management of Ireland's Carbon Fund should be considered within the context of international best practice.

Communicating to Households, Businesses and Individuals

Individuals are responsible for emissions through their behaviour as consumers of fossil fuels and carbon dependent products. Even relatively insignificant behavioural changes, if implemented across society, can have significant aggregate effects. For example, if every household reduced the temperature of its heating system by just 1° C this could cut family energy bills by 5-10% and reduce

carbon emissions by 300kg per household, a total annual saving of upwards of 500,000 tonnes of carbon. The introduction from 2008, on a pilot basis, of a national programme to install a new smart electricity meter in every home will over time have a discernible impact on reducing household emissions (and families' electricity bills).[261]

For businesses, this report identifies two key issues: the inevitable costs associated with the introduction of carbon abatement measures, and the business opportunities which arise on foot of stricter regulatory controls over GHG emissions. Regardless of sector, size or type of business, or location, all will be impacted. It therefore behoves the business community to work with stakeholders to get a better grasp on the practical steps that need to be taken to reduce Ireland's business carbon footprint.

An awareness raising campaign aimed at changing behaviour in households, schools, universities, in the public sector and businesses and engendering increasingly sustainable practices and habits would be consistent with a proactive approach. Building on the current awareness campaign Change Your World, Change the World, this campaign could be aimed first at highlighting the urgency of tackling climate change; second, it could sell a vision of Ireland in 2050 to citizens; thirdly, it could aim to raise awareness of various measures that can be taken to reduce emissions for householders and businesses; and finally, advertise grants and schemes available to citizens and businesses to reduce their carbon footprints and increase their efficiency of energy use.[262]

Government regulation also has a role to play in phasing out most inefficient and outdated technologies, especially where alternatives are already available such as is the case with incandescent light bulbs and wasteful and unnecessary packaging.

For every tonne of carbon that can be saved through these domestic measures, the alternative – Ireland's Carbon Fund buying the same quantum of Kyoto Units at € 20-35/unit – would be avoided.

Institutional Issues

The interdepartmental climate change working group does not have a remit to implement the measures outlined above. A proactive approach would require the establishment of mechanisms or, where necessary, new institutional arrangements to ensure that Ireland's emissions reductions targets are met at least cost to the economy and to Irish society in general.

New institutions could secure full and coordinated delivery of the NCCS measures, and could also play a role in providing the necessary information to government and help drive the debate on climate change. However, proposals for new institutions would need to be placed in the context of existing arrangements and a case would need to be made for the identified gaps and needs which they would cover and the value-added they would provide.

Decisions could be guided by the following options, on the basis that existing resources are redeployed and having regard to the skill set in current organisations dealing with energy and environment issues.

1. The following functions might be considered for the proposed National Climate Change Commission. The NCCC could be established independently of current state bodies, under the auspices of the Department of the Taoiseach. The independence from government of this institution

[261] Statement by the Minister for Communications, Marine and Natural Resources (5 November 2007).

[262] For more information on the campaign visit www.changenow.ie.

would guarantee its ability to provide a clear and objective assessment of the Irish government's climate policy. In addition, it could be granted the power to enforce certain measures such as green procurement policies on behalf of all state agencies and would need to be sufficiently well resourced to fulfil its functions. A resource plan for the NCCC would need to be prepared as a priority, and detailed tasks set for the senior management group.

This Commission could have real power to review and enforce the implementation of the revised National Climate Change Strategy. It could carry out ex-ante assessment of policies and measures within the context of Ireland's progress in meeting its short and long-term emissions targets. It could also serve as a source of new ideas on abatement of climate emissions and adaptation measures.

It should have a very close working relationship with other state agencies responsible for climate change related activities, such as SEI, the EPA and the Department of the Environment, Heritage and Local Government. The clear value–added of transferring to the NCCC any additional functions currently undertaken by existing agencies would have to be demonstrated; these additional functions include: driving public awareness about climate change; securing behavioural change; monitoring emissions; carrying out scientific and other research; and delivering and implementing certain climate change mitigation programmes.

The NCCC could also work closely with the Northern Ireland Administration on common climate change issues.

2. Given that the enterprise sector has a major role to play in terms of developing commercially promising low-carbon technologies, implementing energy efficiency measures, and investing in carbon abatement measures, a Carbon Centre of Excellence – modelled on the UK's Carbon Trust – could be set up under the auspices of the NCCC or SEI in partnership with the private sector. Building on the already significant energy advice services provided to Irish business by SEI, the Centre could be mandated to provide a wide range of programmes to assist the enterprise sector meet its carbon commitments and to exploit business opportunities to expand the market for environmental goods and services.[263] Again, the case for establishing such a body would have to be proven.

3. A national institution for transport and land-use planning could be established to carry out research and modelling for an evidence-based transport and land use policy and to guide a more sustainable form of spatial development in an integrated way, including a revised National Spatial Strategy that has been carbon proofed.

4. In terms of political accountability, the new Oireachtas Committee on Climate Change (and Energy Security) would remain actively involved in addressing emerging policy issues at national, EU and international level and in monitoring the implementation of the NCCS.

5. In the medium-term, the option of establishing a Department with Responsibility for Climate Change and Energy, given the close inter-linkages between these two policy areas, might be considered.

Enhanced R&D Programmes

There could be a greater alignment of national R&D policy with climate change policy by reviewing the public R&D budget and maximising the synergies with Ireland's climate change goals and thereby incentivising large-scale private investment. Ireland has certain advantages in terms of access to wind

[263] For more information on the UK's Carbon Trust visit www.carbontrust.co.uk

and ocean energy resources relative to most other member states. If the economy is to be competitive in the long term then these resources should be exploited to the full. Significant development work has already been completed in respect of on-shore wind. However, much R&D effort remains to be applied to off-shore wind and ocean-based energy systems (wave and tidal current). Priority could be given to the development of second generation biofuels. In addition to targeting and expanding existing available public funding, government could also incentivise (perhaps by way of R&D tax credits) significant private funding in support of policy objectives in this area with the aim of delivering robust, large scale systems in a relatively short time-frame. This would allow the Energy White Paper ocean energy target of 500MW of installed capacity by 2020 to be met and could deliver for Ireland in ocean energy technology what wind energy has delivered for Denmark.

3 Carbon Neutral Option

Under this option, there is recognition that the requirement for action is time-bound – there may not be a future generation able to act if we do not do so now. Ireland would position itself at the forefront of negotiations aligning itself with the "clean, green and rich" member states who call for stricter targets for developed countries to 2020 and beyond.

This package of measures would, along with those considered in the Proactive option, be best designed and implemented within the context of a long-term climate strategy to 2050.

The first step to achieving this vision could be the adoption of a national target compatible with the higher end of the EU's indicative emissions reduction target for 2050 – an 80% emissions reduction based on 1990 levels, equivalent to an 84% reduction on 2006 emissions. This long-term target could be supplemented by an interim target for 2030, the yet to be determined effort-sharing target post-2012, and shorter interim compliance targets (of no greater than five years). Emissions reductions of at least -10% on 1990 levels would have to be achieved by 2020. Consensus would be achieved as in the proactive approach and a revised, comprehensive, evidence-based and fully costed long-term NCCS could be considered once Ireland's burden share post-2012 is agreed at EU level. The initial task is to estimate the cost per CO_2 tonne abated that this could imply and check whether this is an optimal policy for Ireland.

Existing Policy Measures

This approach would require all existing abatement measures to be reached ahead of target. All of the measures identified under the proactive option would also have to be implemented in full if the Towards Carbon Neutral strategic option is chosen.

Additional Policy Measures

The following additional measures could be considered:

- Introduction of individual cap and share scheme with overall cap determined in line with emissions reductions target.
- Establishment of a low carbon power generation sector by 2040 by incentivisation of on and offshore wind through appropriate feed-in tariffs; further extension of the national electricity grid to accommodate widespread penetration of small-scale and intermittent sources of electricity; setting a national target for penetration of distributed power generation for 2050; and, investment in additional electricity interconnector capacity.

- Establishment of targets for carbon neutral new buildings by 2016; and a long-term target for all buildings to be carbon neutral before 2050.
- Removal of private cars from city centres, first through restrictions on parking, then congestion pricing/road pricing and the provision of widely available public transport.
- Implementation of a major afforestation programme with revised afforestation targets.
- A long-term strategy aimed at regulation and eventual elimination of certain unrecyclable and carbon heavy materials used in production cycles; implemented domestically and proposed at EU level.
- A major reapraisal of the structure of our agriculture sector with a view to encouraging more sustainable farming practices

The marginal cost of abatement, which will rise as the easiest options have been exhausted driven by a high carbon price, should remain key in determining which policies are considered. A different formula would, however, be required to that used in the proactive approach. Distributional, spatial and socio-economic consequences of various measures need also to be considered carefully within the context of other policy objectives. More has to be spent on "pull" policies (financed by the general taxpayer) if "push" policies are not put in place.

The Role of the Carbon Fund

Under this scenario, the Carbon Fund would be substantially curtailed and even discontinued on the basis that domestic measures met (or exceeded) Ireland's GHG emissions reductions targets. In the long term, the problem of carbon lock-in – the creation of systemic barriers to low carbon alternatives – needs to be considered within this context. If Ireland had a surplus of carbon credits at some stage in the future, the Carbon Fund could sell these units on the global market.

Communicating to Households, Businesses and Individuals

The importance of an effective communications strategy increases relative to the level of ambition of government policy – the further from Business as Usual that the government moves the more ambitious and well resourced the communications strategy would need to be. In addition to the areas outlined in the Proactive Option, an individual cap and share scheme would require a comprehensive information campaign. However, in the long-term, the scheme could act as an awareness raising campaign in itself, as it would increase awareness of the carbon content of goods and the implications of individual behaviours.

Institutional

The institutional innovations outlined in the Proactive Option would also be required if this strategy were considered.

R&D Programmes

More public funding would need to be provided to the areas identified in the proactive approach, and at an earlier stage.

Conclusions

The global challenge of climate change and the complex and long-term nature of the problem requires a policy approach that is at once dynamic, broadly applied and contains a complementary mixture of short-term actions and long-term goals and targets. The NCCS succeeds in its limited goal of defining how Ireland can meet its legal obligations under the Kyoto Protocol, but it does not attempt to address the much larger task that Ireland must face if we are to contribute to the European Union's goal of reducing emissions by 20-30% below 1990 levels by 2020 and 60-80% by 2050.

A single regulatory measure will not cause Ireland's GHG emissions to decline. This concluding chapter has attempted to outline three strategic options where a number of measures and instruments are considered together. In many cases policy instruments can enhance each other. For example, an incentive-based instrument would be improved by the provision of useful information to consumers and businesses. In some cases more research is required on how different options would work together.

It is evident that the (post-2012) Business as Usual strategic option does not serve Ireland's strategic interests. For example, this option would damage Ireland's competitiveness and prospects for sustainable economic growth and could result in an unmanageable post-2012 distance to target.

The proactive option could be considered if a balance is sought between achieving long-term objectives and keeping current costs to a minimum and between finding a balance between costs to present and future taxpayers. If the threat to international competitiveness is foremost in the minds of policy-makers and if it is considered that society is not yet ready to consider a more radical alternative, this strategy option could be adopted. It has the advantage over Business as Usual of developing the policy framework that would drive Ireland's emissions close to what the scientific evidence suggests might be required of developed countries if dangerous climatic change is to be avoided. Implementing radical and perhaps unpopular policy options will set the country on a long-term trajectory to break the economy's dependency on fossil fuels and move towards a low carbon future. The bottom line is that, with a growing economy and with above-average EU growth forecasts in the short to medium term, the costs of taking targeted domestic measures to mitigate emissions could be affordable. Adoption of the proactive option would place Ireland in a position from which the following more ambitious strategy could be considered, if necessary, in the future.

The Towards Carbon Neutral option recognises the reality that developed countries' economies must eventually become carbon neutral. It might be chosen if policy-makers considered there was an urgent need to prepare for a world of fossil fuels' scarcity in the short-term; security of energy supply is enhanced quicker if this approach is chosen. This approach could ensure greater predictability of energy prices in the economy, though these prices may be higher than would be the case under the proactive option. This vision is more likely than the proactive approach to be compatible with what climate scientists tell us would be necessary for developed countries if dangerous climate change is to be avoided. However, it might imply greater immediate cost to the current taxpayer for measures that would benefit future taxpayers and Irish business could be exposed to competitive pressures.

The most important result of this report is that the wide stakeholder group which has contributed to its publication now has a much better mutual appreciation of the challenges which we all face in addressing climate change. This group has engaged in a constructive manner in an effort to inform public policy options in relation to climate change. This engagement is only beginning. Some issues, for example adaptation to climate change, were consciously avoided so as to focus the work of the

group on building the evidence upon which the strategic options have been based. Other important issues, for example emissions from agriculture, electrification of private transport, waste management and reduction, the importance of personal behaviour, the marginal cost of abatement and the social cost of carbon, have not been addressed in great detail. We hope that we can revisit these issues.

When the idea of preparing a report on climate change to inform the policy debate in Ireland was first mooted, the ambition was to set out the issues, policy options and implications in as clear a manner as possible. It is hoped that this report achieved that objective and as a consequence the policy-making community in Ireland and, indeed, the general public have a point of reference for the ongoing debate on climate change.

Appendix

Occasional Papers

1. *The Science of Climate Change* (Rowan Fealy, Laura McElwain and John Sweeney, all of ICARUS, NUI Maynooth and Ray Bates, UCD)

2. *The Economics of Climate Change* (IIEA Working Paper)

3. *The Economics of Responding to Climate Change* (Richard Douthwaite)

4. *Flexible Mechanisms, Ireland's Carbon Fund and the Carbon* Market (Peter Brennan)

These papers are available at: http://www.iiea.com/projectsxtest.php?project_id=21

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