INTERNATIONAL ENERGY AGENCY

Energy Policies of IEA Countries

IRELAND 1999 REVIEW

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Figure 22 shows the location of a number of Ireland's energy facilities, in addition to the natural gas transmission network.

1

SUMMARY AND RECOMMENDATIONS

General Energy Policy

Three themes underlie Irish energy policy:

- Opening the electricity and gas markets.
- Achieving Ireland's greenhouse gas emissions target.
- Energy security, in particular diversity in the fuel mix.

The Irish energy sector is dominated by the activities of four state-owned bodies: the Electricity Supply Board, Bord Gáis Éireann (gas), Bord na Móna (peat) and the Irish National Petroleum Corporation (INPC, which owns and operates Ireland's only oil refinery on the island). The National Oil Reserves Agency, which is a subsidiary of INPC, ensures that sufficient oil stocks are maintained to meet emergency requirements. Important structural changes are underway in each of these organisations. There are good prospects for the creation of a competitive energy sector, which should bring lower energy costs in Ireland and contribute to sustaining growth in the Irish economy.

Change is being driven in particular by European Union (EU) directives and programmes, and Kyoto commitments on reduction of greenhouse gas emissions, but constrained by long-standing social welfare responsibilities and energy security objectives of the major state energy bodies. In general, this report concludes that there is some uncertainty about the level of commitment to the market principles underlying EU policy and the IEA *Shared Goals*. Sustained effort will be required by the Government and the Regulator to achieve real structural change by promoting competition in the electricity and gas sectors.

Along with structural change, a change in attitude may be necessary. First, so far as energy security is concerned, a more outward-looking approach would be desirable. Many of the recommendations in this report suggest ways in which the Irish energy market might function as part of the wider European and global market. Second, the introduction of competition and the restructuring of state-owned organisations will inevitably lead to questions about their future ownership. Existing legislation would permit Bord na Móna to move into the private sector. As with Bord na Móna, options for the restructuring of other state-owned bodies should include privatisation. Third, as Ireland moves towards the establishment of an energy economy that operates largely independently of the Government, there will be a growing need for the Government to be clear about the rules of the game, and its own role. There is already a pressing need for a statement of general energy policy that is sufficiently final and detailed for each sector to guide the existing players and to encourage further private investment.

Electricity

Ireland is bringing in legislation to implement policies to comply with the EU Electricity Directive. The new legislation contains the basic regulatory tools needed to introduce competition. The plans laid down by the Irish Government to open the market to new entrants, to unbundle transmission activities and to establish a regulated third party access system are commendable. Ireland believes that a combination of growth in electricity demand allied to further market opening based on the experience of the initial period of competition will provide ample opportunity for new entrants.

Nevertheless, as part of maintaining tripartite support for opening the electricity market, the Government has agreed to limit the extent of market opening to the minimum requirement of the Directive despite evidence that many independent operators are interested in entering the market. The policy runs the risk of discouraging some investors from entering the market. There is also a question of the appropriate treatment of investors who may be willing to enter the market, but are unable to do so simply because the permitted level of market opening has been exceeded.

The policies being implemented are likely to leave the current structure of the Electricity Supply Board intact. There can be little doubt that the Electricity Supply Board will continue to enjoy a dominant position in the future electricity market. In these circumstances, competition may fail to develop, even if the letter of the Directive is observed. Recommendations in this report are directed to providing support for the development of competition in the wider interest of improving efficiency in the electricity sector. A very positive signal to the market would be for the first power station to be built under the new arrangements to be owned by a company other than the Electricity Supply Board.

Regulation

The Commission for Electricity Regulation, which will be formally established by legislation, will be funded by industry. The Commission will have a statutory mandate to fulfil and the legislation imposes no constraints on its ability to fund its operations.

The role of the Regulator will be crucial to the successful development of competition in the electricity and gas markets. The Regulator will be exposed to considerable pressure. The Regulator will need independence and unambiguous rules of the game, including the possibility of applying sanctions. It will be vital to the successful implementation of competition that the Commission for Regulation be adequately staffed. Taking on the role of gas regulator will bring an additional burden although it is logical to combine these roles, particularly in a small market.

Gas

Decisions on the gas sector are becoming urgent because of the capacity limit of the single gas interconnector linking Ireland and the United Kingdom and because gas

production from the Kinsale and Ballycotton fields has gone into decline. Decisions on the development of the gas and electricity sectors are closely related to decisions which might be taken to address the problem of the capacity of the present interconnector because gas is the preferred fuel for power generation.

Important relationships between the gas and electricity markets will come to a head when authorisations are granted for new gas-fired generation capacity and applications are made to Bord Gáis Éireann for gas allocations. Bord Gáis Éireann appears to accept that it will have a continuing role in the transition to competition in the gas market and is preparing options for making allocations between competing companies. The level of market opening currently stands at 75%, which would suggest a liberalised gas market has been established. However, this represents only a few major consumers, and only a few new entrants have sought third party access since implementing legislation was passed in 1995. At a policy level it will be important for competition to be made more effective in the gas market, and future development of the gas and electricity sectors should be considered jointly.

Growth in gas-fired generation capacity gives rise to the possibility of growing dependence on gas imports. Security of supply considerations are not sufficient to justify restrictions on the growth of gas penetration although the growth should be monitored. Market mechanisms, such as electricity prices which reflect security of supply, penalties for failure to supply, and contractual arrangements with several gas suppliers, should be part of the response to security concerns. Because of the relatively recent and rapid growth in gas use, the most important response measures, so far as basic infrastructure is concerned, could be the successful development of the Corrib discovery and a second gas interconnector. The Corrib discovery would be important for security of supply. A second gas interconnector would address both security of supply and competition issues by more closely relating the Irish gas market to the wider European market.

Oil

Discoveries of oil and gas would clearly be of major benefit to the Irish economy and to security of supply. Exploration and production policies appear to provide a good framework for stimulating exploration and should continue in their present form.

The mandatory requirement to purchase from the Whitegate refinery is intended to contribute to energy security by ensuring that a range of products is available during an emergency. The Whitegate refinery is likely to continue to under-perform by international comparison, and there could be a continuing investment requirement to contain the costs of its operations and to meet EU standards. An investment programme totalling I£ 70 million was approved in February 1999, primarily to enable the refinery to produce motor fuel products which satisfy the environmental standards set out in the EU Auto Oil Programme. The mandatory purchasing requirement should be removed as quickly as possible, and further consideration should be given to more cost-effective means of ensuring security.

Peat

In general, the IEA does not consider appropriate the use of the energy sector for achieving social objectives such as employment creation. There are no convincing reasons for continuing the use of peat on energy security grounds and the economics of its use are poor. For these reasons, existing peat-fired plants are likely to be phased out, but a closure policy needs to be confirmed and a timetable for closures announced. The performance of the plant now under construction at Clonbulloge should be monitored and the plant should be operated consistent with its environmentally advanced design. No new plants should be built unless substantial improvements are made in the economic and environmental performance of peat-fired plants. Possibly more cost-effective means of diversifying the fuel mix, including renewables, should be considered as part of the response to energy supply security concerns.

Energy Efficiency and the Environment

Ireland has committed to limiting growth in greenhouse gas emissions to 13% above the 1990 level by the target period 2008-2012, compared with a business-as-usual case of about 26% growth. The Government is presently considering a consultants' report on possible measures to achieve the target.

The recommendations made in this report on the supply side (on gas and peat) would go some way to assisting Ireland in meeting its Kyoto target. Demand-side measures, including the use of pricing, could be addressed more forcefully. Implementation of efficiency programmes, most of which are awareness-raising activities and will end in 1999, are presently left to the Irish Energy Centre. More ambitious energy efficiency policies appear to be necessary and need to be developed to replace the present Irish Energy Centre programmes. New measures will need to go beyond current programmes, for example to include pricing of externalities and emissions trading. It is important that any policies on the demand side are designed to be ongoing policies, which are integrated with economic policy to bring about permanent changes in the use of energy in all sectors. One-off changes are unlikely to be effective and should not form the basis of policy. In all cases, cost-effectiveness should be the criterion for selecting response measures, with particular attention taken of any impacts of greenhouse gas reduction measures on gas and electricity sector reform.

Research and Development and Renewables

Renewables are promoted through competitive tendering to meet targets under the Alternative Energy Requirement programme. Both Government and the private sector spend very little on energy research and development and there is very little information on what research and development does occur.

The current low level of expenditure appears inconsistent with the high level of economic growth in Ireland. A research and development programme could help in underpinning the Government's general goal of sustained economic growth. The Government has recently received a report recommending a substantial increase in expenditure on research and development, which is discussed in this report. Priority setting for research and development might be usefully guided by the results of the Alternative Energy Research programme.

There is a need for the development of an integrated policy approach to renewables, which would take into consideration not only the direct costs of renewable energy, but also the landscape value of proposed sites and the grid costs. Trading off plant costs, location values and grid operation efficiency may well lead to different investment choices, and should be included in criteria for selecting projects under future competitions for the Alternative Energy Requirement programme.

RECOMMENDATIONS

The Government of Ireland should:

Environment

- ☐ Develop a national database on greenhouse gas emissions and projections, as a basis for quantifying and evaluating the cost-effectiveness of policy options to reduce the growth in greenhouse gas emissions.

- ☐ Develop and announce detailed response measures to achieve its greenhouse gas emissions target, including an assessment of expected quantitative outcomes in physical terms.

- ☐ Publish the report of the advisory group on domestic emissions trading and the implications for Ireland of an international trading regime; review the report in light of the possible economic advantages to Ireland of developing and exporting skills in financial services related to emissions trading.

Energy Efficiency

- ☐ Develop a programme of energy efficiency measures to replace the current programme of the Irish Energy Centre, which includes the use of pricing and mandatory regulations, and is based on quantitative analysis of possible cost-effectiveness.

☐ Discuss with industry the need for mandatory energy efficiency targets and measures, possibly implemented through enforceable agreements entered into voluntarily.

Electricity

☐ Give a public commitment to the development of competition in the electricity market and favour entry of new competitors, as a means of improving efficiency in the electricity sector; enhance certainty in the investment climate for new entrants by defining the Government's expectation of its future role, and by providing detailed and precise information for potential new entrants to the market.

☐ Allow the number of suitable potential new entrants, and the interest shown by consumers, to determine the pace and level of market opening, if the minimum market opening set by the EU Directive is exceeded.

☐ Ensure that the Commission for Regulation has sufficient resources and powers to undertake the task of regulating and promoting competition in the electricity and gas sectors.

☐ Require the Regulator to monitor the market influence of the Electricity Supply Board arising from its present structure, and require the Regulator to advise the Government on the Regulatory Commission's ability to promote competition without also having the power to address the extent of the Electricity Supply Board's influence.

☐ Require the Regulator to advise on any additional measures which may be needed to introduce effective competition in the electricity market.

Oil

☐ Work towards the objective of removing the mandatory requirement for purchases from the Whitegate refinery.

☐ Consider other possible means of responding to both the economic difficulties of operating the refinery and concerns about product security.

Gas

☐ Now that the gas market is open for larger consumers, develop means to make competition more effective, and ensure that policy developments in both the gas and electricity markets are co-ordinated.

☐ Review gas transmission tariffs with a view to ensuring that they are cost-reflective and transparent.

☐ Develop a policy for making allocations of gas between competing companies in the event that capacity limits arise.

☐ Give priority to gas market issues which impact on electricity sector reform, such as non-discriminatory allocation rules for potential gas-fired power generators, including small cogenerators in the commercial and household sectors.

☐ Allow gas penetration to continue to be determined by the market, while continuing to monitor the energy security implications of relying on growing gas use.

☐ Take into account the energy security and competition benefits in assessing the need for a second gas interconnector.

Peat

☐ Confirm a programme to phase out all existing peat-fired power plants and publish a timetable to give effect to the programme, based on the national economic and environmental benefits arising from the closures.

☐ Ensure an arm's-length relationship is maintained between the Government and the new peat-fired power plant on issues arising from commercial decisions taken by the plant operators.

☐ Seek to develop alternative, cost-effective means to promote employment in areas currently assisted by peat-fired power plants and Bord na Móna.

☐ Objectively identify the net impact on greenhouse gas emissions of the full cycle of peat production, including bogland drainage, peat harvesting and drying, transport, peat combustion and bogland rehabilitation.

Renewable Energy

☐ Analyse the basis for reduced costs for renewables under the Alternative Energy Requirement programme with a view to determining the net economic benefits to the Irish economy of different renewable technologies.

☐ Develop links between priority setting for energy research and development activities, and the renewable energy programme.

☐ Consider incorporating trade-offs between location site values, grid integration costs, and optimal physical performance in evaluating future projects to be supported by the renewable energy programme.

Energy Research and Development

☐ Collate information on energy research and development conducted by government and industry; evaluate the adequacy of the current level of expenditure, the priorities of current programmes, and the extent and effectiveness of collaboration with the private sector, bearing in mind the extent to which the current level and outlook for economic growth in Ireland rest on maintaining a lead in technology and international competitiveness.

☐ Respond to the report of the Energy Panel, giving close attention to the full cost of recommendations, including for so-called enabling policies, the willingness of industry to share the cost of implementing the recommendations, and the experience of other countries in funding research on the particular priorities recommended.

☐ Seek the views of the Energy Panel on concrete ways in which collaboration between researchers, industry, and education and training institutions might take place on an ongoing basis.

☐ Develop a policy on energy research and development which relates energy, environment and industry policy goals to short-, medium- and long-term goals in each of these areas.

2

CONDUCT OF THE REVIEW

REVIEW TEAM

The 1999 International Energy Agency's (IEA) in-depth review of the energy policies of Ireland was undertaken by a team of energy policy specialists drawn from the Member countries of the IEA, which visited Ireland 25-29 January 1999 for discussions with government officials and representatives of the energy supply and distribution industries. Information provided during the visit has been supplemented by published sources and IEA statistical analysis of data provided by the Department of Public Enterprise.

Members of the team were:

Peter Scholten (Team Leader)
Deputy Director-General for Energy
Ministry of Economic Affairs, the Netherlands

Henrik Andersen
Danish Energy Agency, Denmark

Nancy Mahieu
Ministry of Economic Affairs, Belgium

Richard Greenwood
European Commission, Belgium

Carlos Ocaña
Energy Diversification Division, International Energy Agency

John Cameron
Desk Officer for Ireland, Country Studies Division
International Energy Agency

John Cameron was responsible for management of the review and for drafting the report in consultation with the team. Carlos Ocaña drafted the critique on electricity in Chapter 6.

The team held discussions with the following organisations (in order of the programme):

- Department of Public Enterprise
- Department of Marine and Natural Resources
- Department of the Environment

- Department of Finance
- Electricity Regulator Designate
- Electricity Supply Board
- The Irish Business and Employers' Confederation
- The Irish National Petroleum Corporation
- National Oil Reserves Agency
- Bord Gáis Éireann
- Irish Energy Centre
- Earthwatch
- Bord na Móna

The assistance and co-operation of all participants in the review are gratefully acknowledged.

REVIEW CRITERIA

The *Shared Goals* of the IEA, which were adopted by IEA Ministers at their 4 June 1993 meeting, held in Paris, provide the evaluation criteria for in-depth reviews conducted by the Agency. The *Shared Goals* are set out in Annex B.

3

GENERAL ENERGY POLICY

BACKGROUND[1]

Ireland has a population of 3.6 million (1996), of which about one-third are in Dublin (1.1 million), Cork (127 000) and Limerick (52 000). The land area is about 70 000 square kilometres, of which 57% is for agriculture. Average population density is relatively low. Outside Dublin and the eastern region, the population is highly dispersed and low density. The labour force is 1.5 million, of which 9% are employed in agriculture, forestry and fishing, and 24% in industry and construction. The unemployment rate was about 11.25% in 1997 (compared with more than 15% in 1992).

The Irish economy depends heavily on trade and has expanded strongly over the last decade. Gross Domestic Product (GDP) grew by 28% in the period 1990-1995. The rate of growth in economic activity has been more than three times that seen elsewhere in Europe. Growth peaked in 1995, when the rapid expansion of the computer and semiconductor industries worldwide helped boost GDP by more than 10%. The rate of growth remains high. Employment growth has been rapid and inflation has been reduced below 2% per year. Key influences on the pace of economic activity have been foreign investment (notably in the computer, semiconductors, office equipment, software, pharmaceuticals, electrical engineering and soft drink concentrates industries, encouraged, in part, by a low corporate tax rate of 10% in the manufacturing and international financial services sectors), growth in the labour force and the educational standards of the population (almost one-half of school-leavers continue into tertiary education), and a high degree of social consensus which has moderated private sector wage increases in return for tax reductions and reduced the level of industrial disputation.

The economy seems likely to maintain rapid growth. Exports are expected to continue to lead the expansion. Domestic demand is also expected to continue to grow, influenced by rising employment, cuts in income tax and some increases in real wages. If structural transformation of the economy continues, with a rapid inflow and expansion of multinational companies, Irish income levels should converge with those seen in the rest of the EU in about 2002.

GENERAL ENERGY POLICY

Responsibility for energy policy rests with the Department of Public Enterprise (formerly the Department of Transport, Energy and Communications). The

1. Comments in this introduction are taken from *OECD Economic Surveys – Ireland 1997*, OECD, Paris, 1997.

Department of Marine and Natural Resources is responsible for oil and gas exploration. Figure 1 illustrates the structure of the two Departments. The Minister for Public Enterprise is the only shareholder of four state-owned energy companies: Bord Gáis Éireann (effectively a monopoly for natural gas distribution and sales), the Electricity Supply Board (effectively a monopoly for transmission, distribution and power generation), Bord na Móna (effectively a monopoly on commercial peat production), and the Irish National Petroleum Corporation (which owns and operates the only refinery in Ireland). The Irish Energy Centre has responsibility for implementing policy on energy efficiency. The Energy Advisory Board brings the views of industry and the workforce to the attention of the Department of Public Enterprise.

The objectives of Irish energy policy are to:

- ensure environmentally sustainable energy production and consumption;
- develop a competitive energy supply industry;
- ensure security and reliability of energy supply;
- maximise energy efficiency; and
- ensure that energy infrastructure is operated safely.

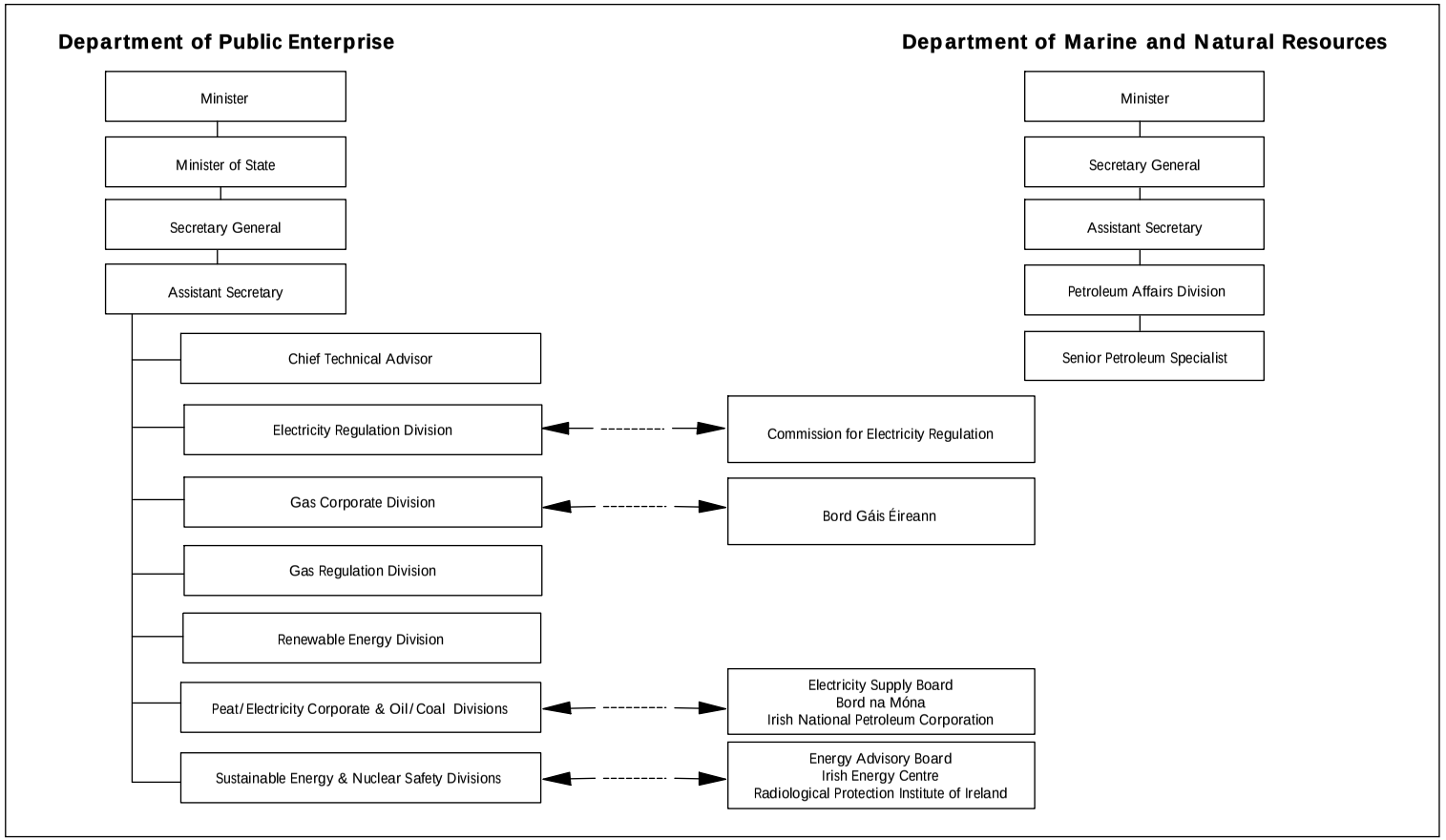
The following are the Government's key strategies to achieve the objectives:

Ensure environmentally sustainable energy production and consumption by:

- achieving an equitable and workable energy solution as part of greenhouse and other gas emission policies;
- promoting the efficient generation of electricity from renewable energy sources and combined heat and power;
- maximising energy efficiency and highlighting environmental implications for consumers of their final energy demand decisions, through Irish Energy Centre programmes and advice;
- encouraging research and development in energy efficiency and renewable energy;
- highlighting the risk and environmental impact of the nuclear industry in the United Kingdom and elsewhere, with the help and advice of the Radiological Protection Institute of Ireland.

Figure 1

Administration of Energy Policy



Develop a competitive energy supply industry through:

- encouraging new entrants into the electricity and gas markets by bringing forward legislation to implement government policy and EU directives on the internal market in these sectors;

- establishing independent regulation, accountable to the Oireachtas[2], for the electricity and gas industries;

- encouraging the extension of the natural gas network as far as practicable to cities and major towns;

- minimising the cost of public service obligations, renewable energy requirements, security of supply provisions and environmental obligations.

Ensure security and reliability of energy supply by:

Electricity

- implementing policy on the use of a wide diversity of fuels in a range of power stations in appropriate locations throughout the country;

- promoting the efficient generation of electricity from peat, renewable energy sources and combined heat and power;

- encouraging interconnections north-south and east-west where they are economic;

- ensuring the availability of a modern high-quality electricity network to meet projected demand.

Gas

- identifying infrastructural development needs to meet future gas demand;

- settling the extent to which the overall energy requirement should be dependent on natural gas;

- examining storage and encouraging interconnections north-south and east-west where they are economic.

Oil

- maintaining an emergency response capacity to deal with potential disruptions in oil supply to consumers;

2. The legislature of the Irish Republic.

- ensuring that the National Oil Reserves Agency continues to manage the national strategic oil reserve at lowest cost to the consumer;

- minimising the effects of oil supply disruptions or emergencies.

Peat

- supporting the commissioning of a new 120 MW peat-fired power station by mid-2001;

- continuing to use peat in power stations where it is economic and efficient, and also for direct domestic consumption.

Maximise energy efficiency by:

- completing implementation of the current national energy efficiency programme which is partly funded by the EU Community Support Framework through the Irish Energy Centre;

- developing new energy efficiency programme for the post-1999 period;

- continuing to use the Energy Advisory Board as a forum to advise the Minister on energy efficiency policy and renewable energy policy.

Ensure that energy infrastructure is operated safely by:

- continuing to require high safety standards in all energy sectors;

- monitoring developments concerning electromagnetic fields associated with the high voltage electricity grid;

- continuing, with support and advice from the Radiological Protection Institute of Ireland, to place pressure on the United Kingdom authorities on nuclear safety and to highlight the issue of safety in all international forums[3].

ENERGY SUPPLY AND DEMAND

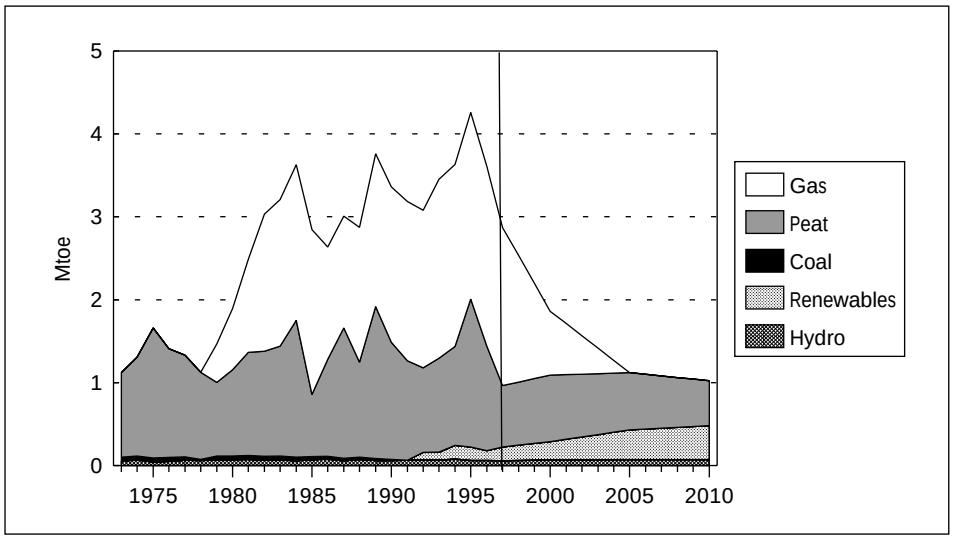
Primary Energy Supply

Annex A contains information on Ireland's energy balances and key statistical data. Ireland depends on imports for about 77% of energy supply. About 92% of Ireland's

3. The Government of Ireland opposes any expansion of the international nuclear industry. Closure of the Sellafield (United Kingdom) operations is an objective.

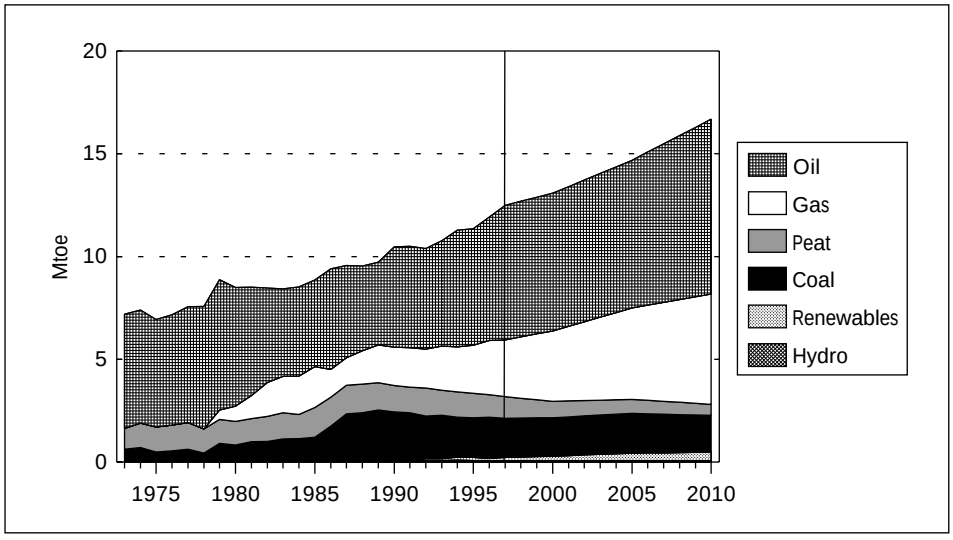
energy supplies are from fossil fuels and 98% from fossil fuels and peat. About 52% of energy supply is imported oil. Ireland has large reserves of peat which is harvested for power generation and non-energy uses by Bord na Móna, and privately

Figure 2
Energy Production, 1973-2010



Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1998, and country submission.

Figure 3
Primary Energy Supply, 1973-2010



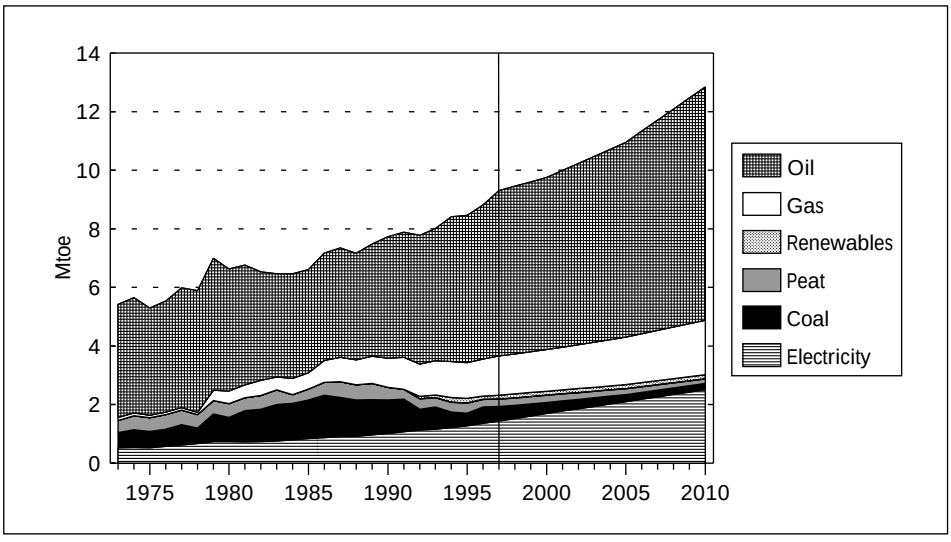
Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1998, and country submission.

for domestic use. Peat accounts for about 26% of domestic energy production. Peat use in power generation is expected to peak when a new peat-fired plant commences production in 2001, after which it will fall as older peat-fired plants are phased out. The only indigenous gas production, from the Kinsale and Ballycotton fields, has gone into decline and is expected to reach economic termination after the year 2005. There are no gas exports. Net imports of energy are therefore expected to rise rapidly after 2000 unless new gas supplies are made available in the near future.

Final Energy Consumption

Total final energy consumption in 1997 was 9.3 Mtoe, a rise of nearly 6% from 1996, but slower than growth in Gross Domestic Product, which grew by 10.6% in the same period. In 1997, oil accounted for nearly 61% of final consumption, electricity 15.4%, gas 14.4%, peat and coal 5.4%, peat 2.7%, and renewables 1.5%.

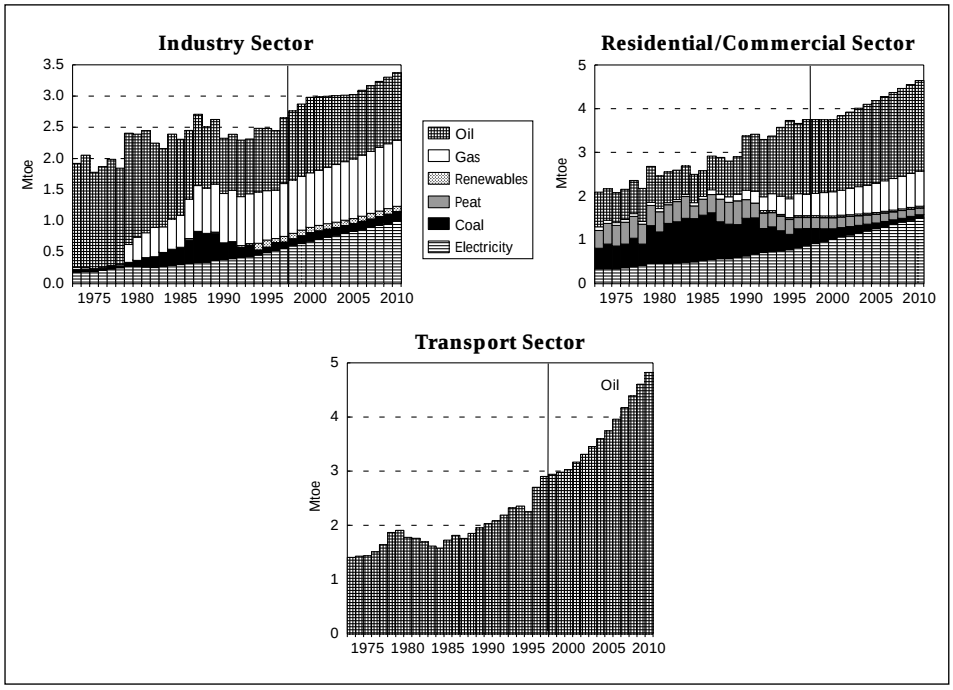
Figure 4
Total Final Consumption by Fuel, 1973-2010



Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1998, and country submission.

In 1997, industry accounted for about 28.5% of final energy consumption, and transport accounted for about 31%. Transport demand for energy has risen by nearly 43% since 1990, and by nearly 107% since 1973. Industrial demand for energy in Ireland has risen by just over 14% since 1990, and by about 38% since 1973.

Figure 5
Final Consumption by Sector and by Fuel



Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1998, and country submission.

CRITIQUE

Several factors need to be kept in mind in assessing Irish energy policy.

- The market is very small (together with New Zealand, Ireland has the second smallest population in the IEA Member countries[4]) and economic activity is focused on a single city, Dublin.

- Energy security is a central issue. Peat will become the only domestic energy resource in a matter of years, unless new gas development occurs; there is no electricity interconnector other than to Northern Ireland; and the single gas interconnector is close to full capacity.

- The economy has grown rapidly over the last decade, but only after an extended period of stagnation and net emigration. Private consumption per capita remains below that of most of the IEA Member countries and can be expected to grow.

4. Luxembourg has the smallest population of the IEA Member countries (413 000 in 1995).

- The Irish economy is the most open of all the Member countries of the Organisation for Economic Co-operation and Development (OECD): exports account for nearly 70% of GDP (in 1995) and the rate of growth in exports is faster in Ireland than in any other OECD country, except Mexico. The international markets in which Ireland competes (notably electronics and computers) are characterised by falling prices. Economic growth depends crucially on maintaining international competitiveness.

- Economic performance has been assisted by a broad political consensus. Maintaining the consensus is likely to remain an important national goal and could have implications for the future of the energy sector, for example if the energy sector continues to be used as a means of redistributing income and creating employment.

- EU funds have played an important role in almost every aspect of energy policy, for example capital grants for the gas interconnector, a new peat-fired power station and electricity network rehabilitation, and programme funding for energy efficiency, energy research and development, and renewable energy.

Against this background, achieving a balance between economic growth, environmental performance, security of supply and socio-economic objectives, is likely to be difficult. The relatively recent upturn in the economy will bring understandable pressure to ensure its unchecked continuation and for the benefits to be fairly distributed. Regulatory reform of the energy market should improve efficiency in the energy industries to help underpin future growth, but energy consumption and greenhouse gas emissions can be expected to rise at rates related closely to the pace of economic growth. Nevertheless, the relatively recent history of high economic growth also provides an opportunity to establish the structural conditions for sustainable growth, and the resources to fund programmes in, for example, energy efficiency and energy research and development, which could help bring these conditions about.

Success will call for a level of commitment to, and confidence in, the ability of the market to achieve energy policy goals effectively and efficiently, including the goal of energy security. Ireland has the potential to take its place as one of the leading countries in the world in terms of both economic and environmental performance. Short-term pragmatic decisions which seek to preserve existing structures or which hinder the full development of competition, for example, may incur high costs in the future. Already the cost of using peat production as a means of creating employment is costing about I£ 13.25 million[5] per year (see Chapter 8), and maintaining Whitegate refinery on energy security grounds is costing about I£ 5 million per year (see Chapter 7).

The clarity and integration of policy will be important for both its acceptance and its success. Consensus policies have proven to be successful in Ireland, but

5. On average in 1998, I£ 1 = US$ 1.429. As at 4 January 1999, I£ = € 1.2697.

leadership will be required if change is to occur at a satisfactory pace. Successful opening of the gas and electricity markets would benefit from a clearer statement of policy objectives and certainty on timing of change. Similarly, the advice which has been given to the Government on possible greenhouse measures needs to be quickly turned into a firm and transparent set of policies and measures, combined with a mechanism for monitoring progress. On the demand side, a commitment to a new and enlarged programme of efficiency measures is required urgently, while on the supply side, the Government's view on the future of peat needs to be clarified and decisions must be reached on gas infrastructure.

Progress in energy policy may be hampered by the limited resources available for developing policy. In electricity, in particular, the timetable to meet the deadline for implementing the EU Directive is very short. The issues and the range of options are well understood in the Department of Public Enterprise, but consideration might be given to providing additional expertise to maintain the quality of policy advice and the pace of policy implementation.

4

ENERGY AND THE ENVIRONMENT

ENERGY-ENVIRONMENT POLICY

Greenhouse Gas Emissions

Under the Kyoto Protocol, the EU has committed to the reduction, individually or jointly, of the emissions of a basket of six greenhouse gases[6], to 8% below their 1990 level by 2008-2012. The EU and member States together will achieve this target, using the provisions for joint attainment in Article 4 of the Kyoto Protocol. At the meeting of the EU Council of Environment Ministers in June 1998, Ireland agreed to a national target to limit the net increase of emissions of greenhouse gases to 13% *above* 1990 levels in the target period 2008-2012. The target is to be achieved by actions at national level across all greenhouse gas emissions, enhancement of sinks, common and co-ordinated action at EU level, and international flexibility mechanisms.

Carbon dioxide (CO_2) constitutes the largest element of Ireland's basket of greenhouse gases (57% of the basket in 1995), and energy use is responsible for 95% of the emitted CO_2. The relative contributions of the gases are shown in Table 1. Aggregated on the basis of their Global Warming Potentials[7], the total in 1995 was estimated to be 59.4 million tonnes of carbon dioxide equivalents, which is a 4.3% increase over the estimated 56.9 million tonnes in 1990. If account is taken of increased afforestation, the net increase in emissions would be about 2% over the period. The contribution of methane and nitrous oxide to total emissions is unusually high because of the significance of agriculture in the economy. Agricultural emissions measured on the basis of Global Warming Potential represent about 35% of total emissions.

Energy Sector Emissions

Carbon dioxide emissions by sector and by fuel are illustrated in Figure 6. Combustion of fossil fuels (coal, oil and gas) and peat for energy production is the

6. Gases which contribute to the warming of the earth's surface. The Kyoto Protocol (December 1997) defines commitments to reduce emissions of the following six greenhouse gases: CO_2 (carbon dioxide), CH_4 (methane), N_2O (nitrous oxide), HFCs (hydrofluorocarbons), PFCs (perfluorocarbons), SF_6 (sulphur hexafluoride). On a global level, CO_2 is the single most important anthropogenic greenhouse gas. Fossil fuel production and use represent about three-quarters of CO_2 emissions from human activity. Other energy-related greenhouse gases include CH_4 from the production, transportation and use of natural gas and coal, and N_2O primarily from fuel wood use. The three other greenhouse gases covered by the Kyoto Protocol are not energy-related: HFCs (used as alternatives to ozone-depleting substances, such as coolants), PFCs (from aluminium smelters), and SF_6 (used in insulators for electrical transmission and distribution systems).
7. As defined by the United Nations Intergovernmental Panel on Climate Change (UNIPCC).

Table 1
Greenhouse Gas Emissions in 1995
('000 tonnes)

	CO_2	CH_4	N_2O	HFC	PFC	SF_6
Energy	32 105	14.99	3.52			
Industrial Processes	1 772		2.62			
Agriculture		636.86	19.11			
Land Use Change and Forestry	–6 230	24.36	0.79			
Waste	54	136.03				
TOTAL	**33 931***	**812.24**	**26.04**	**111**	**103**	**84**
Contribution to Total (%)**	**57.2**	**28.7**	**13.6**	**0.2**	**0.1**	**0.2**

* Excluding land use change and forestry.
** On the basis of global warming potential.
Data for HFCs, PFCs and SF_6 are estimated and presented in CO_2 equivalents.
Source: *Limitation and Reduction of CO_2 and Other Greenhouse Gas Emissions in Ireland*, Environment Resources Management in association with Byrne Ó Cléirigh, Dublin, and Economic and Social Research Institute, Dublin, Government of Ireland, 1998.

greatest source of emissions (95% of carbon dioxide and 57% of total emissions). The largest source of these emissions is from fuel combustion for power generation, which accounts for 23% of total emissions, compared with the OECD Europe average of 28%.

Projections of Emissions

Projections for greenhouse gas emissions in Ireland vary widely. Forecasts for net greenhouse gas emissions in the target period 2008-2012 range from 11% to 24% above the 1990 level. The range is determined largely by the range of projections for carbon dioxide (from 15% to 41%) which, in turn, reflects the range of assumptions for economic growth. The assumed annual rate of economic growth to 2010 in Ireland's *Second National Communication*[8] was 4%, compared with 4.2% actual growth in the period 1960 to 1995 and a peak rate of about 10% in 1995. Figure 7 illustrates some plausible current projections of economic growth, energy supply and demand, and emissions.

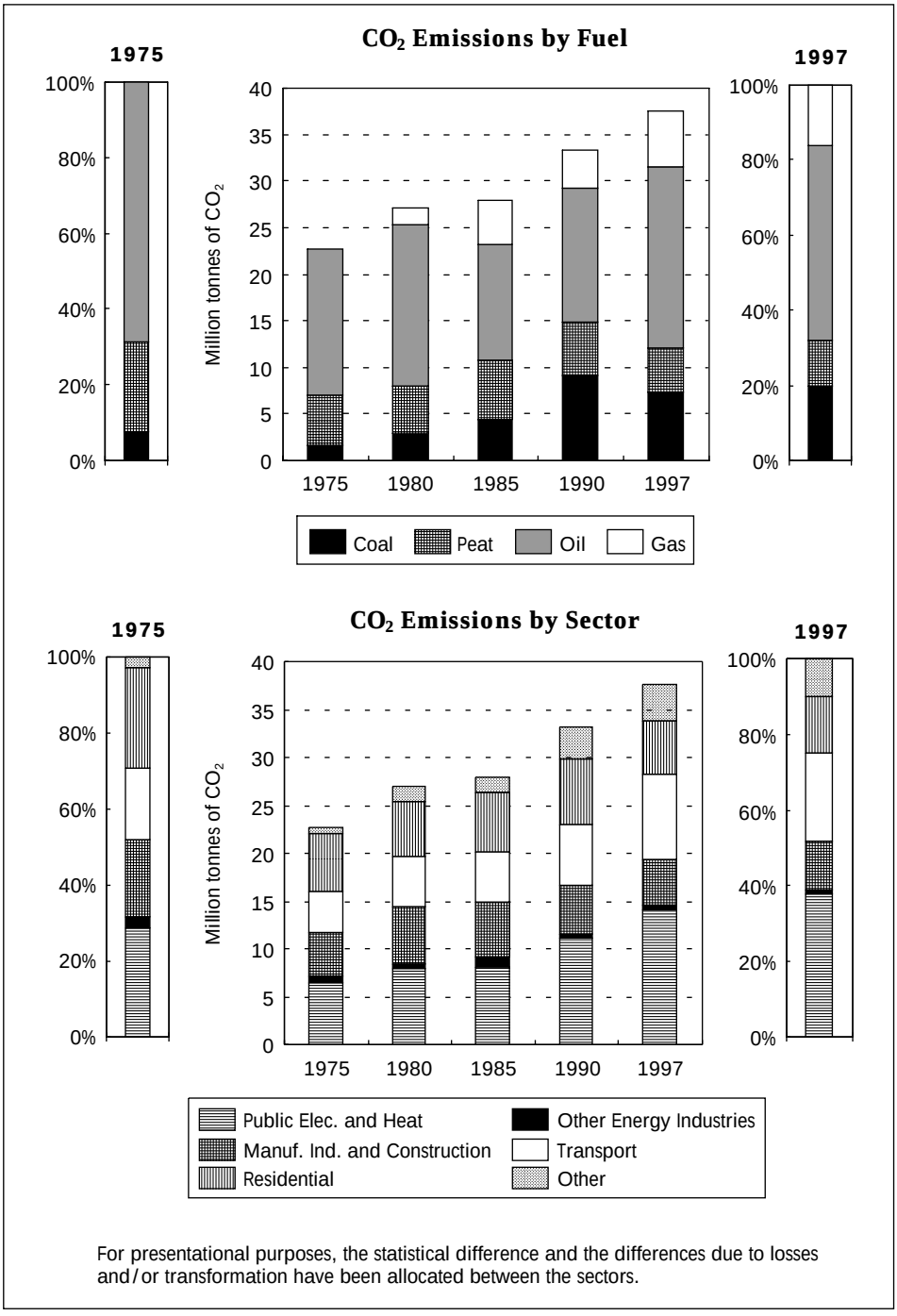
Existing Response Measures – Energy Sector

A number of measures are currently in place to mitigate greenhouse gas emissions in the energy, transport, residential, industrial, agricultural, waste and commercial

8. *Ireland, Second National Communication under the United Nations Framework Convention on Climate Change*, 1997.

Figure 6

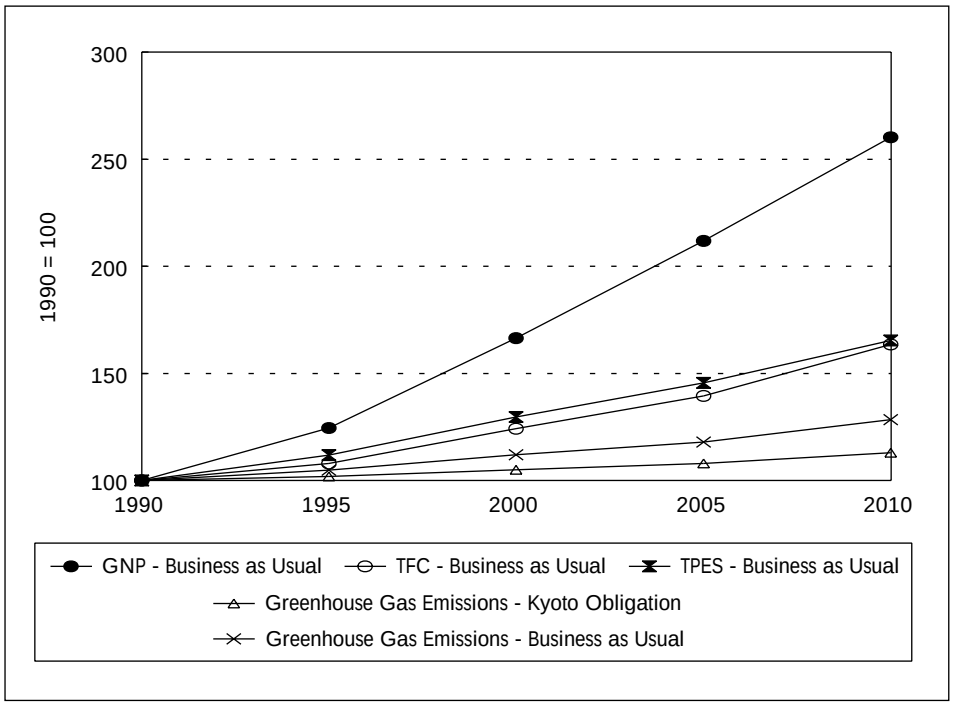
Carbon Dioxide Emissions by Sector and by Fuel, 1975-1997



For presentational purposes, the statistical difference and the differences due to losses and/or transformation have been allocated between the sectors.

Source: *CO_2 Emissions from Fuel Combustion*, IEA/OECD Paris, 1998.

Figure 7
Projected Rates of Economic Growth, Energy Supply and Demand, and Greenhouse Gas Emissions



Source: Department of Public Enterprise.

sectors. These are outlined in detail in Ireland's *Second National Communication*. In the energy sector, policies and measures seek to improve the general level of efficiency of energy use. In relation to energy supply and production, they aim to improve the efficiency of electricity production, reduce the level of carbon intensity and manage growth in demand (see also Chapters 5, 6, 7 and 8).

Measures to improve energy efficiency include:

- Establishment of the Energy Advisory Board in September 1994, to bring together energy sector interests, including trades unions, to advise the Government. The establishment of the Board typifies a broad consensus-making approach to policy formulation in Ireland.

- Establishment of the Irish Energy Centre (IEC) in September 1994, as a joint initiative of the Government and industry, with the task of co-ordinating and implementing the national energy conservation programme. Total funding of the IEC for the period 1994 to 1999 is I£ 40 million. The IEC provides grant support to individual companies, technical advice and financial support for investment in energy-efficient technologies, and information campaigns directed

at improving energy efficiency in public sector buildings and raising general public awareness.

- Building Regulations were revised in 1991 to raise standards of thermal insulation in most new buildings. By 1996, 149 000 houses, or 12% of the total housing stock, had been built under the new regulations. The Building Regulations were further revised in 1997 and an energy rating was introduced as an optional method of showing compliance for housing. Energy efficiency in housing is promoted by the IEC, the Electricity Supply Board (ESB) and Bord Gáis Éireann.

- Guidelines for design and construction of social housing by local authorities and others were issued in 1997. Further guidelines are planned.

- Participation in EU programmes (THERMIE and SAVE) to, for example, demonstrate technical innovations in housing and other areas, and establish energy efficiency standards and regulations including energy labelling.

- Demand-side management by the Electricity Supply Board, to manage growth in electricity load while not constraining economic growth.

- Promotion of combined heat and power (CHP) by the Electricity Supply Board and Bord Gáis Éireann.

Supply-side measures include:

- Improvement in overall generation plant efficiency; replacement of some existing plants with new gas-fired combined-cycle plants; transmission and distribution system renewal. Natural gas accounts for about 29% of electricity generation.

- Replacement of some peat-fired electricity generation capacity with a new fluidised bed peat-fired plant; improvement in the average quality of peat delivered to power plants to improve conversion efficiency.

- Fuel switching from coal and peat to natural gas in residential uses, including through investment in the natural gas network. The number of customers grew by about 52% in the period 1990-1995, and is expected to nearly double from 1995 to 2010.

- Completion of the natural gas interconnector between Ireland and the United Kingdom, which has been in commercial use since 1995.

- Extension of Integrated Pollution Control Licensing by the Environmental Protection Agency to the power generation sector. All new and existing large-scale power generation plants will be required to operate using the principle of Best Available Technology Not Entailing Excessive Costs.

- Support programmes for renewable energy, including the Alternative Energy Requirement (AER) programme and the EU Altener programme; establishment

in 1995 of the Renewable Energy Information Office as part of the Irish Energy Centre; Guidelines on Wind Farm Development in 1996 to assist planning authorities and project developers.

- The Waste Strategy, October 1998, will put in place measures to reduce emissions of methane by diverting biodegradable waste from landfill and the recovery of landfill gas. The target is an 80% reduction from this source over fifteen years.

Existing Response Measures – Transport Sector

The broad objective of policies in the transport sector is to decouple growth in transport from economic growth. However, the Government of Ireland considers that there are fundamental difficulties in reducing transport growth at the current stage and pace of Irish economic development. Measures to limit emissions from the transport sector are focused on improving the efficiency of the rail and road transportation systems, promoting public transport and other alternatives to the private car in Dublin and other major urban areas, and reducing the age profile and improving the fuel efficiency of private cars. Specific measures include:

- Raising the proportion of public expenditure on public transport from 5% of total expenditure on transport infrastructure in the period 1989 to 1993, to 25% in the period 1994 to 1999.

- Completing the development of the national primary road network by 2005 and providing an inter-urban travel speed on completion of 80 kilometres per hour. The total investment is estimated to be I£ 160 billion.

- Investing of over I£ 275 million in the rail network and on new rolling stock over the period 1994 to 1999.

- Establishing the Dublin Transportation Office to co-ordinate and monitor the implementation of the Dublin Transportation Initiative. In the period 1994 to 1999, provision has been made for an investment programme of I£ 626 million to enable substantial progress to be made on implementation of the public transport elements of the Dublin Transportation Initiative, including I£ 200 million for the priority phases of the light rail network and I£ 34 million for traffic management measures.

- Financial support (over I£ 1 billion in the last ten years) for socially necessary but financially non-viable public transport. Approximately 90% of the expenditure is for the railway network.

- Reduction in specific energy consumption by 10% between 1993 and 2000 by investment in more fuel-efficient buses and locomotives.

- Promotion of alternative transport fuels by excise duty relief for approved biofuel projects during the period 1996 to 1998.

- Vehicle registration tax refund of I£ 1 000 to owners of private cars more than ten years old who buy a new car and dispose of the old car for scrap.

- Requiring roadworthiness tests for private cars more than four years old.

- Vehicle registration tax and annual road tax graduated according to engine size.

- A number of green taxation measures were introduced in the 1998 Budget: restructuring of vehicle registration tax rates on cars to favour smaller cars; tax incentives for park-and-ride facilities; monthly rail and bus passes provided by employers for employees will not be subject to benefit-in-kind tax; a review of introduction of benefit-in-kind tax on car parking spaces provided by employers to employees; reduction of excise duty on liquefied petroleum gas (LPG).

Additional Response Measures

Domestic Emissions Trading

The Minister for the Environment and Local Government has established an advisory group of key players to examine the option of the development of a domestic emissions trading market and the implications for Ireland of an international trading regime.

Development of a National Strategy

The Department of Public Enterprise and the Department of the Environment and Local Government jointly commissioned consultants to identify and evaluate the scope for intensifying policies and measures and undertaking additional measures to limit and reduce greenhouse gas emissions. The report, *Limitation and Reduction of CO_2 and Other Greenhouse Gas Emissions in Ireland*[9], was published as a consultation document in June 1998. Submissions were invited from interested bodies, individuals and organisations, and a consultative forum was held in October 1998 for those who had made submissions on the study. A national strategy for meeting Ireland's greenhouse emissions target is being developed, building upon existing measures and developing additional policies and measures for implementation in all sectors.

The report concludes that the range of existing measures will influence the rate of the future increase in greenhouse gas emissions, but that they will not be sufficient to keep emissions below targeted levels. The range of costs for optional measures is summarised in Table 2.

9. Environment Resources Management in association with Byrne Ó Cléirigh, Dublin, and Economic and Social Research Institute, Dublin, Government of Ireland, 1998.

Table 2
Summary of Emission Saving Potentials from a Range of Policy Options

Sector	*Measure*	*Cost (I£/tonne of CO_2 equivalent)*	*Total Reducible Emissions ('000 tonnes CO_2 equivalent)*
All	Carbon tax	*a*	
	Tradeable permit	*a*	
Energy	Replacing Moneypoint with CCGT	–0.53	3 342
	Replacing peat plants with CCGT	–27.91	1 447
	Replacing oil plants with CCGT	–23.82	769
	CHP	38 – 286	54 – 271
	Renewables	44.90	1 390
Industry	Energy efficiency	low cost	300 - 1 000
		< 200	1 000 +
Commerce	Energy efficiency	low cost	350 *b*
		< 1 200	25
Transport	Efficiency improvements	–11.11	up to 550
	Alternative fuels	0 to 521	*c*
Residential	Energy efficiency	low cost	Approx. 400
	Building standards	72	210
	Fuel switching	74	146
Agriculture	Reduced herd size		*d*
	Dairy	322	
	Other cattle	163	
	Sheep	155	
	Biogas from manure	57	*d*

CCGT: Combined-cycle gas-turbine power generation.
CHP: Combined heat and power generation.
Notes: Costs relating to efficiency programmes include a cost of I£/tonne of carbon dioxide as a programme cost.
a The cost would be expected to increase with the total emissions reduced; costs would be expected to be less than for the same reduction by other means.
b Technically achievable at zero or negative cost; no account taken of the cost of putting incentives in place nor the level of actual take-up.
c Potentially large but uncertain.
d No estimate made.
Source: *Limitation and Reduction of CO_2 and Other Greenhouse Gas Emissions in Ireland*, Environment Resources Management in association with Byrne Ó Cléirigh, Dublin, and Economic and Social Research Institute, Dublin, Government of Ireland, 1998.

A study by the Economic and Social Research Institute has concluded that a carbon tax could have a positive effect on the Irish economy provided other taxes are reduced. The impact on competitiveness could be addressed by exempting some users, but only by raising the cost for other sectors where the relative cost of reducing emissions is greater. The effect of the proposed EC carbon/energy tax (rate escalating to US$ 10 per barrel of crude oil in 1990 prices by 2000, divided

50:50 on energy and carbon content, i.e. $US 100 per tonne of carbon for oil or $US 370 per tonne of carbon dioxide emitted) is illustrated in Table 3.

Table 3
Impact of Carbon/Energy Tax on Fuel Prices by 2000

Fuel	*% Price Increase*
Coal (residential)	22.7
Coal (other)	100
Peat briquettes	25.3
Petrol	5.9
Gas (residential)	9.8
Gas (for electricity generation)	52.5
Electricity	15.9

Source: Fitzgerald, J. and McCoy, D., *The Economic Effects of Carbon Taxes*, Economic and Social Research Institute, Dublin, 1992.

If price-based measures are not used, then the largest one-off reductions could be achieved in the energy sector by switching from peat and coal to gas. The report considers that replacing the coal-fired Moneypoint plant would yield the largest emission reduction and would be a profitable investment. Phasing out peat-fired power generation would have a lesser impact on emissions because of the scale of the plants, but would also be a profit-making option. If the Government chooses to retain control over the fuel mix, then a policy change would be necessary to achieve reductions by this route. Table 4 shows average prices and carbon dioxide emissions associated with different generation modes. The table illustrates the complementary economic and environmental advantage of phasing out peat-fired power generation and, to a lesser extent, oil- and coal-fired generation, relative to gas.

Table 4
Price and Emissions from Power Generation

Fuel	*Fuel Price (pence/kWh)*	*Emissions (kg CO_2/kWhe)*
Coal	2	0.912
Peat*	6	1.607
Gas		
Single cycle	2.5	0.489
CCGT	2	0.346
CHP	2.5	0.238
Oil	3	0.782
Renewables	> 4	0

CCGT: Combined-cycle gas-turbine power generation.

CHP: Combined heat and power generation.

* Peat-fired generation in existing plants. The IVO plant, now under construction, is expected to produce electricity in the region of 3.5 pence/unit.

Source: *Limitation and Reduction of CO_2 and Other Greenhouse Gas Emissions in Ireland*, Environment Resources Management in association with Byrne Ó Cléirigh, Dublin, and Economic and Social Research Institute, Dublin, Government of Ireland, 1998.

The report reaches the following conclusions for other sectoral measures:

- *Industry:* support for an expanded Irish Energy Centre with a programme along current lines.
- *Commerce:* programmes through the Irish Energy Centre; scope for novel measures such as an energy efficiency rating for offices.
- *Residential:* encouraging fuel switching, such as switching from electrical space heating to gas.
- *Transport:* technological improvement of fuels and vehicles; traffic management; integrated approach to improving public transport while discouraging the use of private cars.
- *Agriculture:* use of biogas; discouraging the use of fertiliser through taxation.

Other Emissions

The Air Pollution Act 1987 provides a comprehensive legal framework for the control of air pollution. Among controls under the Act is a requirement that certain classes of industrial plant, including fossil-fuel burning power plant, be licensed, and a provision for regulating the marketing, sale and distribution of fuels.

The Air Pollution Act 1987 (Combustion Plant) Regulations came into effect on 1 October 1992. They implement the requirements of EU Directive on the limitation of emissions of certain pollutants into the air from new large combustion plants. Emission limit values are set in respect of sulphur dioxide, nitrogen oxides and dust, depending on plant size and fuel type.

The Environment Protection Agency Act 1992 provides for the establishment of an Environmental Protection Agency whose responsibilities include an integrated pollution control licensing system. Integrated pollution control licences will be required for gas-fired power generation, and gas-fired boilers and furnaces, from September 2000; for coal-fired and oil-fired power generation, and for coal-fired and oil-fired boilers, from March 2001; and for peat-fired power generation and peat-fired boilers, from January 2002.

Ireland has signed the Sofia Protocol to the United Nations Geneva Convention on Long Range Transboundary Air Pollution on the stabilisation of nitrogen oxides (NO_x) emissions at 1987 levels. Measures to achieve this include the installation of low NO_x burners in the three boilers in the coal-fired power station at Moneypoint, County Clare.

Sustainable Development

Energy consumption, in particular fossil fuel consumption, has implications for environmental policies across the board, for example in relation to acidification,

urban air pollution, and habitat protection. A *National Sustainable Development Strategy* was published in May 1997, setting out a national sustainable energy policy. The objectives of this policy are to:

- Ensure security of energy supply in order to support economic and social development while protecting the environment.
- Maximise efficiency of generation and emphasise the use of renewable resources.
- Promote energy conservation by users.
- Minimise emissions of greenhouse gases and other pollutants, both by clean generation and by sustainable consumption levels in all sectors.
- Maintain local air quality and limit and reduce the Irish contribution to regional and global environmental problems.

Following a consultation process, the Government has agreed to establish the National Sustainable Development Partnership (known as COMHAR), to deliver on the Government's commitment to increasing partnership and consultation in the area of environmental policy. COMHAR's terms of reference are to:

- Advance the national agenda for sustainable development.
- Evaluate progress in this regard.
- Assist in devising suitable mechanisms and advising on their implementation.
- Contribute to the formation of a national consensus in these areas.

CRITIQUE

Ireland's target for carbon dioxide emissions appears generous, but high economic growth will make it almost certainly unattainable in a business-as-usual scenario. The industry/government Energy Panel[10] has estimated that Ireland will fail to reach its target by the equivalent of 6 million tonnes of carbon dioxide emissions per year. Compared with the target of 64.3 million tonnes (1990 base year emissions of 56.9 million tonnes plus 13% growth), the Energy Panel therefore expects total emissions to be 70.3 million tonnes[11] of carbon dioxide in the target period 2008-2012. This would represent a growth of 8.5% above the target, or 23.5% above the

10. Technology Foresight Ireland, Energy Panel, *Final Report*, 27 January 1999. The report is also discussed in Chapter 10.
11. This figure is implied by the Energy Panel, but not stated.

1990 base year. The Irish Business and Employers' Confederation considers that growth in excess of 28% is more likely[12].

The high expected rates of growth in emissions principally reflect confidence in future economic growth. Economic growth should not be seen as a limitation on Ireland's capacity to make progress towards its target since growth should also generate the resources to pay the cost of response measures. But high expected economic growth underlines the need for the Government to address the interface between economic and environmental policy by developing feasible and cost-effective policies and measures to reduce growth in emissions. The energy industries are the principal target for action since carbon dioxide accounts for 57% of the basket of greenhouse gas emissions in Ireland, and the energy sector contributes 95% of the carbon dioxide emissions or over one-half of the basket.

Ireland has no published plan to respond to growth in greenhouse gas emissions. The consultants' report discussed in this chapter provides a revealing analysis of the options open to the Government, but does not amount to a policy prescription. A number of general conclusions can be reached from the report. First, fiscal policies designed to bring about structural change are favoured. However, in a small trade-dependent economy like Ireland, it is difficult to see how carbon taxes and/or tradeable permits could be acceptable, unless implemented co-operatively with Ireland's principal trading partners. Second, demand-side measures (other than pricing and taxation) to improve energy efficiency in industry, commerce, transport and residences have only limited potential. For those policy options where the report quantifies reducible emissions, efficiency measures account for about one-third of the reductions, if cost is disregarded, and about one-fifth, if only low-cost energy efficiency measures are considered. Third, supply-side measures are the principal area where, according to the consultants' calculations, cost-effective action could be taken.

Fiscal measures may be feasible only in a wider EU context. So far as emissions trading is concerned, it is worth commending for further study the recommendation of the Energy Panel that the Government should support an energy emissions trading exchange in the International Services Centre, Dublin. The report notes that Ireland could gain by establishing expertise in the provision and export of emissions trading services and products.

Efficiency measures are discussed further in Chapter 5. The Irish Energy Centre (IEC) has proved an effective means for raising awareness of energy issues generally, and for promoting an awareness of the value for industry of improving energy efficiency specifically. The IEC's programme concludes this year, and formulation of a new programme should be a priority for the Government. Consideration needs to be given to more coercive measures, if efficiency measures are to make a real contribution.

The options for supply-side measures are limited because of the small scale of the energy economy (backing out of coal, for example, would mean the closure of

12. *Position Paper on Sustainable Energy Development*, Submission to Government, June 1998.

Ireland's only coal-fired plant), socio-economic policies (backing out of peat would remove an important income-support measure), and gas penetration is already very high and dependent on imports (giving rise to concerns about security of energy supply).

Despite the difficulties presented by the consultants' report, it should be a priority for the Government to develop a list of measures to demonstrate how it proposes to work towards the target. Ideally, each of the measures needs to be evaluated and the quantitative contribution which might be made should be estimated. As the Irish Business and Employers' Confederation has noted, strengthening national statistics is a prerequisite for developing a rational policy on emissions. No adequate database exists of greenhouse gas emissions and projections. The consultants' report reveals that there are no data for HFCs, PFCs and SF_6, which are emitted by industrial sources. These emissions can be expected to grow with industrial development in Ireland. The electronics industry, for example, which has been an important development underlying Irish economic growth, uses SF_6 and emissions of this gas can be expected to grow.

RECOMMENDATIONS

The Government of Ireland should:

- ☐ Develop a national database on greenhouse gas emissions and projections, as a basis for quantifying and evaluating the cost-effectiveness of policy options to reduce the growth in greenhouse gas emissions.

- ☐ Develop and announce detailed response measures to achieve its greenhouse gas emissions target, including an assessment of expected quantitative outcomes in physical terms.

- ☐ Publish the report of the advisory group on domestic emissions trading and the implications for Ireland of an international trading regime; review the report in light of the possible economic advantages to Ireland of developing and exporting skills in financial services related to emissions trading.

5

ENERGY EFFICIENCY

THE IRISH ENERGY CENTRE

The Irish Energy Centre (IEC) is the main instrument of energy efficiency policy. The IEC was established in 1994 as a joint initiative of the Department of Public Enterprise and industry. In conjunction with the energy utilities, the IEC co-ordinates and implements national objectives and policy relating to energy efficiency and renewable energy sources, provides technical advice and support on these matters to all sectors of the economy, administers energy conservation grant schemes, co-ordinates a range of promotional and educational initiatives and promotes a number of EU energy programmes in Ireland. Total EU and government funding over the period 1994 to 1999 will amount to I£ 21 million. With a further I£ 19 million in private funding, expenditure will total some I£ 40 million.

Industrial Sector

Energy Audit Grants

Under the Energy Audit Grant Scheme, the IEC provides energy audit and investment grants of 40%, up to a maximum of I£ 5 000, to energy users in the industrial, commercial and institutional sectors towards the cost of hiring consultants to conduct energy audits and to advise on the steps to be taken to improve and enhance energy efficiency. Total grants in 1997 under the Energy Audit Grant Scheme amounted to approximately I£ 200 000. The IEC also provides support and information through workshops and meetings, and IEC staff carry out site visits to advise on implementing energy conservation measures. The overall aim is to increase awareness of energy efficiency among employers, employees and customers, to reduce energy use and increase energy savings, and to reduce carbon dioxide emissions from Irish industry.

The Annual Self-Audit and Statement of Energy Accounts Scheme is a voluntary scheme which aims to promote energy efficiency issues among intensive energy users. While members are offered guidance and support, there is no direct grant support. The scheme has fifty-nine members, with combined annual energy bills of approximately I£ 120 million. Annual savings from the scheme are estimated to be over I£ 2 million per annum (or 1.7% of expenditure on energy).

In the "Company-by-Company" Report for the Self-Audit Scheme, members recorded a reduction in an IEC Energy Performance Index of three percentage points for 1996-97, representing a reduction equivalent to more than 150 000 tonnes per annum in carbon dioxide emissions.

Energy Awareness Week

Energy Awareness Week, in which over two hundred companies and organisations participate, seeks to heighten nation-wide awareness of energy efficiency. A feature

in 1997 was the formal involvement of the Department of Economic Development in Northern Ireland in the week's activities. Energy Awareness Week 1998 focused on householders and home energy consumption, participation of energy equipment suppliers, and a major campaign in schools.

Energy Efficiency Investment Support Scheme

The Energy Efficiency Investment Support Scheme has a fund of I£ 7.1 million to provide grant assistance to energy users in the industrial, commercial and institutional sectors for investment in energy efficiency technologies. The next phase of the scheme will promote the replication of successful projects funded to date.

Under the EU's SAVE programme[13], the IEC has organised seminars and initiated award schemes to highlight and reward good practice in the management, maintenance and improvement of boilerhouse practices in Ireland, which achieve energy savings. In 1997, the competition attracted a total of 170 nominations across four categories.

Residential and Commercial Sector

Energy Action

Energy Action is a registered charity which provides free energy conservation and advice services for the elderly and low-income groups in the Dublin area. Energy Action is part-funded through the IEC. Average annual energy savings are estimated at I£ 35 000. A pilot initiative through the local area partnership replicated the Energy Action model in four other parts of the country. Three of the four continue to operate.

Regional Energy Offices

Two regional energy offices of the IEC operate in Sligo and Cork. They respond to enquiries and promote local energy initiatives. Each office also supports the various national activities of the IEC. The offices have provided evaluation services, support for Energy Awareness Week events and the preparation and delivery of a series of papers and training courses.

Demonstration Housing Projects

Under the EU's THERMIE programme[14], fifty-eight houses have been built in Ireland as part of a European-wide "low energy, low CO_2 housing" project which has supported the construction of five hundred energy-efficient homes. By involving

13. The SAVE programme has been principally concerned with the achievement of energy efficiency within the EU through the uptake of existing technology and best practice by, for example, energy labelling of appliances, inspection and certification of boilers, energy audits in buildings, combined heat and power, and programmes aimed at influencing the behaviour of final energy consumers.
14. The THERMIE programme promotes and supports the widespread application of energy-efficient technologies throughout the European Union.

developers, builders, local authorities and financial institutions, the project aims to demonstrate to the general public and the building industry that it is practicable and cost-effective to build competitively houses which will achieve substantial energy savings and environmental benefits relative to current practice.

All fifty-eight houses have been constructed by five development teams on seven sites in Dublin, Drogheda, Dundalk, Waterford and Galway. They were occupied between mid-1994 and late 1997. Three of the developments are in the private sector and two are social housing projects. The new houses incorporate a variety of architectural and technological features new to the mainstream housing market in Ireland, but used widely in Europe.

In the RE-Start-Dublin project[15], five hundred housing units will be constructed throughout Ireland, with an emphasis on Dublin City. The project constitutes the single most important initiative in Ireland directed to addressing the potential for the design and construction of more energy-efficient housing. It is expected to attract considerable attention from local authorities and semi-state bodies as well as the commercial sector.

MEASURES TARGETING TRANSPORT

Coras Iompair Éireann (CIE) provides bus and rail services throughout Ireland. On average, across all of CIE's services, specific energy consumption per traffic unit (energy/passenger kilometres plus tonne kilometres) is expected to be reduced by about 10% between 1993 and 2000.

Operational Programme for Transport

The Operational Programme for Transport 1994-1999 includes provision for substantial EU-assisted investments in the mainline rail network and public transport services in the Greater Dublin Area. Total investment in the mainline rail network will amount to approximately I£ 275 million. This investment, which will focus on track renewal, modern signalling systems and rolling stock, is intended to encourage greater use of the railways for passenger and freight traffic, particularly longer-distance passenger journeys and freight considered unsuitable for road transport. An investment of approximately I£ 295 million should enable substantial progress to be made on implementation of the public transport elements of the Dublin Transportation Initiative, including the introduction of a light rail network and Quality Bus Corridors. Implementation of the public transport elements of the Operational Programme for Transport and the Dublin Transportation Initiative

15. RE-Start is a European Commission targeted demonstration project co-ordinated by RESET (Renewable Energy Strategies for European Towns). RE-Start aims at providing public authorities, institutions and professionals in important industrial European cities with exemplary projects involving innovative integration of energy efficiency and environmental planning.

strategy is intended to produce a positive environmental impact from a significant shift from private to public transport.

A study of the environmental impact of continuing transport growth and the scope for ameliorative measures is taking place under the Technical Assistance element of the Operational Programme for Transport. The principal elements of the study are an assessment of the environmental impact of existing transport volumes and patterns, and projections of the environmental impact of continuing traffic growth and network development. The study is expected to be finalised in 1999.

OTHER POLICIES

Demand-side Management

Demand-side management was adopted by the Electricity Supply Board (ESB) in the late 1980s as a means of managing load growth. The ESB estimated that the optimum rate of growth in demand is approximately 3% per year compared with an average rate of 5% per year in the late 1980s. The lower figure was set as the goal of the programme. If achieved, the goal would reduce required additional generating plant by 240 MW by 2000 or approximately 5.5% of estimated installed capacity in 2000. The programme has three key elements:

- Slowing growth in demand by improving end-use efficiency.
- Supporting combined heat and power projects through technical and financial support for suitable projects, in co-operation with Bord Gáis Éireann.
- Tariffs to shift demand away from peaks during the day.

Building Regulations

New building regulations were introduced in 1991 for new houses. Further changes were made in 1997 which came into force in 1998. The 1991 regulations sought to reduce carbon dioxide emissions from new houses by about 20%, and the 1998 regulations by a further 5%.

EVALUATION OF CURRENT POLICIES

The IEC programme is a relatively low-cost programme which has resulted in an approximate 1% reduction in carbon dioxide emissions[16]. The most effective

16. *Limitation and Reduction of CO_2 and Other Greenhouse Gas Emissions in Ireland*, Environment Resources Management in association with Byrne Ó Cléirigh, Dublin, and Economic and Social Research Institute, Dublin, Government of Ireland, 1998.

programmes, measured by savings in carbon dioxide emissions, have been the Energy Efficiency Support Scheme, which has encouraged investment in proven energy efficiency technology and practices. The effectiveness of the measures, measured by annual reductions in carbon dioxide emissions (in thousand tonnes), is as follows:

- Energy Efficiency Investment Support Scheme .. 100
- Domestic Sector Programmes 75
- Self-Audit 68
- Boiler Programme 22
- Public Sector 11
- Energy Audit Grant Scheme 10
- Renewables 1

The IEC estimates that by the end of 1999 its programmes will have made cumulative energy savings of I£ 40 million in expenditure on energy. Ongoing savings are estimated to be I£ 20 million per year, or 1.4% of total expenditure on energy in the sectors targeted by the IEC.

Demand-side management schemes complement IEC programmes. The ESB[17] has estimated that carbon dioxide savings from the programme totalled 0.48 million tonnes in 1995 and 0.9 million tonnes in 1998. Eighty per cent of the estimated savings are attributed to efficiency programmes and 20% to combined heat and power. Some aspects of the ESB's demand-side management programme are directed to levelling the load and will not necessarily affect total energy consumption or growth. These aspects can be expected to continue after liberalisation of the electricity market, but aspects designed to reduce the rate of growth in demand may come into conflict with commercial goals once competition is established.

Transport measures are not considered to have resulted unambiguously in reductions in carbon dioxide emissions or energy consumption because improved efficiency of the road network has encouraged demand for its use.

Building regulations have had an impact on new housing, but the housing stock is growing by between twenty and thirty thousand completions a year, contributing to higher carbon dioxide emissions and energy consumption. Existing houses are not affected. The total housing stock is about 1.1 million units, a significant proportion of which has no insulation.

17. *Report on the Demand Side Management Activities undertaken by the Electricity Supply Board, Ireland 1991-1995*, Electricity Supply Board, 1996.

POLICY OPTIONS FOR THE FUTURE

Policy options will require consideration of the measures to be adopted and the way in which they are delivered. The IEC is winding down its programme and very little expenditure will continue after 1999 from the current programme. The ESB and Bord Gáis Éireann are facing competition, and concern has been expressed that they may no longer see energy efficiency as a priority unless consistent with their commercial goals.

There is scope for improving the delivery of services. Many measures are available for consideration. In the Irish context, particular attention has been drawn to continuation of the activities of the IEC and retro-fitting of existing buildings. Options for improved delivery of services include voluntary agreements, and the possible establishment of a new organisation which would bring together the energy efficiency promotion activities of the IEC and the utilities.

If its own programme were continued, the IEC would recommend planning over a longer period than the current five-year programme, and funding demonstration "model audits" of the energy efficiency activities of key companies. The IEC estimates that a twelve-year programme costing I£ 19.5 million per year (total cost I£ 234 million) might result in energy savings of I£ 294 million per year and annual carbon dioxide emission reductions of 3.5 million tonnes at the end of the programme.

The Energy Panel considers that there is a vast potential to reduce energy consumption and to improve comfort levels in both new and existing buildings. Even after taking account of the expected increase in building stock by 2015, the Energy Panel considers that it should be possible to reduce significantly the total energy consumption and carbon dioxide emissions of the building sector.

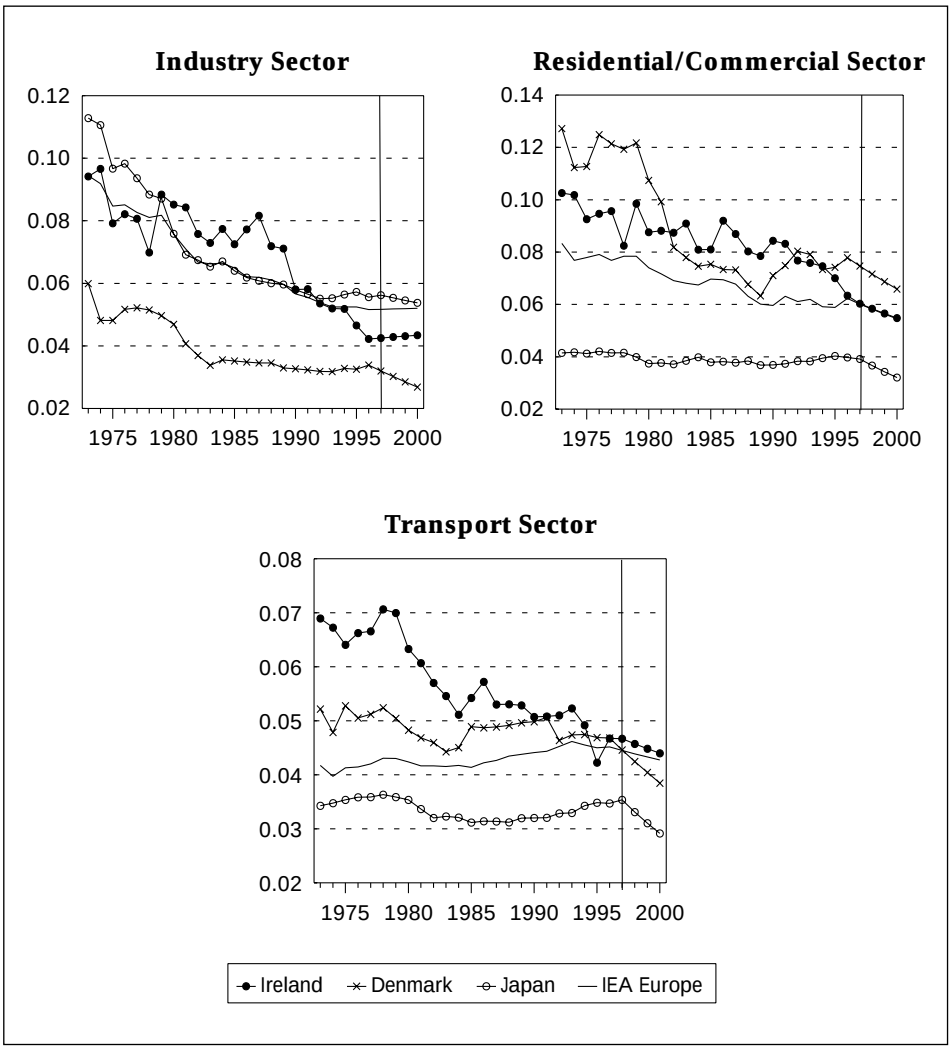
CRITIQUE

Achievements to Date

Measured by energy consumption per unit of output (energy intensity) and carbon dioxide emissions per unit of output (carbon intensity), energy efficiency has improved in Ireland, although not necessarily as a result of the policies described in this chapter. Much of the improvement seen since 1990 could have arisen autonomously as industry sought to improve efficiency in all cost areas to improve productivity and competitiveness at a time of high economic growth.

Energy intensity has fallen steadily in Ireland since about 1982. As in other IEA countries, energy intensity fell markedly at the time of the oil crises (1973-75 and 1979-82) but has declined at a slower rate since. Energy intensity has declined fastest in industry, followed by the residential and transport sectors (see Figure 8).

Figure 8
Energy Intensity, 1973-2000
(Final Consumption/GDP in Purchasing Power Parities:
toe per thousand US$ at 1990 Prices and Purchasing Power Parities)



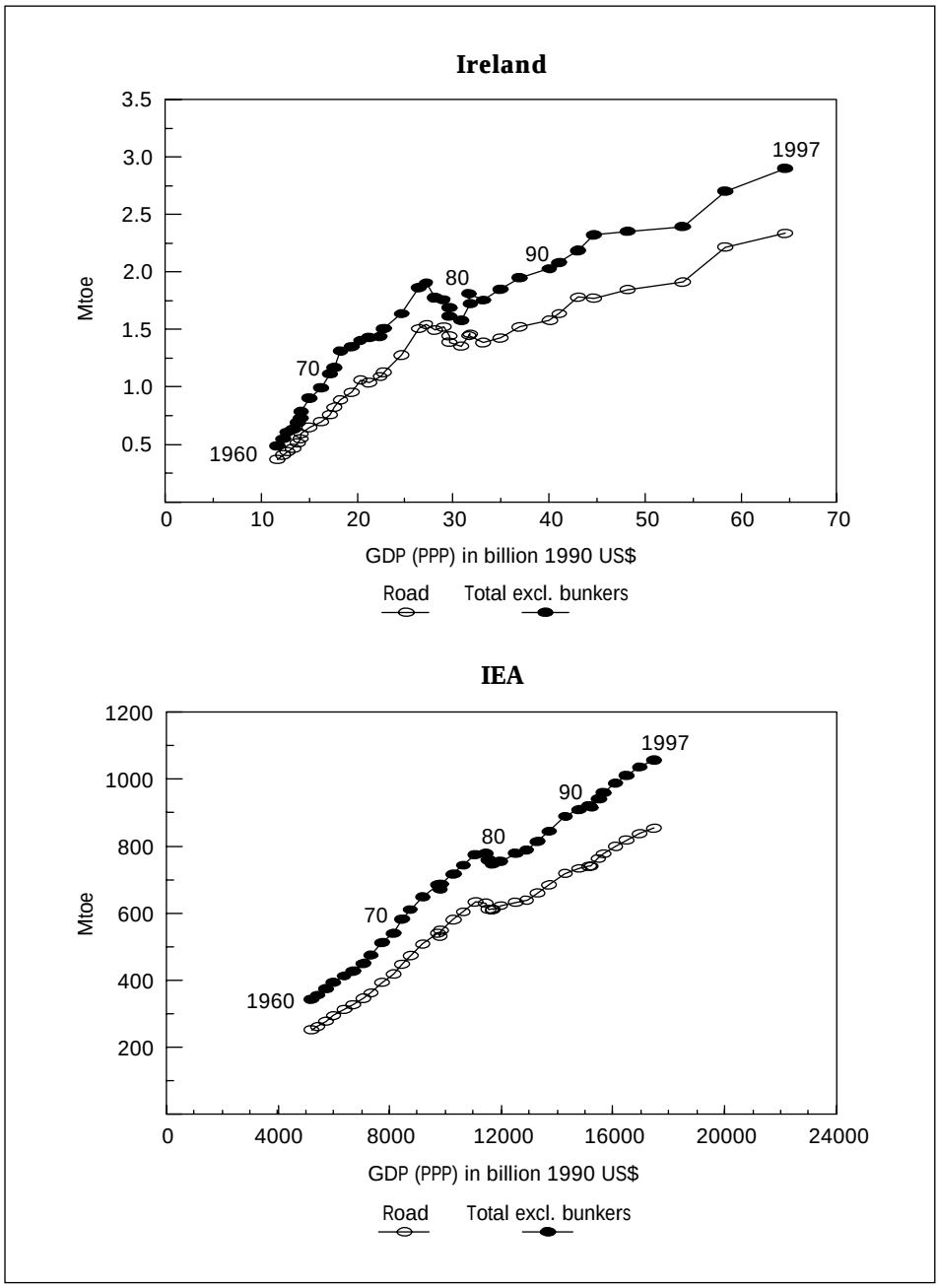
Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1998; *National Accounts of OECD Countries*, OECD Paris, 1998; and country submissions.

Figures 9, 10 and 11 show the historical relationship between energy use and economic growth (measured by growth in Gross Domestic Product) in the three main energy services: electricity demand, oil-fuelled mobility, and stationary fossil fuel end-uses. Changes in energy consumption relate directly to changes in GDP in all three sectors. While the impact of the first oil shock is limited, the trend exhibits a clear break at the time of the second oil shock.

Figure 9

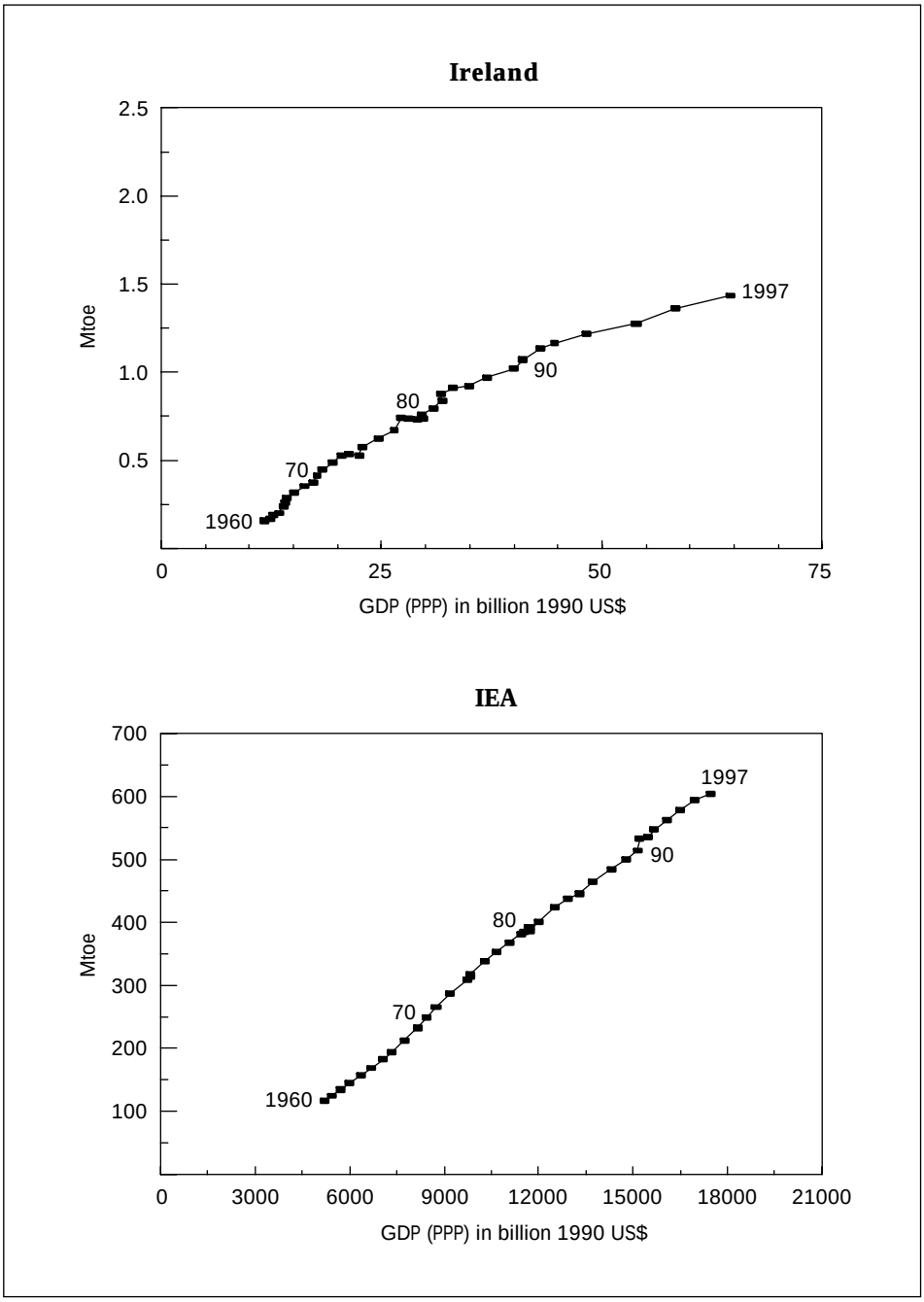
Energy Consumption in Transport and Economic Growth

(Total Final Consumption in the Transport Sector, excluding electricity/GDP in Purchasing Power Parities)



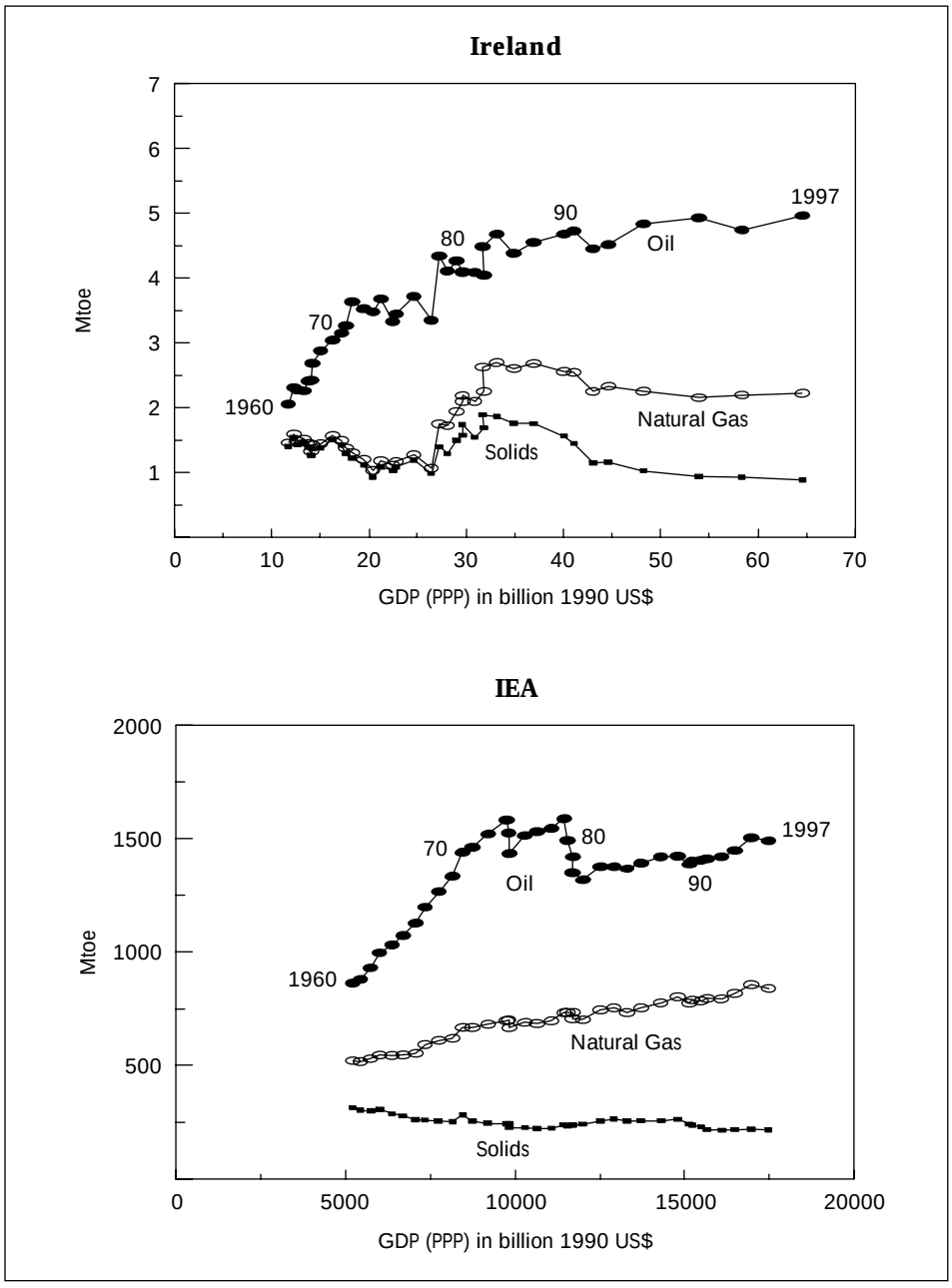
Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1998, and *National Accounts of OECD Countries*, OECD Paris, 1998.

Figure 10
Electricity Consumption and Economic Growth
(Electricity Consumption/GDP in Purchasing Power Parities)



Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1998, and *National Accounts of OECD Countries*, OECD Paris, 1998.

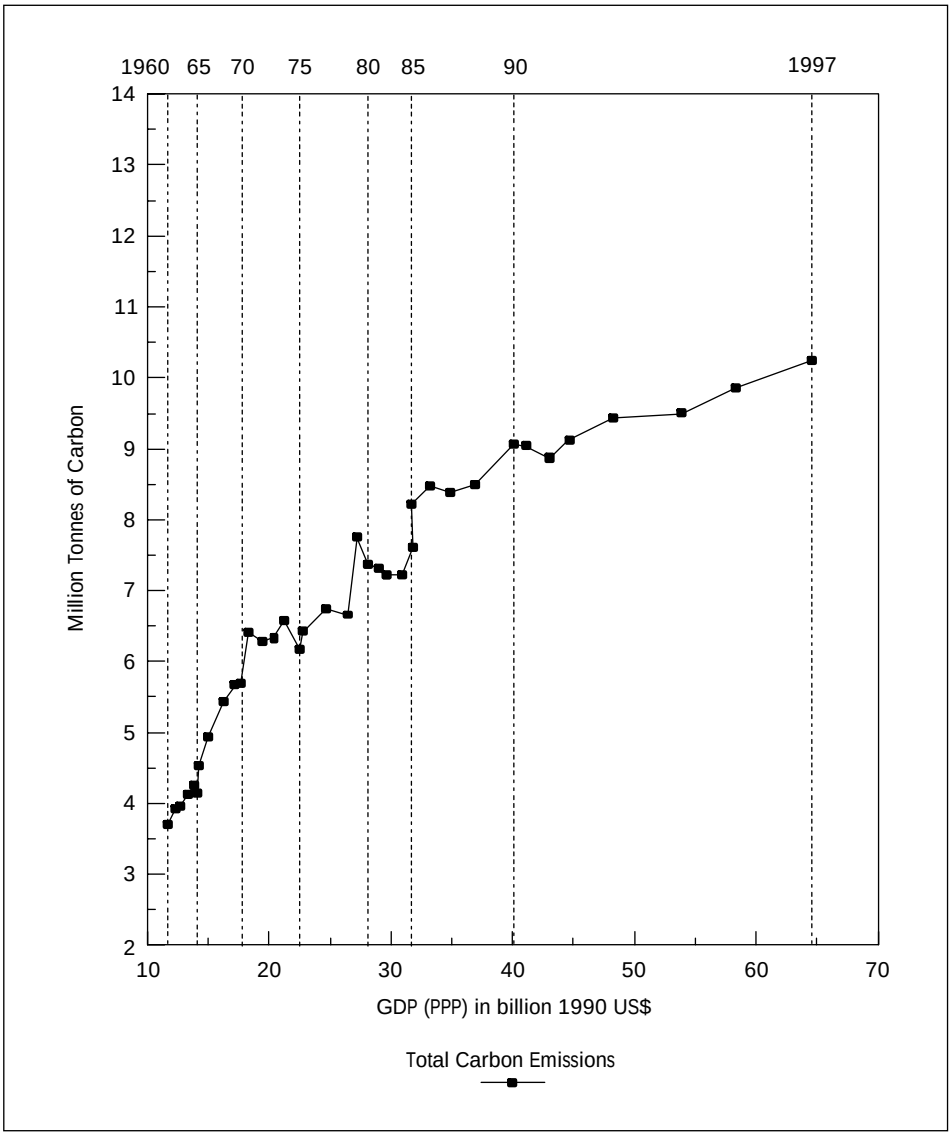
Figure 11
Consumption of Fuel in Stationary Uses and Economic Growth
(Stationary Fossil Fuels/GDP in Purchasing Power Parities)



Note: Data for the production of electricity and heat by autoproducers in the US are estimated prior to 1989.
Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1998, and *National Accounts of OECD Countries*, OECD Paris, 1998.

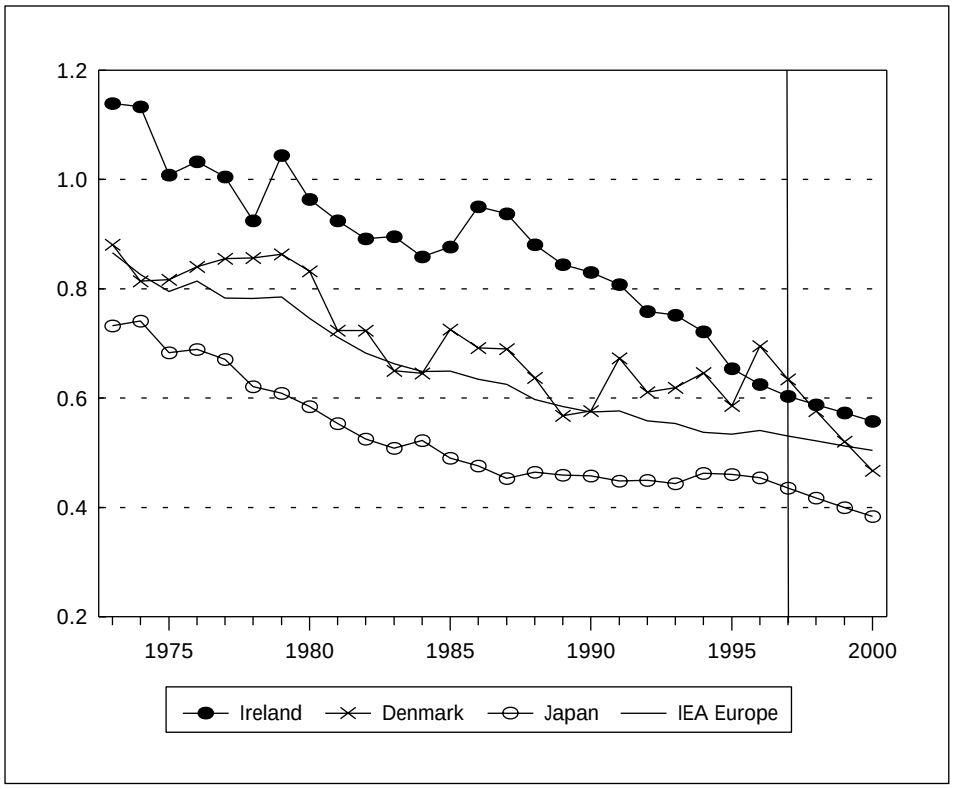
Figure 12 shows how total carbon emissions have grown with GDP. Nevertheless, they have risen more slowly than GDP and emissions of carbon dioxide per unit of GDP have fallen steadily since about 1985 (see Figure 13). This might be expected, given the nature of economic activity in Ireland and the steady penetration of gas in electricity generation.

Figure 12
Carbon Output and Economic Growth, 1960-1997
(Carbon Output and Growth in GDP in Purchasing Power Parities)



Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1998; *National Accounts of OECD Countries*, OECD Paris, 1998.

Figure 13
Carbon Intensity, 1973-2000
(Carbon Dioxide/GDP in Purchasing Power Parities)



Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1998; *National Accounts of OECD Countries*, OECD Paris, 1998; and country submissions.

Effectiveness of Existing Policies

Ireland's economic growth has brought with it rising energy consumption and higher emissions of greenhouse gases. Ireland is expected to achieve a standard of income comparable with levels seen elsewhere in the EU by 2002. At the same time, growth in emissions of greenhouse gases is likely to be double the level of 13% growth over 1990 agreed by the Government as its contribution to achieving the EU emissions target. Against this background, and even though energy intensity has generally fallen, far greater energy efficiency improvements or fuel-switching are likely to be required than have been achieved to date.

The Irish Energy Centre has raised awareness of energy efficiency issues in Ireland, and promoted co-operation with industry to bring about energy efficiency improvements on a voluntary basis. The IEC's programme will end this year, and there is an urgent need to develop a new programme.

Policies for the Future

In designing a new programme, consideration has first to be given to the potential benefits of energy efficiency improvements in Ireland. Consultants to the Department of Public Enterprise have sought to quantify the effectiveness of measures to reduce greenhouse gas emissions in Ireland (see Chapter 4) and their report concludes that the focus of measures with early effectiveness would be on the supply side. However, the supply-side measures would not bring about structural change which might be sustained in the longer term. The net effect of the recommended supply-side measures would make Ireland almost totally dependent on imported gas, in the absence of new domestic gas developments, giving rise to concern about energy diversity and security. It is likely that effective efficiency measures would have to play a major role to avoid such drastic change on the supply side.

Fiscal measures and emissions trading pose problems which, at best, could delay their introduction. Industry has expressed concern about the scope for further efficiency improvement and raised the possibility that future economic growth could be jeopardised. Clearly, in the time frame imposed by internationally agreed emissions targets, efficiency measures in Ireland will need to be more effective, including the use of mandatory standards, for example. Hence, there is a need for new measures to be developed and introduced with the support of industry, if they are to be cost-effective. The IEC should be subject to careful evaluation before any decision is taken on its future. Particular attention should be given to quantifying the costs and benefits of IEC programmes in relation to both energy savings and greenhouse gas emissions, compared with other measures such as demand-side management by the utilities.

Ireland has a history of tripartite consensus decision-making that could provide scope for developing voluntary agreements along the lines seen elsewhere in the EU. Unlike the measures employed by the IEC, voluntary agreements in, say, the Netherlands, are based on independent studies of the scope for efficiency improvements in individual enterprises and legally bind individual companies or sector organisations. Although still open to criticism, more binding voluntary agreements could formalise some of the IEC's industry programme, helping to extend its coverage and to overcome the potential for "free-riders". Formal agreements would also help define the level of autonomous efficiency improvement which might be expected to occur in the absence of government policies and measures. The size of the efficiency improvement measured by the IEC as attributable to the Annual Self-Audit and Statement of Accounts Scheme (a 1.7% reduction in annual energy costs) is of an order of magnitude which could be expected to occur as a result of normal competitive pressures during a period of high economic growth.

In common with other IEA countries, Ireland needs to address the full range of measures which might encourage change in patterns of energy consumption and the introduction of technology which might help maintain economic output at a lower level of energy consumption. Economic instruments and technological change are obviously related in a theoretical sense, as relative prices will influence decisions energy consumers take on energy in the same way as they influence decisions taken on other commodities bought and sold in free markets. For policy-

makers, the problem is to create a policy package which provides incentives to develop new technologies (for example through research and development), and which creates the environment in which existing or new technologies will be used (for example through information dissemination, and through the fiscal regime by means such as attractive depreciation allowances), while maintaining international competitiveness (including through gaining the acceptance of similar policies among competitors). Technologies such as combined heat and power, for example, may appear attractive from a technical viewpoint (because of high thermal conversion rates), but may not be of interest to private investors because they are not commercially viable (for example if there is no market for the heat produced), or less energy-efficient technologies are equally attractive, without incurring additional investment, for example because of low electricity prices which fail to encourage discrimination between different technologies on the basis of efficiency.

Some aspects of the Energy Panel report[18] offer pointers towards the sort of integrated package of measures that is required in Ireland. For example, Key Technology III recommended by the panel proposes a package of policies including substantial tightening of building standards and mandatory energy ratings (which would create an efficiency regime that can be monitored and enforced, and which would increase the overall price of energy), a scheme of personal tax relief for investment in energy conservation measures (which would lower the cost of the investment required to a feasible level), a research programme on energy use in buildings in Ireland (which would identify the technology required), and education and training (which would ensure the market is informed of available options). Policy packages on this scale are expensive. The Energy Panel estimates that this part of its recommended programme would cost over I£ 24 million. In principle, the cost should be a transition cost, which would be recovered from the economic benefits which the Energy Panel judges would result from the programme.

RECOMMENDATIONS

The Government of Ireland should:

- ☐ Develop a programme of energy efficiency measures to replace the current programme of the Irish Energy Centre, which includes the use of pricing and mandatory regulations, and is based on quantitative analysis of possible cost-effectiveness.

- ☐ Discuss with industry the need for mandatory energy efficiency targets and measures, possibly implemented through enforceable agreements entered into voluntarily.

18. Technology Foresight Ireland, Energy Panel, *Final Report*, 27 January 1999. See Chapter 10 for more detail on the recommendations made in the report which relate to energy efficiency.

6

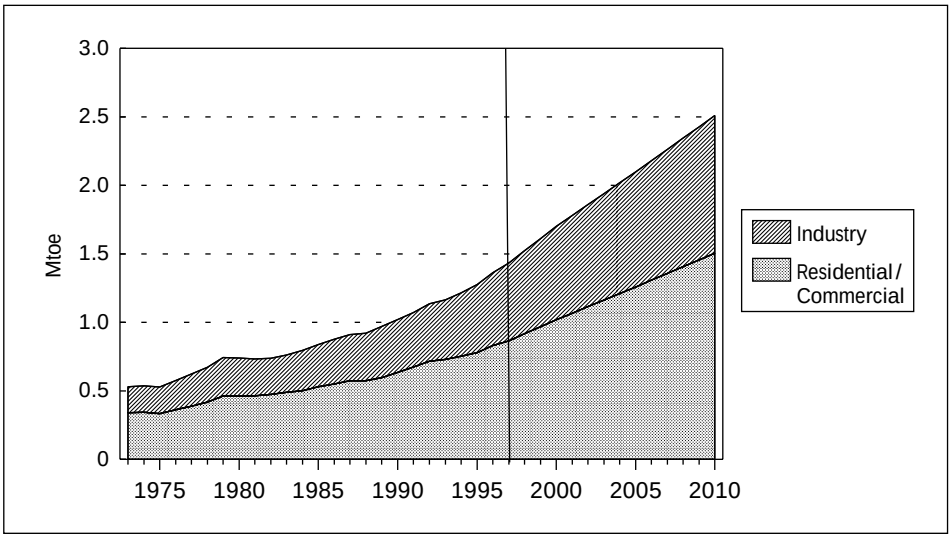
ELECTRICITY

STRUCTURE OF THE ELECTRICITY SECTOR

The electricity sector in Ireland is dominated by the Electricity Supply Board (ESB), Ireland's largest energy company and employer. The ESB owns almost all of the power stations. At the end of 1997, ESB power generation plant capacity was 4 121 MW, and small-scale generation plant capacity was 176 MW[19]. The ESB purchases surplus power from the independent plants at prices reflecting avoided costs. The ESB owns all of Ireland's transmission and distribution systems in the six distribution regions. Distribution costs are relatively high because of the large percentage of rural customers.

Electricity consumption in Ireland has increased by 50% since 1990 (Figure 14) and new capacity will be required soon. The ESB estimates that the position is satisfactory until 2001 but new capacity will become necessary in late 2001/early 2002, and more than 800 MW will be required by 2005. The ESB's last major addition to capacity was the coal-fired Moneypoint plant (900 MW), commissioned in 1986 (see Figure 22 for location). In October 1998, Poolbeg CT2 was commissioned, adding 150 MW, and Poolbeg CC is expected to be commissioned in December 1999, adding 160 MW.

Figure 14
Electricity Consumption by Sector, 1973-2010



Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1998, and country submission.

19. The composition of the small-scale capacity is given in Table 15, Chapter 9.

The Finnish IVO Group was selected in January 1998 as the preferred bidder in a competitive tender for a new peat-fired power station. The station will be located at Clonbulloge, County Offaly (see Figure 22 for location), and have a capacity of 120 MW, burning about one million tonnes of peat each year. The station will be based on fluidised bed peat combustion technology. IVO will build, own and operate the new peat station which will commence production by mid-2001.

Interconnection with Northern Ireland was re-established in April 1995 after a twenty-year period in which it remained out of service because of security problems on the border. At present, the interconnector is being operated to achieve economic benefits through spinning reserve savings, and through spot energy trading. The interconnector has a peak carrying capability of about 250 MW. Neither the ESB nor the Department of Public Enterprise regards the interconnector as a reliable alternative to additional generation capacity.

Fuel Mix for Electricity Production

Historically, Ireland has been concerned about growth in oil use in electricity generation. More recently, growth in gas use and the depletion of Ireland's only gas field at Kinsale have given rise to concerns about the degree of dependence on imported gas. The single interconnector with the United Kingdom operates at close to full capacity and only one discovery (Corrib – see Chapter 7) has reasonable prospects for development. The new peat-fired power station is seen as one means of responding to import dependency by using domestically produced peat. The Government does not consider nuclear power is an option. Table 5 shows the current and forecast fuel mix for power generation, using ESB data.

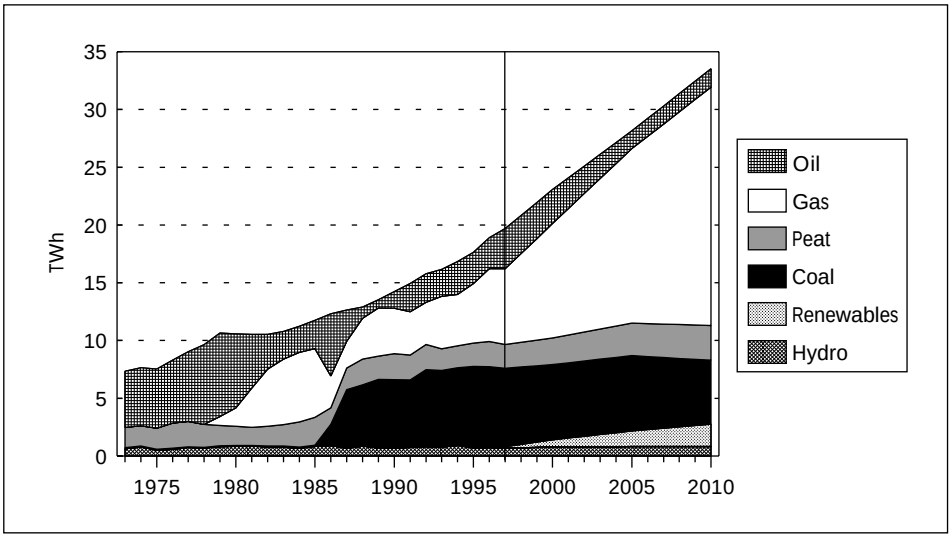
Table 5
Contribution of Fuels to Electricity Production

Fuel	*1995 (%)*	*2010 (%)*
Gas	29	64
Peat	11	5
Coal	39	17
Renewables	5	8
Oil	16	6

Source: Electricity Supply Board.

Figure 15 illustrates the fuel mix, using IEA data. The share of oil has declined significantly because of its displacement principally by coal. In 1986, oil accounted for 48% of fuels used in electricity production, and in 1997 it accounted for 18%. The use of gas as a primary energy source has also steadily increased over the same period from 16% in 1986 to 33% in 1998.

Figure 15
Electricity Generation by Fuel



Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1998, and country submission.

Combined Heat and Power

There were fifty-three combined heat and power (CHP) plants in Ireland at the end of 1997, with a total installed capacity of 86.65 MW. The Department's fourth Alternative Energy Requirement competition (designed to encourage investment in renewable energy sources — see Chapter 9) was launched to support the competitive development of CHP in Ireland. Proposers bid their binding price for the electricity subject to a price cap of 3 pence per unit sold. The Department appointed the United Kingdom agency, ETSU[20], to run the competition on its behalf. The competition should result in an additional 26 MW of new CHP capacity. The winning bids ranged between 2.25 pence and 3 pence per unit of electricity. Winning projects are planned to be located on sites with significant heat loads.

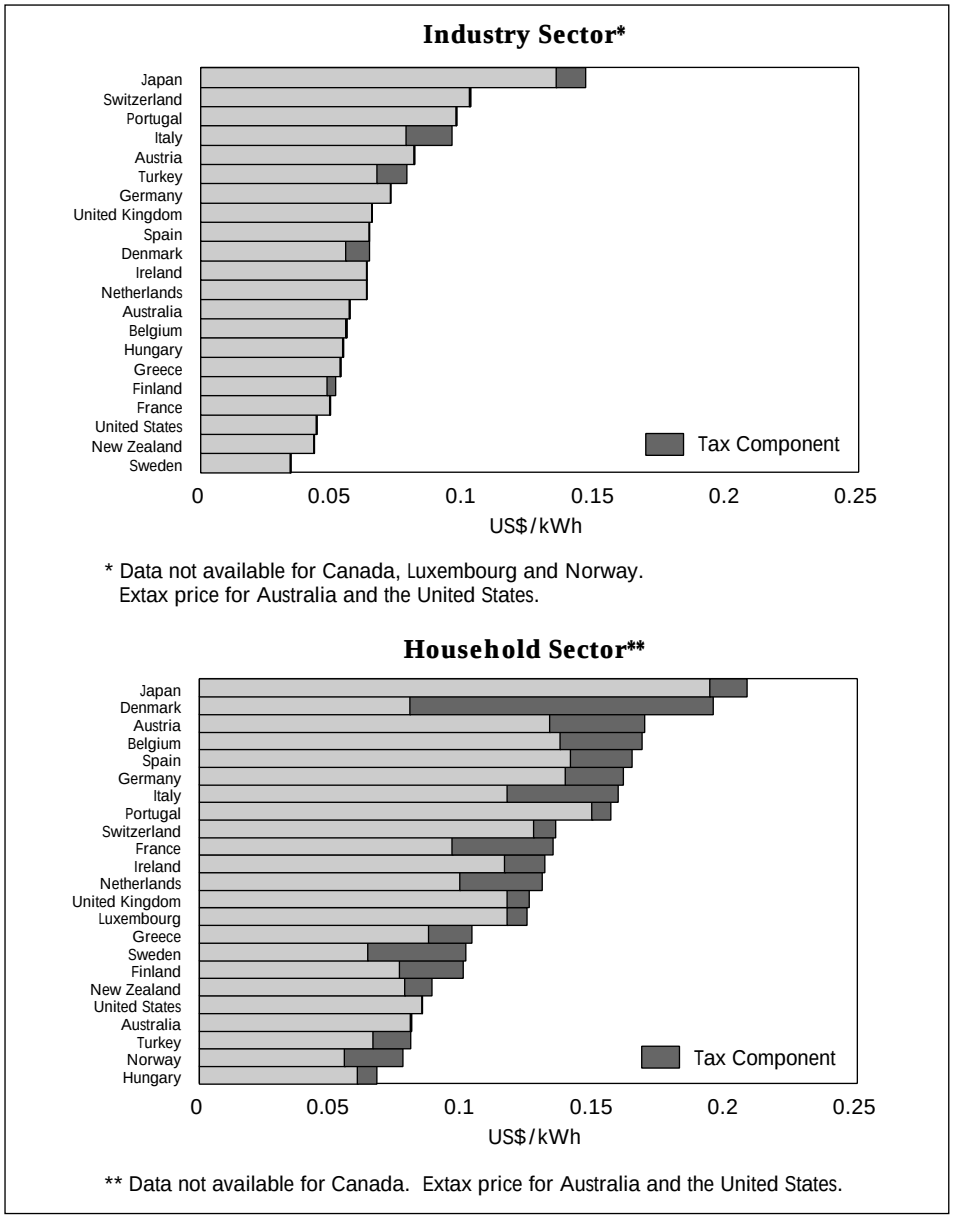
Electricity Prices

Ireland has relatively low electricity prices, compared with other IEA countries, in both the industry and household sectors. The low prices may be considered to be due, in part, to low investment in the network. Prices were increased by limited amounts in 1996 and 1997 to fund substantial new investment. The ESB is undertaking capital works of around I£ 1.5 billion over a period of five years to

20. Originally known as the Energy Technology Support Unit.

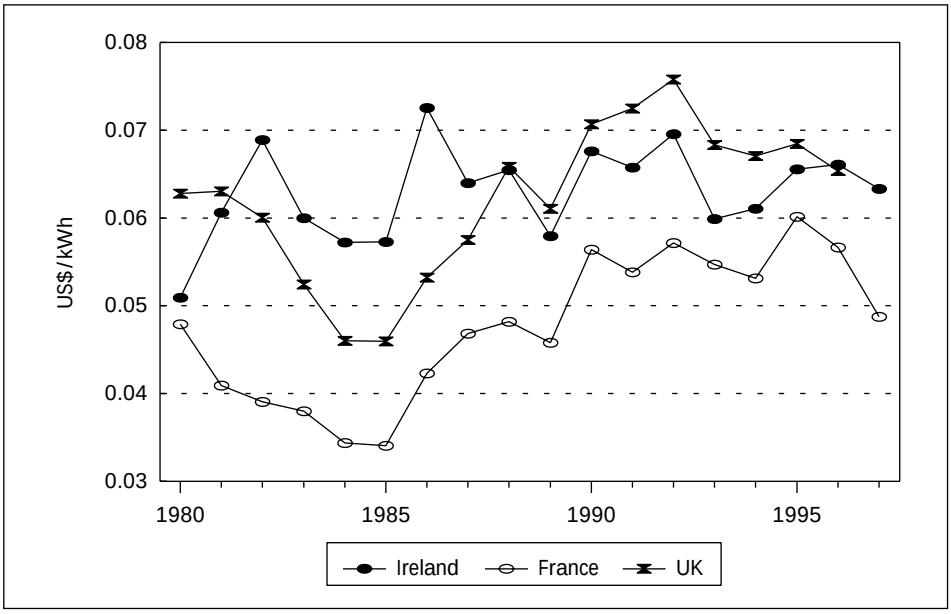
upgrade the network, particularly in rural areas, and to provide extra generating capacity for forecast rising demand. Tariffs are being amended to reflect costs of supply. The Government approved price rises in 1996 and 1997 conditional on improvements in efficiency in the operations of the ESB.

Figure 16
Electricity Prices in IEA Countries, 1997



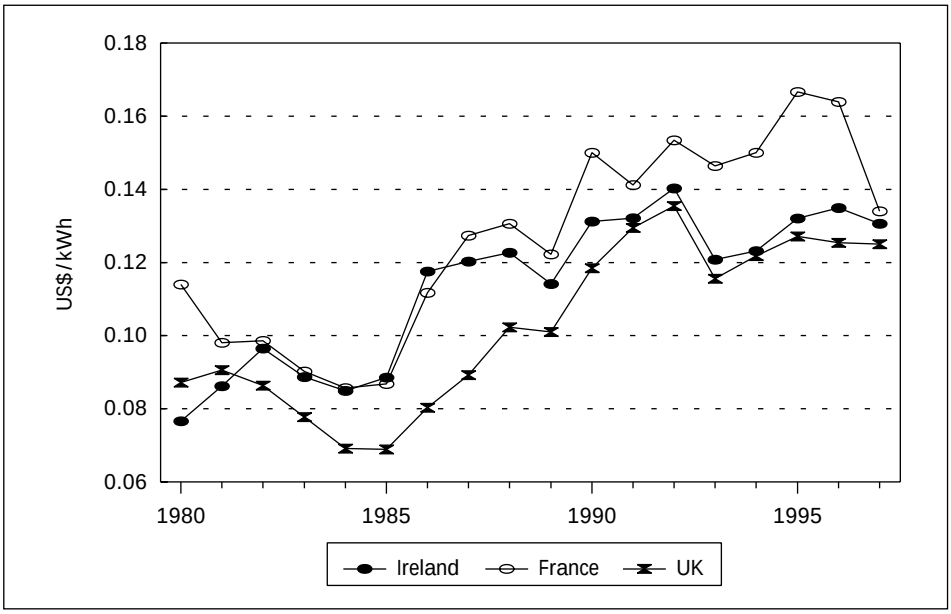
Source: *Energy Prices and Taxes*, IEA/OECD Paris, 1998.

Figure 17
Electricity Prices in the Industry Sector, 1980-1997



Source: *Energy Prices and Taxes*, IEA/OECD Paris, 1998.

Figure 18
Electricity Prices in the Household Sector, 1980-1997



Source: *Energy Prices and Taxes*, IEA/OECD Paris, 1998.

PREPARATION FOR ELECTRICITY MARKET REFORM

The Cost and Competitiveness Review

The Cost and Competitiveness Review Agreement, approved in May 1996, is now in its third year of implementation. Designed to prepare the ESB for a future based on competition, the agreement has the objective of lowering ESB's costs, principally labour costs, through reductions in the workforce and work practice changes. Implementation of the agreement is proceeding satisfactorily and the full target net savings of I£ 58 million per year should be achieved. Legislation is being prepared to convert the ESB from a statutory corporation into a public limited company under the Companies Act.

Based on satisfactory implementation of the agreement, electricity prices have increased for the first time in more than ten years. The first increase, an average of 2%, took effect on bills issued to customers in July 1996. The second, an average of 1.5%, came into effect for the billing period from May/June 1997. The increase for domestic, industrial and commercial customers amounts to 2%, 1.5% and 1% respectively. A new Regulatory Commission will determine the allocation of the next increase over the different categories of customers. An average increase of 3% was proposed in 1998. However, the current profitability of the ESB, which is significantly above expectations, led the Government not to approve any increase in 1998. The correction of existing imbalances in ESB tariffs will continue to take place over a number of years, with the aim of ensuring that the ESB charges for its various categories of customers on a cost-reflective basis with no cross-subsidies. The process of tariff rebalancing will be overseen by the new Electricity Regulator.

Regulatory Regime

Implementation of the EU Electricity Directive

At present the ESB has a monopoly on transmission and distribution and a virtual monopoly of power generation. The EU Directive on common rules for the internal market in electricity came into force on 19 February 1997. The Directive must be implemented in Ireland by February 2000 (one year later than in most EU member States). Approximately 28% of the electricity market will be opened to competition in 2000, rising to about 32% in 2003. Implementation of the Directive will allow independent electricity generators to contract directly with eligible customers for the supply of electricity.

First Proposal – Tendering for New Capacity

In May 1997, the Department of Public Enterprise published a consultation paper setting out one possible framework for implementing the Directive. The paper attracted a wide range of responses, most of which were critical of various aspects of the approach outlined. The main suggestions in the paper were:

- A tendering procedure for new generation capacity, with a parallel authorisation procedure of independent producers and autoproducers.

- A single buyer to be the power procurer within ESB.

- The power procurer to have the obligation of ensuring that the national capacity obligation (i.e. the availability of adequate generation capacity) is met.

- An independent transmission system operator to be set up in a new company owned by the State and separate from ESB.

- Establishment of a wholesale market.

- Establishment of an independent regulator.

Second Proposal – Authorisation Procedure

In January 1998, the Department announced that it was exploring an authorisation procedure, as an alternative to tendering. The establishment of an independent electricity Transmission System Operator together with an authorisation procedure is now considered the best option to ensure fair and transparent market access for new entrants. The Electricity Bill, described below, incorporates these features and provides for the granting by the Commission for Electricity Regulation of plant authorisations and licences to generate and supply electricity. Further legislation is being drafted to establish the Transmission System Operator.

In May 1998, the Department published a Consultation Document giving details of legislative proposals for the implementation of the EU Electricity Directive. These proposals relate to proposed primary legislation and were published for comment as a further form of public consultation before seeking government approval for the drafting of the Bill. During the consultation process, legal advice was received to the effect that, while full implementation of the Directive in Ireland is required by February 2000, a key part of the Directive relating to the establishment of an independent regulatory body should be implemented as soon as possible. The regulatory body would take over the licensing of generation and supply from ESB.

Phased Reform

The Electricity Directive will be implemented in two phases. Phase one will see the necessary minimum provisions to establish a regulatory regime being put in place as soon as possible. Phase two involves further legislation to complete the implementation of the Directive and establish ESB as a public limited company.

The Electricity Regulation Bill was published on 1 December 1998. This first phase legislation includes provisions relating to:

- The appointment of a Commission for Electricity Regulation to exercise the regulatory functions of:

- granting, modifying, and revoking licences;
- authorising the construction of generating stations;
- approving charges for access to the transmission and distribution systems, and approving the provision of information relating to both systems;
- determining disputes relating to access, and authorising the construction of direct lines where access is refused on the basis of insufficient capacity.

■ The definition of eligible customers.

■ The provision of a right of access to the transmission and distribution systems.

The Commission for Electricity Regulation (the "Regulator") will be required to report to a Joint Committee of the Oireachtas, and to submit an annual report to the Minister for Public Enterprise. The Commission's decisions are subject to an independent mechanism for appeals and to the Freedom of Information Act 1997. The Commission will be funded by the industry. It will consist of one member[21] initially, but could be expanded up to three members.

Further arrangements to be included in the proposed second phase legislation include:

■ Expansion of the powers of the independent Commission for Electricity Regulation;

■ Establishment of an independent Transmission System Operator in accordance with the requirements of the Electricity Directive;

■ Licensing the distribution system operation within ESB;

■ Establishing a licensed Public Electricity Supplier within ESB to serve all other electricity customers; and

■ Unbundling the accounts of ESB's various activities, in line with the requirements of the Electricity Directive.

The second phase legislation is also likely to include provisions which will change the corporate structure of the ESB from the existing statutory corporation to a public limited company remaining in State ownership.

Transmission and Distribution Charges

The Electricity Regulation Bill includes a provision that the ESB will prepare a statement for the approval of the Commission for Regulation, which sets out the basis upon which charges are imposed for use of, and connection to, the

21. Mr Tom Reeves, former Assistant Secretary, Energy, Department of Public Enterprise, is the Regulator Designate.

transmission and distribution systems. Accordingly, the independence of the Transmission System Operator is crucial. The structure of the Transmission System Operator will be addressed in phase two of the legislation. Phase two of the legislation will also provide that the Public Electricity Supplier be subject to price regulation.

Electricity Trading

The Electricity Regulation Bill includes a provision enabling the Commission for Regulation, under a policy direction from the Minister, to prepare proposals for the establishment of a system of trading in electricity. This provision will require public consultation on the issue, as well as the final consent of the Minister, which sets out the basis upon which charges are imposed for use of, and connection to, the transmission and distribution systems.

Capacity Additions

The Electricity Regulation Bill includes a provision enabling the Commission to direct ESB to prepare a forecast statement on capacity, forecast flows and loading on the transmission system. This is intended to provide a signal to the market of the likely capacity requirements and identify those parts of the transmission system most suited to new connections.

Fuel Mix

The Electricity Regulation Bill empowers the Minister to specify, by order, criteria which may relate to, among other things, the nature of the primary sources of energy to be used by a generating station, protection of the environment including the limitation of emissions into the atmosphere, water or land, and the efficient use of energy. Article 5.1 of the EU Electricity Directive allows member States to lay down such criteria for the grant of authorisations for new capacity.

CRITIQUE

Objectives and Benefits of Reform

The Irish Government has made significant progress in reforming the electricity market. In addition to the enactment of legislation to comply with the EU Electricity Directive, some important steps have been taken to improve the transparency of the regulatory system and to introduce competition. Overall, these measures will help significantly to increase the efficiency of the industry.

Transparency should increase with the creation of an independent electricity regulator and with the adoption of new procedures for setting up regulation. The appointment of the Regulator will greatly help to separate and clarify the different roles that the Government has traditionally played as regulator, owner and policy-

maker. In particular, it removes the potential conflicts of interest that may emerge when ownership and regulatory powers are held under the same authority.

The new legislation also contains the basic regulatory tools needed to introduce competition. The plans laid down by the Irish Government to open the market to new entrants, to unbundle transmission activities and to establish a regulated third party access system are commendable. Ireland believes that a combination of growth in electricity demand allied to further market opening based on the experience of the initial period of competition will provide ample opportunity for new entrants.

Market Structure

The main challenge for the Government is to introduce effective competition. Introducing effective competition requires, in addition to adopting market-oriented regulations, an adequate market structure, including a sufficient number of comparable competitors. Otherwise, competition may fail to develop. The reform of the electricity market must address the issue of market structure.

The Irish electricity market is highly concentrated and is likely to remain so for some time. At present, ESB is virtually a monopoly and the policies being implemented are likely to leave its structure intact in the generation, distribution and supply businesses. Thus, the ESB is likely to maintain its dominant position once competition begins. In the short term, strong regulatory intervention may be needed to protect consumers and to compensate for the lack of a competitive market structure.

The overall efficiency of the Irish electricity supply industry should improve as reduced concentration leads to more intense competition. As long as divestiture measures are not on the political agenda, entry of new competitors (for example through investment in new generation assets) is the only way in which competition will develop in Ireland. International electricity trade, another potentially significant source of competitive pressure, will have a very limited impact, at least for as long as the Irish electricity system is not fully interconnected. It is thus important for the future of the electricity supply industry that conditions are set to ensure entry of new competitors. The principal issue will then be to ensure that new entrants do compete and not simply take advantage of oligopoly tariffs set by the ESB. New entrants are a necessary condition to promote competition but will not alone ensure that the competition develops.

The speed and the extent of entry will depend critically on developments in energy policy. Even if there are no *a priori* regulatory constraints on new entry, the Government will have a key role in promoting and facilitating entry and even, possibly, in selecting new entrants. Investment in new generation assets is likely to be rationed by the limited availability of additional gas supplies, at least in the short term, so that choices between competing projects may have to be made effectively

by the Government. In addition, some of the main potential entrants into the electricity market (for example Bord Gáis Éireann and Bord na Móna) and the incumbent (ESB) are publicly-owned and their role in the electricity market will depend on government policy. A very positive signal to the market would be for the first power station (or stations) to be built under the new arrangements to be owned and operated by a company other than the ESB.

The ESB's continuing influence in the market will be an important factor for the Regulator to monitor. If competition fails to develop, the Government may have to act directly to moderate the ESB's influence.

Commission for Regulation

The newly established Regulator, the Commission for Electricity Regulation, will have a prominent role in the new system. The Regulator will be responsible for the implementation of competition in the electricity sector. The Regulator will also have to manage a largely regulated system for as long as market concentration threatens to impede development of competition. This dual role of implementing competition, while at the same time assuming the regulatory functions held previously by the ESB, will expose the Regulator to considerable pressure. Taking on an additional role as regulator of the gas industry will create an additional burden. Thus, in line with the plans set out by the Irish Government, the Commission for Regulation must have adequate staff and resources, and its independence be supported.

As long as the ESB remains the dominant player, the Regulator should closely monitor the evolution of the electricity market and, particularly, the competitive behaviour of the ESB. The ESB's influence derives from its integrated structure and its near complete monopoly. Initially, the ESB will be regulated through regulation of access to the system and various price controls. Further regulatory roles are expected in proposed legislation. However, the Regulator is not expected to have the power to address the extent of the ESB's influence. The Government should seek the advice of the Regulator, in an open and public way, to identify any additional measures needed to introduce competition in the electricity market.

Development of the Regulatory Framework

The reform of the electricity supply industry is still at an early stage and some significant uncertainty remains regarding the future regulation and policies affecting the industry. This is understandable because the market will not be open until February 2000. Nonetheless, the prospects for investment and the development of competition are hampered by the lack of clarity about the new rules and the future role of Government. A public commitment to the development of competition, including to the non-discriminatory entry of new competitors, would enhance the

investment climate and foster the development of competition. In addition, there is a pressing need for a sufficiently detailed and final statement on the regulatory framework and the role of Government.

Ensuring the development of effective competition free of oligopolistic influences should be the primary goal of the new regulatory framework. Some other elements of the regulatory framework that need further development are the trading mechanism, the unbundling of transmission, the pricing of transmission, the conditions of access to the grid and the regulatory techniques to be used (e.g. price caps and other tools of incentive regulation).

Once effective competition is established, the trading mechanism will be a key element of the regulatory framework. An efficient trading mechanism is essential to allow short-term cost minimisation of the whole electricity system. The viability of smaller competitors critically depends on the trading mechanism providing opportunities to buy and sell energy and ancillary services at competitive prices. New entrants will invest in generation assets only if, in addition to securing long-term demand from eligible consumers, they can handle short-term variations in demand and supply economically.

The trading mechanism needs to include provisions to protect small competitors. It must ensure that all competitors have access to energy and ancillary services, including back-up supply, by imposing an obligation to trade on the market participants. In addition, under the existing market structure, the market price of traded energy and ancillary services may be distorted and, therefore, a regulated price may have to be applied as a safeguard to protect small generators and their clients.

The Irish Government plans to separate transmission activities from the rest of the ESB operations but has not yet reached a final decision on which form of separation will be implemented. An independent and non-discriminatory system operation is a necessary precondition for competition, and the objective of achieving an effective separation of transmission should remain a priority of the reform programme. The fact that significant new investments in grid renovation and augmentation will be needed in the near future gives additional weight to the case for establishing a strictly independent and non-discriminatory transmission company. Transmission will absorb a significant share of industry revenues because of the cost of upgrading the grid and providing capacity to ensure security of supply and connections to remote plants. It is therefore vital that these revenues are not used to cross-subsidise consumers or to discriminate against new entrants. Independence is also necessary to ensure that investments in the grid are selected in an efficient and non-discriminatory fashion. In practice, the fact that the Irish Government is the owner of the transmission system means that strict separation criteria can be set in a relatively straightforward manner, without having to deal with the rights of third parties as would be the case if the industry were privately-owned.

Effective regulation of transmission also requires the development of a grid code setting transparent conditions for open and non-discriminatory access and for the

provision of ancillary services; and the adoption of a price methodology for access charges which reflect costs.

Finally, the regulatory framework requires the development of the regulatory techniques to be applied to set regulated prices and/or price caps. The Regulator intends to rely on incentive regulation, such as price caps related to the retail price index (RPI-X price caps), to provide incentives to industry participants to improve efficiency. This approach seems promising and its use is supported by some successful applications in other countries.

Transition Issues

The Irish Government has agreed to limit the extent of market opening to the minimum required by the EU Directive despite evidence that many independent companies are interested in entering the market. While such an agreement may help to obtain wider support for the opening of the electricity market, it is likely to be costly. There is a potential loss of investment and efficiency in Ireland if the opening of the market is capped at the minimum levels set by the Electricity Directive. There is also a question as to how investors willing to enter the market should be treated once the level of allowed market opening has been reached. A more promising and flexible approach could be to freeze power generation investment by the ESB and to allow market growth to determine the pace and level of market opening.

Stranded assets may arise in the transition to a competitive electricity market. There has been some discussion on how stranded assets should be treated, but an assessment of stranded costs in Ireland is still to be made and it is not known how they will be allocated, if found to be significant. Overall, under present circumstances, there are no compelling reasons to set stranded cost payments to the ESB. First, the ESB is publicly-owned instead of investor-owned so that the logic underlying stranded cost payments to compensate investors for losses that would result from changes in regulation does not seem to apply. Second, stranded costs emerge only to the extent that competition can force down prices. In the environment of little or no competition and correspondingly stable prices that may continue for some time after the opening of the Irish market, stranded costs may not materialise. For instance, countries like Germany and Norway, in which electricity prices have remained more or less stable after the opening of the market, do not have stranded cost payments. Third, even if stranded cost payments were to be set in Ireland, there is mounting evidence in the United States and elsewhere suggesting that initial stranded cost estimates are set too high because prices have been kept above short-run marginal cost because of lack of competition. One way to eliminate the bias is to sell off the assets so that the market provides an objective valuation. However, if the potentially stranded assets are not going to be divested, the Government must take into consideration the risk of an upward bias in the valuation of the assets.

There is a still unsettled debate on whether the current tariff structure subsidises domestic consumers at the expense of larger consumers. If this is the case, the subsidy

should be removed. At the same time, lowering the price of electricity to the largest consumers, which are the only eligible consumers in the initial stage of market opening, would add a significant difficulty to new entrants and to the development of competition. If, in the end, it is established that a cross-subsidy does exist and has to be dismantled, it would be advisable to consider other measures, such as a further market opening, to compensate for the potentially negative impact of tariff restructuring on competition. Furthermore, even if it is determined that prices paid by large consumers should be reduced, this should not necessarily result in an increase in the prices paid by smaller consumers. Indeed, these prices could also be expected to decrease over time as competition and regulatory measures decrease cost.

Privatisation

The future ownership of the ESB should be considered. Bord na Móna has been positioned to move into the private sector and this policy is expected to improve the productivity and efficiency, and even the profits, of Bord na Móna. The same benefits may result from the privatisation of the ESB, possibly as a number of smaller entities. In addition, the ESB will be competing increasingly with privately-owned companies and the Government will find it increasingly difficult to play a dual role both as owner and policy-maker.

Renewables and Combined Heat and Power

The general framework for renewables policy is now under review by the Irish Government. As a general principle, an integrated policy approach to renewables would be beneficial. In this approach, in addition to the direct costs and benefits of renewable energy, consideration should be given to back-up costs, required investments in grid augmentation and, consistent with overall environmental policy, the landscape value of proposed sites. Investment choices may well be different once all the costs and benefits are taken into account. An integrated assessment should also consider the alternatives to renewable energy sources like CHP, including micro-CHP applications such as small-scale CHP plants in individual buildings, which may, in some circumstances, constitute a more efficient approach to reducing the environmental impact of electricity production. However, CHP and micro-CHP are likely to develop only if they can take advantage of high peak load tariffs in an undistorted tariff structure that is truly cost-reflective.

RECOMMENDATIONS

The Government of Ireland should:

- ☐ Give a public commitment to the development of competition in the electricity market and favour entry of new competitors, as a means of improving efficiency

in the electricity sector; enhance certainty in the investment climate for new entrants by defining the Government's expectation of its future role, and by providing detailed and precise information for potential new entrants to the market.

☐ Allow the number of suitable potential new entrants, and the interest shown by consumers, to determine the pace and level of market opening, if the minimum market opening set by the EU Directive is exceeded.

☐ Ensure that the Commission for Regulation has sufficient resources and powers to undertake the task of regulating and promoting competition in the electricity and gas sectors.

☐ Require the Regulator to monitor the market influence of the Electricity Supply Board arising from its present structure, and require the Regulator to advise the Government on the Regulatory Commission's ability to promote competition without also having the power to address the extent of the Electricity Supply Board's influence.

☐ Require the Regulator to advise on any additional measures which may be needed to introduce effective competition in the electricity market.

7

OIL AND GAS

OIL

Oil and Gas Exploration and Production

There is no direct government involvement in oil and gas exploration. The objective of policy is to maximise the benefits to Ireland from exploration for and production of indigenous oil and gas resources, whilst ensuring that activities are conducted safely with due regard to their impact on the environment and other land and sea users. Private ventures are licensed to conduct exploration and production on terms which balance the interests of the State and those of private enterprise while ensuring that effective and efficient exploration and production are undertaken in accordance with best practices.

Since 1992 Ireland has had a comprehensive regime of fiscal and non-fiscal measures applicable to hydrocarbon exploration, development and production. The Irish upstream fiscal regime is considered to be one of the most attractive in the world. Corporation tax at 25% applies where production of oil and gas takes place under leases issued before certain specified dates. To qualify for this rate, petroleum leases for fields in the more accessible waters must be granted by 1 June 2003, leases in respect of "deep water" fields must be granted before 1 June 2007, and leases in "frontier" waters must be granted before 1 June 2013.

Taxation allowances of 100% are available for exploration, development and operating expenses with a provision for allowance of unsuccessful exploration expenditure for twenty-five years. A "ring fence" provision operates around oil and gas exploration and production activities so as to prevent the tax yield for non-petroleum activities being reduced by offsetting the high cost of petroleum development. There is also provision for an allowance with respect to expenditure on the abandonment of fields and dismantling of pipelines.

There is no provision for royalty payments or State participation in the current licensing terms. In the case of the Kinsale and Ballycotton gas fields, production is carried out under an earlier agreement and a royalty of 12.5% applies.

Exploration acreage is allocated either through open access or by promotion through a system of acreage allocation Rounds. Four formal Rounds have been held to encourage development in under-explored frontier areas: in the Slyne and Erris Troughs off the north-west coast of Ireland; in the Porcupine Basin off the west coast; in the Rockall Trough off the west and north-west coast; and the most recent in the South Porcupine Basin off the south-west coast of Ireland, which closed in December 1998. Two applications were received in the last Round and two licences covering eleven blocks were granted. At present, twenty-six exploration licences are held, each carrying an obligation to undertake a specified work programme involving a high level of exploration activity.

Enterprise Oil has announced encouraging appraisal results from its Corrib gas discovery in Block 18/20 in the Slyne Trough (see Figure 22). Holdings in the consortium are UK-based Enterprise Oil 45%, and Norwegian companies Saga Oil 40% and Statoil 15%. The licensees commenced a second appraisal well in May 1999 and if results continue to remain positive, further appraisal work will be required. Corrib is close to Achill Island and to the mainland, but some distance from the existing network. A new pipeline would be required to take any gas to markets in the south.

Industry Structure

The Irish National Petroleum Corporation

The Irish National Petroleum Corporation (INPC) is a government-owned company founded in 1979 to source, process, store and supply petroleum to the market on a commercial basis, having regard to safety, the environment and national strategic considerations. INPC consists of the parent company and three subsidiaries: Irish Refining plc, Bantry Terminals Limited, and the National Oil Reserves Agency. INPC is responsible for the purchase and shipping of crude oil, oil trading, and marketing and product sales.

Whitegate Refinery

Irish Refining plc (IRC) operates the Whitegate refinery, Ireland's only oil refinery, in Cork Harbour. The refinery was originally designed and built to Esso specifications and basic practices, and its construction over the period 1957 to 1959 was supervised by Esso Engineering Company Limited. IRC assumed the management of the refinery in 1982. The refinery can process some 68 000 barrels per day in a hydroskimming facility. It also has a naphtha reformer and a desulphurisation unit. A 7 MW combined heat and power plant and a road loading facility have been added recently. Jetty capacity has been expanded to receive tankers up to 82 000 tonnes.

Before 1993, the refinery produced petrol, gasoil and diesel, fuel oil and liquefied petroleum gas. Most of the fuel oil was exported. In anticipation of the growing demand for kerosene and jet fuel, production facilities and tankage were installed for these products, which by 1997 amounted to 16% of the lighter ("white") product mix. Nonetheless, the problem remains that technical limitations place constraints on the overall white product yield and 38% of the output of the refinery has to be exported for further processing.

Whiddy Terminal

Whiddy Terminal in Bantry Bay began operations in 1968 as a crude oil transshipment facility to service the European refinery interests of Gulf Oil. Bantry Bay is a deepwater port, capable of taking very large crude carriers and enabling lesser tonnages to be shuttled to other locations. In 1986, Whiddy Terminal was acquired by INPC from Gulf's acquirer, Chevron as part of Chevron's European

divestment programme. Bantry Terminals Ltd was incorporated to own and manage the terminal on INPC's behalf. The one million tonne terminal became dormant following a disaster in 1979, although some 205 000 tonnes of crude oil forming part of Ireland's strategic reserves were added in 1990 under exceptional arrangements. The terminal was reactivated in 1998 with the commissioning of a Single Point Mooring facility and currently holds both strategic and commercial stocks.

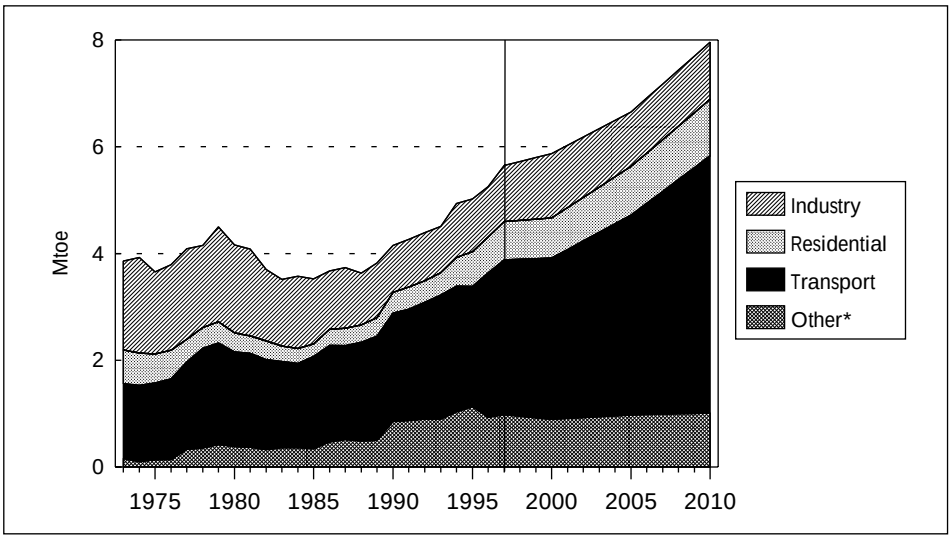
Other Participants

The oil market is also served by a number of multinational and domestic independent companies. Each company is currently obliged to obtain 20% of its requirements of gasoline, gasoil and diesel oil from the Whitegate refinery. The balance is imported mainly from the United Kingdom.

Oil Demand

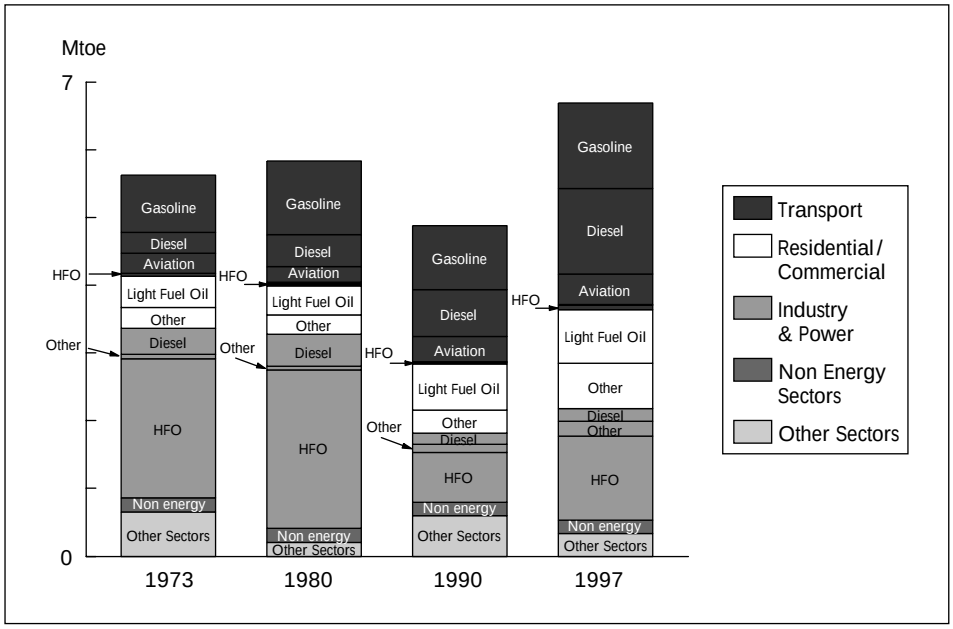
In terms of overall oil consumption, middle distillates (gasoil, diesel, kerosene and jet fuel) dominate Irish oil requirements, representing 53% of total demand in 1998. Fuel oil at 26% is next in importance, although consumption is dominated by the Electricity Supply Board and a small number of large industrial users. Petrol represents about 19% of oil demand while liquefied petroleum gas (LPG) accounts for 2%. Figure 20 illustrates oil consumption by sector in the period 1973-1997.

Figure 19
Final Consumption of Oil by Sector, 1973-2010



* Includes commercial, public service and agricultural sectors.
Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1998, and country submission.

Figure 20
Oil Consumption by Sector, 1973-1997



Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1998.

Refining Policy

The Government decided in November 1996 to modify rather than abolish, as previously intended, the mandatory regime which requires oil importers to purchase a portion of their supplies from Whitegate refinery at prices determined by the Minister. The decision was prompted by adverse developments in international refining markets as a result of which Whitegate refinery would not have been in a position to operate on a purely commercial basis. From 1 January 1997, the obligation was reduced from 35% to 20% and income support for the refinery was capped rather than determined on a cost-recovery basis.

During 1998, INPC prepared a major Strategic Business Plan for the period 1998-2005. The plan involves a I£ 105 million investment programme to upgrade the Whitegate refinery, largely to meet the latest environmentally-based requirements of the EU Auto Oil Programme which will become effective from 1 January 2000. The project will be funded by borrowing by INPC. When approving the investment programme in February 1999, the Government noted that the price support provided by the Mandatory Regime was crucial to underwrite the borrowing by INPC. The Government agreed that the 20% mandatory purchase of gasoline and gasoil/Derv would be continued subject to annual review. The review would include a consideration of the need to service the borrowing associated with the investment project and have regard to minimising the imposition on the consumer.

At the same time, the Government requested INPC to examine the scope for other commercial opportunities to underpin the operation of the refinery, including possible joint ventures or a strategic partnership in activities related to oil refining. The mandatory purchase requirement is expected to continue for the foreseeable future, while INPC continues to increase the proportion of its production that is sold on a purely commercial basis.

As a result of an earlier major investment programme at the refinery, capacity increased from 55 000 to 65 000 barrels per day in 1997. The average daily throughput is now 62 000 barrels. The establishment of a road loading facility at the refinery has contributed greatly to increased sales, particularly in the south and south-west of the country. The high volume of exports mainly represents sales of SRAR (Straight Run Atmospheric Residue) and naphtha as feedstocks, for which there is no market in Ireland. Unless a partnership or joint venture can exploit the SRAR stream, it is likely that an export market will continue to be necessary for a substantial part of the refinery's output.

Taxation

Taxes on excisable energy products in Ireland include excise and value added tax (VAT) components. Taxes are levied for revenue raising purposes, although environmental, social and competitiveness considerations influence tax levels on particular fuels. Generally, heating fuel (which also enjoys a lower VAT rate) and heavy fuel oil used in industry have lower excise duty rates compared with road fuels.

Liquefied petroleum gas, both for heating and automotive purposes, also benefits from lower excise duty rates when compared to, for example, petrol. Petrol and autodiesel are liable for the standard rate of VAT but a reduced rate applies to heating fuels. Coal, peat and natural gas prices do not have excise tax components.

Excise duty increases of 4 pence per litre (including VAT) for leaded petrol and super unleaded (98 RON) petrol were implemented following the Budget of December 1997. There was no change in excise rates for other oil products. As a result, the differential between leaded and unleaded petrol prices has widened to more than 10 pence per litre with differences of up to 14 pence per litre in some outlets.

The National Oil Reserves Agency

In June 1995, the administration of strategic stocks was formalised by establishing the National Oil Reserves Agency (NORA) as a subsidiary company of INPC. Under EU and IEA rules, each member of these organisations is obliged to hold strategic reserves equivalent to ninety days of annual petroleum consumption. Prior to 1995,

the obligation was met by a combination of stocks in Ireland, stocks abroad and stock credit at Whitegate for the four oil companies which had owned the refinery before 1982.

Although NORA is a subsidiary company of INPC, it operates at arm's length from the parent company. NORA's function is to arrange for the holding of oil stocks at a level determined annually by the Minister, either directly by the Agency itself or on its behalf by third parties at home or abroad. The main objective is to ensure that a higher proportion of the total stocks is held in Ireland. NORA is required to operate on a break-even basis and is being funded by a levy of 0.375 pence per litre on oil sales. It is intended that NORA should operate in a cost-effective manner and provide the consumer, on whose behalf strategic oil stocks are held, with value for money. In this context, the levy is kept under regular review to ensure that its cost to the consumer is kept to a minimum.

In March 1995, the Minister directed INPC to install a single buoy mooring at Whiddy Island Oil Terminal which had been non-operational following a major accident in 1979. Work on the project was completed in 1996 and the terminal was officially reactivated in April 1998 when two cargoes amounting to 140 000 tonnes of crude oil were added to existing strategic stocks there. The reopening of the terminal will increase the effectiveness with which NORA can discharge its remit in relation to both crude oil and finished products, and also opens the prospect of commercial use of the facility.

Table 6
Average Annual National Oil Stocks
(days)

1995	*1996*	*1997*	*1998*
90	98	104	104

Source: Department of Public Enterprise.

Fuel oil stocks are far in excess of requirements mainly because of high stock levels held by the Electricity Supply Board. Difficulties remain with stocks of petrol, kerosene and gasoil because of rising demand and the shortage of facilities for holding these products. In response, NORA has purchased gasoil and gasoline, mostly for storage abroad, in order to continue to meet stock-holding requirements. Arrangements for the provision of additional storage will also have to be made to cater for the future growth in the market.

Emergency Measures

Legal Authority and Emergency Organisation

The Minister for Public Enterprise is empowered under the Fuels Acts 1971 and 1982 to regulate the supply and distribution of petroleum products if the Government decides that an emergency situation warrants action. Responsibility

for the implementation of this legislation rests primarily with the Department of Public Enterprise. Industry representatives would be consulted in the event of intervention by the Minister.

Emergency Reserves

Ireland's stock policy has evolved in response to its international commitments, particularly its membership of the European Union. The Fuels Acts and European Communities (Minimum Stocks of Petroleum Oils) Regulations 1974-95 were enacted to safeguard the supply and distribution of oil in an emergency, to meet EU and IEA stockholding obligations, and to gather adequate data regarding consumption, trade and stocks of oil products.

Under 1995 regulations, the National Oil Reserves Agency (NORA) was established. It has statutory responsibility for ensuring that sufficient stocks are in place to meet IEA and EU obligations. The basic principle of the present policy is that the State retains a strategic stock-holding function and levies the cost on to oil companies, who in return may recover it through retail prices.

Oil importers and large oil consumers are no longer obliged to hold strategic stocks but are expected to hold a prudent level of operating stocks, which are included in Ireland's stock-holding calculation. Ireland would have no legal or other problems participating in joint stockdraw operations including any below the ninety-day level. The regulations on minimum stocks allow the Minister to authorise stocks to be drawn down in an emergency.

Demand Restraint

Ireland's emergency response programme centres initially on demand restraint measures aimed at limiting the amount of fuel in the hands of oil distributors and reducing availability to consumers. The Government could introduce emergency response measures through Ministerial Orders based on the Fuels Acts independently of the activation of the IEA emergency response measures. Compulsory orders could be introduced in a sub-crisis situation. Formal rationing schemes are given lower priority than in the past. The administration has prepared necessary draft Ministerial Orders for the implementation of demand restraint measures.

GAS

Natural gas increased its share of the Irish energy market from 15% in 1987 to 23% in 1998 (including natural gas used for fertiliser feedstock). Overall, gas demand has grown at about 8% per year since 1992. Growth in the domestic and in the small commercial/industrial sectors has been about 10% per year since 1992, driven by extensions of the gas distribution grid and increasing penetration of the existing market. The growth in the power generation sector has also been high at about

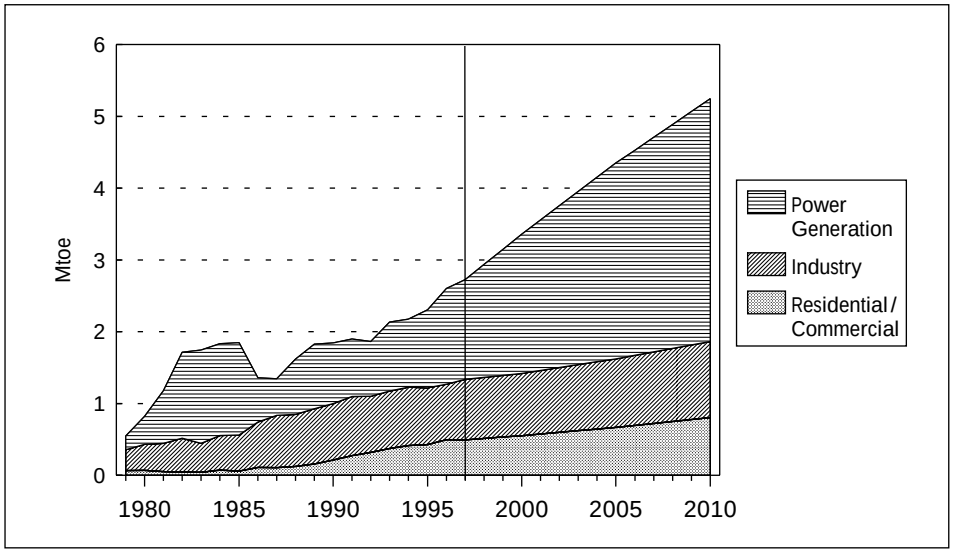
13% per year since 1992, driven by the growing competitiveness of natural gas compared with competing heavy fuel oil, especially in dual-fuelled generation plant. This trend is expected to continue. Growth in large industrial uses and for fertiliser manufacture (ammonia) has been much slower, at less than 2% per year.

Table 7
Natural Gas Network – Houses Adjacent to the Network and Number of Customers Connected
Actual and Forecast

Year	*Houses in Network ('000)*	*Customers ('000)*
1990	240	159
1991	246	171
1992	274	189
1993	300	205
1994	330	223
1995	350	241
2000	550	345
2010	650	480

Source: *Ireland, Second National Communication Under the United Nations Framework Convention on Climate Change*, 1997.

Figure 21
Natural Gas Supply, 1979-2010



Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1998, and country submission.

Industry Structure

Gas is supplied from the Kinsale/Ballycotton field and through an interconnector with the United Kingdom. The interconnector now supplies about 50% of gas requirements under a variety of contracts with a duration ranging from very short-term to five years.

The Minister for Public Enterprise has overall responsibility for the development of the natural gas industry. Policy is determined by the Minister who is also the sole shareholder of the State-owned body, Bord Gáis Éireann (BGE) which holds an effective monopoly over natural gas transmission, distribution and sales in Ireland. The Irish gas legislation, however, allows persons other than BGE to construct gas pipelines, subject to certain conditions. BGE serves the electricity generation, fertiliser feedstock, industrial, commercial and domestic markets. The Electricity Supply Board and a single fertiliser plant are the main natural gas consumers, consuming about 50% and 20% respectively of total gas sales. Electricity generation provides a proportion of the swing requirement, with the balance being provided by the interconnector from the UK market.

There are no gas storage facilities, and variations in supply, including in emergencies, can only be met by replacing gas used in power generation with heavy fuel oil.

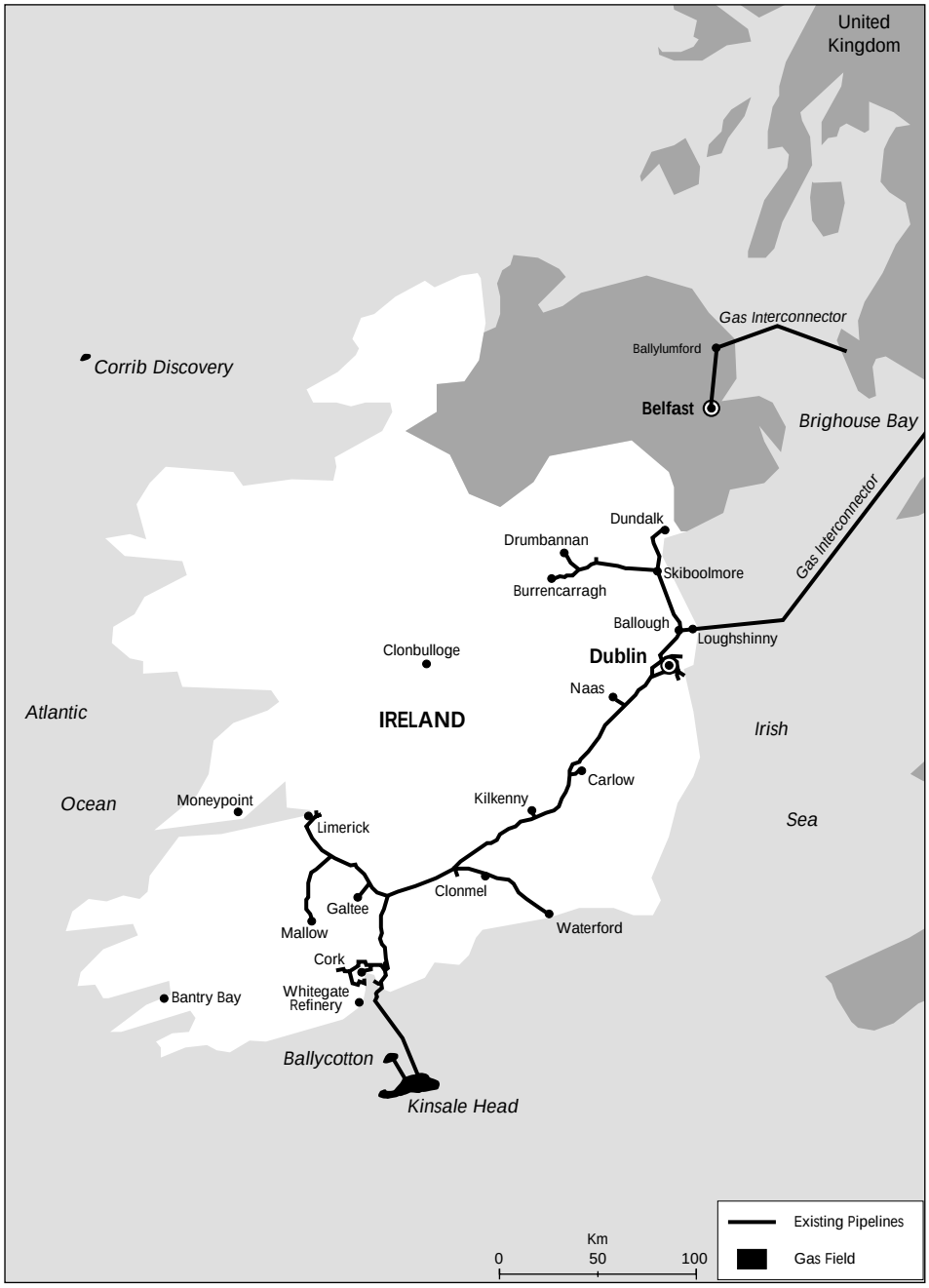
Infrastructure Requirements

The gas network serves the southern, eastern and north-eastern areas of Ireland (Figure 22). BGE continues to extend the natural gas network where it is commercially viable to do so. The network now serves over 300 000 domestic consumers and some 11 000 industrial and commercial consumers. Gas accounts for more than 20% of total primary energy requirements.

Since December 1993, Ireland has been linked to the United Kingdom gas market through a subsea interconnector between Scotland and Loughshinny in north County Dublin. The interconnector began commercial operation in 1995 and currently operates at close to full capacity. The capacity of the interconnector is 10 million standard cubic metres per day, but is planned to be increased to 14 million standard cubic metres by October 2000 with compression at Moffat, and to 17 million standard cubic metres by October 2001 with compression at Brighouse Bay.

BGE and the Department of Public Enterprise are making a comprehensive study of gas demand to the year 2025 to examine the infrastructure requirements to meet forecast demand. The study examines the demand and technical and financial aspects of incremental supplies for Ireland. On the basis of demand scenarios developed in the study, a significant increase in the demand for gas to 2010 and beyond is anticipated, which would exceed the capacity of the existing interconnector pipe some time between 2003 and 2008.

Figure 22
Natural Gas Transmission Network



Source: IEA.
Note: This map also shows the location of a number of key energy facilities: the coal-fired power station at Moneypoint, the new peat-fired power station at Clonbulloge, the Whitegate refinery, and the Whiddy oil terminal in Bantry Bay.

The timing of the interconnector reaching full capacity coincides with the expected depletion of the Kinsale/Ballycotton reserves. The recent Corrib discovery, if it proves commercially viable, could help replace indigenous supplies, but the timing of its development would also come close to the critical period in which existing indigenous production will cease and the interconnector reaches full capacity. Moreover, the development of Corrib, off the west coast, may be delayed until new markets develop on the west coast or there is a commitment to connecting the development to the existing gas network in the south-east, which links Kinsale/Ballycotton in the south to markets in Dublin, Cork, Limerick and Waterford.

Gas Prices

All gas currently produced from Kinsale/Ballycotton is sold to BGE on a take-or-pay contract basis that has two price regimes: the first is based on production costs and the second on international oil prices. Gas is supplied from the domestic field at prices which have been historically lower than prices for North Sea gas, but the price increases under an agreement between BGE and Marathon as the reserves are depleted. The difference in prices is narrowing, reflecting the decline in domestic reserves and the general reduction in gas market prices.

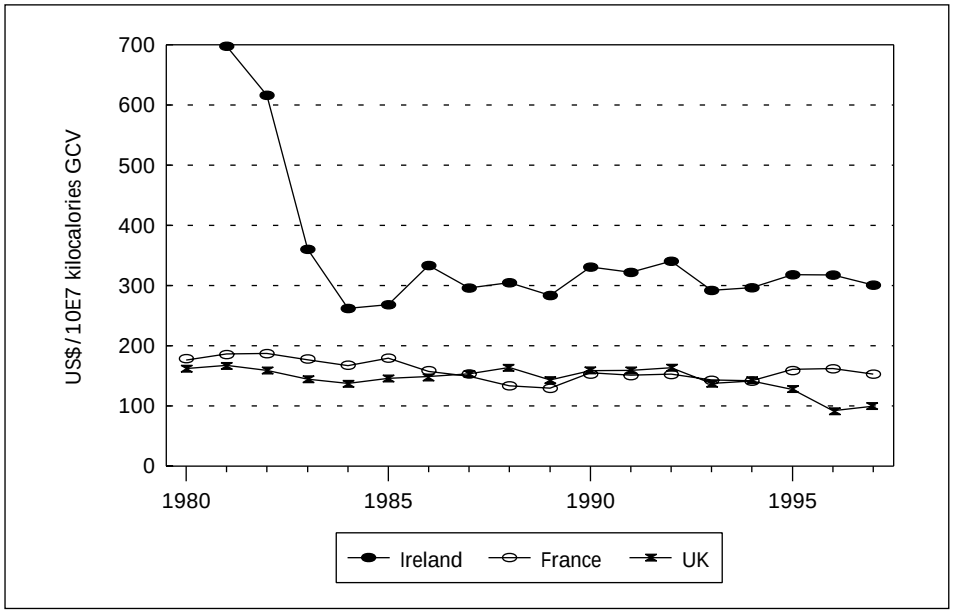
End-user gas prices have fallen but remain substantially higher than in the United Kingdom (see Figures 23 and 24). A standard tariff has been introduced by BGE for new central heating customers based on a "two-part tariff" approach, i.e. a fixed element independent of consumption and a variable element based on consumption. While all new customers sign on to this tariff automatically, existing Supersaver (central heating) customers have the option of remaining on their current tariff.

Market Opening

The Energy (Miscellaneous Provisions) Act 1995 provides a legal framework for third party access by large consumers to the BGE gas network, and is broadly in line with the EU Directive concerning common rules for the internal market in natural gas. The Directive will introduce competition into the natural gas industry through enabling third party access to gas networks throughout the European Union.

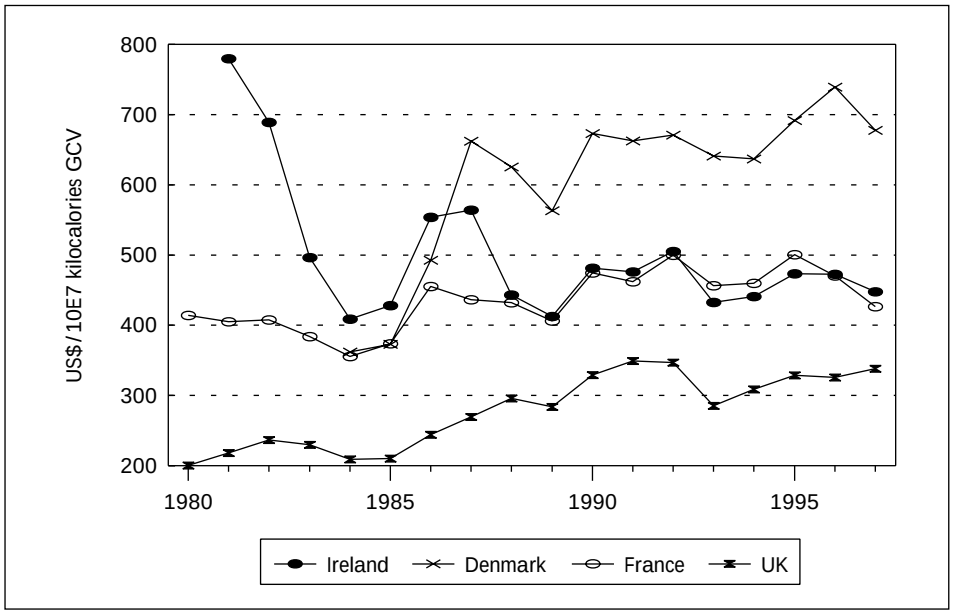
The Act enables eligible gas consumers, such as the Electricity Supply Board, the fertiliser company and other large consumers to purchase their supplies directly from gas producers and to have the gas transmitted through the BGE network on commercial terms. The threshold in the Act is 25 million standard cubic metres of gas per year. On the basis of that figure, a legislative framework exists to potentially open some 75% of BGE's market by volume to competition, but the number of eligible customers is less than ten. The Act also allows the Minister to give general directives to BGE relating to transmission and pricing of third party access.

Figure 23
Gas Prices in the Industry Sector, 1980-1997



Source: *Energy Prices and Taxes*, IEA/OECD Paris, 1998.

Figure 24
Gas Prices in the Household Sector, 1980-1997



Source: *Energy Prices and Taxes*, IEA/OECD Paris, 1998.

Transportation tariffs are being introduced. Draft ministerial directives have been prepared and published for comments. In addition, BGE, in consultation with interested parties, is preparing a Gas Network Code of Operations.

The eligible customers, i.e. those consuming more than 25 million standard cubic metres per year, can now identify the various elements of their gas price based on the wholesale gas market price in the United Kingdom. As an element in implementing the 1995 legislation, BGE has given an undertaking to ensure the integrity of information between its gas transportation and gas trading units.

The implementation of the laws, regulations and administrative provisions of the EU Directive in the year 2000 will entail a major review of the Gas Acts 1976-1998. A new Act will be drafted transposing the EU Directive into national legislation to establish the future structure of the Irish gas industry. A separate Act on the structure and corporate nature of BGE will also be prepared.

CRITIQUE

Oil

The objective of Ireland's oil supply policy is to facilitate the supply of oil to consumers as efficiently as possible, at internationally competitive prices, while taking into account supply security considerations. Ireland is totally dependent on imports and is vulnerable to factors outside its control. Nonetheless, the relatively small Irish market has the potential to take advantage of improvements in efficiency of production, manufacture and distribution of oil supplies in the European market.

Exploration and Development

While energy security can be achieved through trade, the discovery and development of new petroleum resources would clearly be of great benefit to Ireland. Exploration and production policies are very competitive by international standards and appear to provide a good framework for stimulating exploration and should be continued in their present form.

The Corrib gas discovery is important in this context, but equally its development should be on a cost-effective basis, allowing for the cost of the infrastructure required to bring its gas into the existing network. The discovery is close to shore, but some distance from current gas market demand centres. Decisions on the infrastructure should be taken on a commercial basis, but in consultation with the potential developers of the field and potential users of the gas. Potential users may be ready to pay a premium above imported gas prices for indigenous supplies, if they judge indigenous sources to be the more secure source of supply.

Refinery Policy

In 1999, INPC will complete a three-year commercial plan, designed to enable it to operate on a commercial basis. The plan involved both a major investment programme at the Whitegate refinery and the implementation of supply and marketing arrangements to support the increased capacity of the refinery. The two targets were completed successfully. However, the viability of INPC is primarily determined by the external refining margin, i.e. the relationship between the cost of crude oil and the revenue from refined products. Both are determined by open international market forces and towards the end of 1996, margins fell significantly short of INPC's expectations. On this basis, the requirement of companies to purchase a proportion of their products from the Whitegate refinery was reduced, rather than eliminated, so that only 60% of the throughput was sold on the basis of international prices.

Margins have continued to be poor. The viability of the Whitegate refinery was weakened further by the fall in international refining margins in 1997. Lower prices also produced substantial losses in the value of stocks in the first quarter of 1997. Low margins and stock losses combined to produce an operating loss of I£ 8 million during the year. Although the market recovered briefly, the decline in oil prices following economic problems in the Asian economies, mild winter weather and increased Iraqi exports caused further stock losses in the first quarter of 1998.

Conversely, the commercial plan has made some impressive achievements in areas where management has control. The refinery's investment programme was achieved on time and within budget. At 65 000 barrels per day, the refinery now operates at a level some 70% higher than the average before 1993. The product range has been widened and new markets have been developed. Overall, the cost to the consumer, including the maintenance of a substantial part of Ireland's strategic stock through NORA, has been reduced progressively to less than 0.2 pence per litre in a price of between 61 pence and 64 pence per litre for petrol and diesel fuel.

Despite these very considerable achievements, the factors underlying the failure to achieve the primary goal of the commercial plan — operation on a commercial basis — are fundamental problems, and likely to continue in the immediate future. Even if margins recover and further stock losses are avoided, improvements in these areas will also benefit competing refineries worldwide, leaving the Whitegate operations essentially no better off. Although the cost to consumers of Whitegate's losses might appear small against the cost of transport fuel, it is high in absolute terms at about I£ 5 million per year[22].

The refinery is technically limited as it is a simple hydroskimmer. The configuration of the refinery cannot be modified to match the demand slate of the domestic market, and an export market will always be necessary for a substantial part of the

22. On the basis of about 2 500 million litres of petrol and diesel consumption per year.

output. Private investors abandoned the plant because of its likely continuing poor profitability arising from its underlying technical limitations. Over time, further investment is likely to be required in the refinery to meet EU requirements.

On balance, it is reasonable to expect that continuing good management of the refinery will help contain costs, but that the fundamental market and technical difficulties facing the refinery will thwart INPC's aim to achieve commercial viability. The question then arises as to whether the Government and consumers should continue to support the refinery, given that support will probably be required indefinitely, or wheter further support should be withdrawn and the future of the refinery should be left to market forces.

The poor profitability outlook of the refinery was known at the time the Government took the decision to take over its operations. The decision was based on security of supply considerations, as the presence of an operating refinery on the national territory was seen as vital, especially in view of Ireland's peripheral location, to enable the conversion of crude oil to finished products in a reasonable time scale in an emergency. Consideration should nonetheless be given to the range of feasible, possibly more cost-effective, means of ensuring security. The possible conversion of the refinery to a storage terminal has already been rejected by the Government on economic grounds. Other options might include, for example, developing formal agreements with oil companies to ensure fair and equal treatment for Ireland in the event of an emergency, and other forms of storage of an appropriate range of products domestically or at secure offshore locations.

Impact of Emergency Management on INPC's Commercial Prospects

Strong growth in oil demand in recent years presents a significant challenge to NORA in meeting national stock-holding requirements within Irish territory. NORA's objectives are essentially non-commercial and different in nature from the ultimate objective of INPC to become commercially viable. Although NORA operates at arm's length from INPC, its operations may potentially create conflicts which would be better resolved if NORA were truly independent.

Difficulties could arise in a number of ways. For example, NORA is obliged to rent storage. INPC is one of many companies that could rent storage to NORA, but by being in INPC, NORA could feel under pressure to favour INPC or be open to the accusation of favouring INPC. Government policy is to increase the proportion of national emergency stocks held on Irish territory. INPC would probably benefit from this policy as it would have most of the available storage in Ireland. During an emergency, INPC would be one of many companies wishing to obtain stocks from NORA. Again, NORA may feel under pressure to favour INPC, or be similarly open to the accusation of favouring INPC because of its location within INPC. It would be in the interests of both organisations if NORA was separated from INPC, leaving INPC to focus exclusively on improving its commercial viability.

Gas

Demand Growth, Infrastructure Requirements and Security of Supply

The current high rate of growth in the Irish economy is leading to a significant growth in electricity demand. It is likely that incremental power generation demand in Ireland will be met through combined-cycle gas-turbine plant for the foreseeable future because of the liberalisation of both the gas and electricity markets, the favourable economics of gas-fired power generation and the need to reduce greenhouse gas emissions. Gas penetration in the residential and small industrial/commercial sectors has brought environmental benefits as well as economic benefits by backing out peat and coal (assisted by policies banning domestic coal-burning in some areas).

The Kinsale Head/Ballycotton gas reserves are now depleting and are expected to be exhausted for commercial purposes some time after 2005. In 1996, BGE imported 20% of its gas requirements through the interconnector with Scotland. Imports grew to about 30% of supplies in 1997 and to 50% in 1998. In 1999, imports are expected to supply 70% of BGE's requirements. The gas is sourced through a portfolio of contracts in the United Kingdom market but the duration of contracts has given rise to concern in Ireland because of the growing dependence on the interconnector for meeting long-term, uninterruptible supplies.

The options for future gas supply policy are limited. First, an arbitrary limit could be placed on gas penetration. Unlike the United Kingdom, which has placed a moratorium on new gas-fired power generation because of distortions in electricity price setting, the development of the gas market in Ireland has not been distorted[23] and growth in gas demand results from competitive advantages. If gas penetration were limited by government policy, peat and coal would have to meet growing energy demand (offset by gains in end-use efficiency) at some economic cost, and the environmental benefits of gas would be lost.

Second, the Corrib discovery, if it proves commercial, could be developed on a fast-track schedule and used to offset falling supplies from Kinsale Head/Ballycotton. The timing would involve some risk and require a large and carefully planned investment to develop the field, to construct a pipeline to shore, and to construct a pipeline onshore to the existing network. The security benefits of this option should be recovered from buyers and not be allowed to over-rule unfavourable economics, as should also be the case with a second interconnector.

Third, new infrastructure could be considered, including gas storage and a second interconnector. A second interconnector would link Ireland to the United Kingdom market and allow the possibility of a range of contracts matched to the needs of consumers. The range of contracts currently and potentially available should be

23. See discussion on the development of gas-fired power generation in the United Kingdom in *Energy Policies of IEA Countries: The United Kingdom — 1998 Review*, IEA/OECD Paris, 1998.

regarded as equivalent to a highly diverse range of suppliers. Technical risk aside (which would, in any case, be reduced by duplicating the present interconnector), a second interconnector would offer far greater diversity of supply than a single new domestic gas development. Of course, in view of the rate of growth in gas demand, a second interconnector should complement development of Corrib. Domestically produced gas and imported gas together offer scope for competition to ensure consumers receive the lowest cost supply, regardless of the source.

A second interconnector could be provided without government or other external assistance. One private proposal has already been made to build a second interconnector at a cost of about I£ 300 million, compared with I£ 280 million for the existing interconnector built by BGE with EU assistance. Clearly, a private developer could not proceed without having contracts in place and assurances from the Government about future gas policy.

Developing Competition

The size of the market and the small number of major consumers limit the prospects for competition, but progress has been made. A few big companies such as the Electricity Supply Board will shortly import gas directly, using the interconnector on payment of a fee to BGE. Appropriate steps have been taken to implement the EU Directive and BGE is being restructured. The Department of Public Enterprise has split responsibilities for regulatory policy and corporate governance of BGE. Independent regulation of gas will be established, possibly by adding responsibility for gas regulation to the Commission for Electricity Regulation. Within BGE, management responsibility for transmission and other functions has been split. Arrangements for developing third party access are being developed on a regulated basis, including for transmission, pricing and a network code.

BGE considers that it faces a form of competition from the United Kingdom market. Because pricing and costs are transparent, the price BGE can charge is based on the price in the United Kingdom plus transport. This formula is, in principle, correct, but can be assured only if the gas purchase, transportation and supply functions in BGE are fully separated. BGE faces inevitable change in the near future. At present it has 750 employees and makes a profit of over I£ 60 million on a turnover of about I£ 300 million. Its profitability cannot be sustained because the rising proportion of gas imports are at a higher cost than domestic sources. Legislation to transform BGE into a public liability company is being drafted and is expected to be enacted in 2000. The possibility of restructuring BGE into a number of separate bodies has not been addressed but BGE has plans to diversify its activities into telecommunications and power generation. If a number of business units were created, it would be only a small further step to take to privatise the separated components of BGE.

Relationship of Gas and Electricity Markets

Energy markets are increasingly integrated and sectoral energy policies need a broad focus. Gas policies need to take into account their potentially large impact on electricity markets. In particular, gas availability may constitute a bottleneck for

the development of competition in electricity because new generating units are likely to be gas-fired. BGE is already faced with the need to develop an allocation procedure to choose between competing requests for gas from potential new entrants to the electricity market, authorised by the Regulator. Until surplus capacity becomes available through construction of a second interconnector or the development of gas finds, availability of gas may limit how many electricity generation projects can proceed. Availability of competitively priced gas will also be crucial for the successful development of combined heat and power projects. Thus, investments in gas infrastructures must take into account the benefits for the electricity sector that would result from increased gas availability and from increased integration with the larger United Kingdom gas market. Open and non-discriminatory access to gas supplies is a necessary precondition for an efficient performance of the Irish electricity market.

RECOMMENDATIONS

The Government of Ireland should:

- ☐ Work towards the objective of removing the mandatory requirement for purchases from the Whitegate refinery.
- ☐ Consider other possible means of responding to both the economic difficulties of operating the refinery and concerns about product security.
- ☐ Now that the gas market is open for larger consumers, develop means to make competition more effective, and ensure that policy developments in both the gas and electricity markets are co-ordinated.
- ☐ Review gas transmission tariffs with a view to ensuring that they are cost-reflective and transparent.
- ☐ Develop a policy for making allocations of gas between competing companies in the event that capacity limits arise.
- ☐ Give priority to gas market issues which impact on electricity sector reform, such as non-discriminatory allocation rules for potential gas-fired power generators, including small cogenerators in the commercial and household sectors.
- ☐ Allow gas penetration to continue to be determined by the market, while continuing to monitor the energy security implications of relying on growing gas use.
- ☐ Take into account the energy security and competition benefits in assessing the need for a second gas interconnector.

8

PEAT AND COAL

PEAT

Resources and Reserves

Ireland has some 1.2 million hectares of peat[24] bogs and reserves of about six billion tonnes (6×10^9 tonnes). Peatland occupies some 17% of the country. Ireland is among the four largest peat users (with the former Soviet Union, Finland and Sweden), and has a long experience in reserves assessment, harvesting, drying and use. Bord na Móna (the Irish Peat Board) owns and works 88 000 hectares of peatland, representing 7.3% of Ireland's total peat reserve. Bord na Móna's peatlands have an estimated remaining working life of some thirty years. It is unlikely that new bogs will be developed for commercial peat production, and future activity is likely to remain in five developed locations serving the existing power stations (reserves: 69.7 million tonnes), East Midland Bog Group (reserves: 24.6 million tonnes, which are developed and which will serve a new peat-fired plant), and Derryfada (reserves: 12 million tonnes, of which approximately one-third is developed).

Production Policies

Bord na Móna was established in 1946 as a state-owned company to develop the peat resources of Ireland in the national interest through the production and marketing of turf and turf products. Since then, it has acquired and developed about 88 000 hectares of bogland. It supplies peat to five power stations and to a large number of Irish homes in the form of peat briquettes. It also produces and markets horticultural products to many European States. Since its inception, Bord na Móna has designed and developed its own peat production machinery. The company has also developed pollution abatement systems using peat and provides consultancy and analytical services.

Bord na Móna was originally established as a statutory corporation, but the Turf Development Act (July 1998) provided for the incorporation of Bord na Móna as a public limited company and for the incorporation of its individual businesses as separate limited liability subsidiaries. The Act gives the company a modern

24. Peat is a soft organic material consisting of partly decayed plant matter together with deposited minerals. Peat occurs mainly in wetlands where micro-organisms promoting the decomposition of dead vegetation are unable to decompose all the material, often due to lack of oxygen in waterlogged areas. Peat is generally a few thousand years old, and is often classified for this reason as a fossil fuel although substantially younger than coal which varies from 15 million to some 400 million years old. It is also sometimes classified as a biofuel. Its combustion and handling properties are similar to those of some brown coals.

configuration and introduces greater transparency into its various activities. The Act allows up to 50% of the Government's shareholding to be disposed of with ministerial approval and above 50% on the basis of a resolution of Parliament.

Peat production depends heavily on weather conditions and thus varies from year to year (see Figure 2). In 1997-98, Bord na Móna produced 2.7 million tonnes (0.5 Mtoe) of milled peat, down from 5 million tonnes (0.93 Mtoe) in 1996-97. Extraction of peat by private sector operators, including hand-cut peat production for local and household use, has expanded from about 300 000 tonnes in 1982 to around 1.3 million tonnes per year currently.

Unless further gas developments occur in the near future, peat will be Ireland's only significant domestic source of fuel after about 2003. Security of supply has been an important consideration in policy towards peat since the oil crises of the 1970s when it was cheaper than oil, at times significantly so, for many years. While security of supply remains relevant, Bord na Móna's substantial socio-economic role is now a very important fact in its ongoing operations. Bord na Móna employs more than 2 000 people in the severely disadvantaged Midlands region, where most of its operations are concentrated.

Peat Consumption

Power Generation

The five main peat-fired power stations, located adjacent to the peat bogs to reduce transport costs, produced 11% of Ireland's electricity in 1997-98. The largest is at Shannonbridge, County Offaly, with an output of 125 MW (see Table 8). The plants were built between 1957 and 1983 and are all pulverised fuel-fired. During the early days of peat use, the power plants were used only to meet peak demand, but with the oil crises of the 1970s and the increased cost of other fuels, they were increasingly used for baseload. The plant under construction at Clonbulloge by a subsidiary of the Finnish energy group, Fortum/IVO (see location on Figure 22) is based on fluidised bed combustion technology.

The use of milled peat for power generation has been relatively static in recent years (see Table 9). Given the age of the generating plants using peat, the contribution of peat power generation from existing plants is expected to fall significantly in coming years.

To ensure a continuing role for peat in Ireland's electricity generation mix, the Government supported Bord na Móna's proposal for the new 120 MW peat-fired power station at Clonbulloge, County Offaly. Independent consultants ran an open competition to select a bidder to build, own and operate the station. In January 1998, the Finnish group, Imatran Voima Oy (IVO), was selected. The station will burn one million tonnes of peat per year and will cost around I£ 100 million. Construction of the new plant is on schedule for start-up by end 2000. The project is supported by € 26 million in grant aid from the EU Economic Infrastructure Operational Programme, which amounts to about one-fifth of the capital cost of the power station.

Table 8
Existing and Planned Peat-fired Power Stations

Unit	*Size (MW)*	*Commissioned*	*Planned Closure Date**
Ferbane 1	20	1957	1995
Ferbane 2	20	1957	1997
Ferbane 3	20	1957	2000
Ferbane 4	30	1964	2005
Rhode 1	20	1960	1995
Rhode 2	20	1960	1999
Rhode 3	40	1963	2006
Lanesboro 2	40	1966	2007
Lanesboro 3	45	1983	2023
Shannonbridge 1	40	1965	2006
Shannonbridge 2	40	1977	2018
Shannonbridge 3	45	1982	2022
Bellacorick	20	1962	2004
	20	1963	2004
Clonbulloge	120	2001	

* Plants shown with a closure date earlier than 1999 are understood to be operating at below capacity, but are not yet closed.

Source: Department of Public Enterprise.

Table 9
Peat Consumption in Electricity Generation – Current and Forecast

Year	*Peat Consumption Existing Plants (Mt)*	*Peat Consumption New Plant (Mt)*	*Electricity Generated from Peat (% of total generation)*
1988	3.26		13.50
1989	3.18		13.90
1990	3.13		14.75
1991	3.36		13.50
1992	3.26		13
1997-98	3.00		11
2000	2.56		10
2005	1.50	1	10
2010	1.25	1	9

Note: Electricity generated from peat estimated by the IEA Secretariat for 2000, 2005 and 2010 on the basis of the current level of generation. With growth in electricity output, the share of peat should be lower than shown.

Source: Department of Public Enterprise (Bord na Móna, *Annual Report 1997-98* for data on 1997-98).

Briquettes

There are three briquetting factories with a capacity of about 0.4 million tonnes per annum. Briquettes are used as industrial and domestic fuels. Bord na Móna produced 0.41 million tonnes of briquettes in 1997-98. About 2.6 tonnes of milled peat at 55% moisture are needed to make one tonne of briquettes.

Other

The Horticulture Division of Bord na Móna markets peat and peat-based growing media and other horticultural products. About 90% of the output is exported. The Environmental Division of Bord na Móna produces and markets a range of pollution control products and provides an environmental consultancy service. It has a substantial market in Ireland and the United Kingdom and is developing a market in the United States.

Subsidies

Since 1996, the Government has injected I£ 108 million into Bord na Móna to repay unsustainable debts (estimated at I£ 110 million in 1996). These debts arose from energy investments undertaken to increase the production of indigenous fuels following the oil crises of the 1970s and 1980s. The slump in oil prices in the mid-1980s rendered most of the investments uneconomic. The repayment of the debt and the Board's own efficiency improvements have enabled the Board to significantly reduce the price of milled peat sold to the Electricity Supply Board for electricity generation, from about I£ 19 per tonne to about I£ 15 per tonne.

COAL[25]

Consumption of coal in Ireland rose from 0.5 Mtoe in 1973 to a peak of 1.1 Mtoe in 1990 and has since stabilised at about 0.5 Mtoe per year. The market share of coal has fallen under competitive pressure from gas. In 1997, coal contributed 15.2% of total primary energy supply in Ireland, falling from 22.7% in 1990. The share of natural gas has risen from 17.9% to 22.2% over the same period.

Almost all coal consumed is for power generation. Coal has the highest output share in electricity generation of all fuels (34.4% in 1997) followed closely by gas (33.4% in 1997). Ireland has one coal-fired power station, operated by the Electricity Supply Board at Moneypoint in County Clare. The plant has a net capacity of 915 MW (three units of 305 MW each) and is fitted with an electrostatic precipitator and NO_x control. Coal for electricity generation is shipped through the

25. IEA statistics usually combine coal and peat. In this report, coal and peat are considered separately throughout.

Electricity Supply Board's coal terminal at Moneypoint. The terminal has a capacity of 6 Mt per year and a current throughput of 2.6 Mt per year.

Small quantities of coal are also consumed for residential use and in industry, and consumption in both sectors is declining. The sale, marketing and distribution of bituminous fuels have been banned in Dublin since 1990 and in Cork since 1995. The ban reduced residential coal consumption by two-thirds in the period 1990 to 1996. The ban was extended to five other urban centres (Arklow, Drogheda, Dundalk, Limerick and Wexford) with effect from 1 October 1998. Since Bord na Móna's purchase of Coal Distributors Ltd., it has become the largest coal importer to the residential domestic market. Imports for the residential market come largely from the United States, Poland and the United Kingdom. Coal Distributors Ltd. operates its own berth in Dublin, with a capacity of 0.5 Mt per year.

Table 10
Use of Coal
(Mt)

	1978	*1985*	*1990*	*1996*
Electricity*	–	0.1	2	2.3
Industry	–	0.3	0.3	0.1
Residential	0.5	1.2	0.9	0.3
TOTAL	**0.5**	**1.6**	**3.2**	**2.7**

* Electricity Supply Board.

Source: *Coal Information 1997*, IEA/OECD Paris, 1998.

Coal is imported from a wide variety of countries and volumes imported from any single country have varied considerably over a span of years, suggesting that price is the major determinant of sourcing. Table 11 lists the major suppliers. Ireland considers that the number of suppliers and the open and competitive nature of the international coal market provides assurance of security of supply.

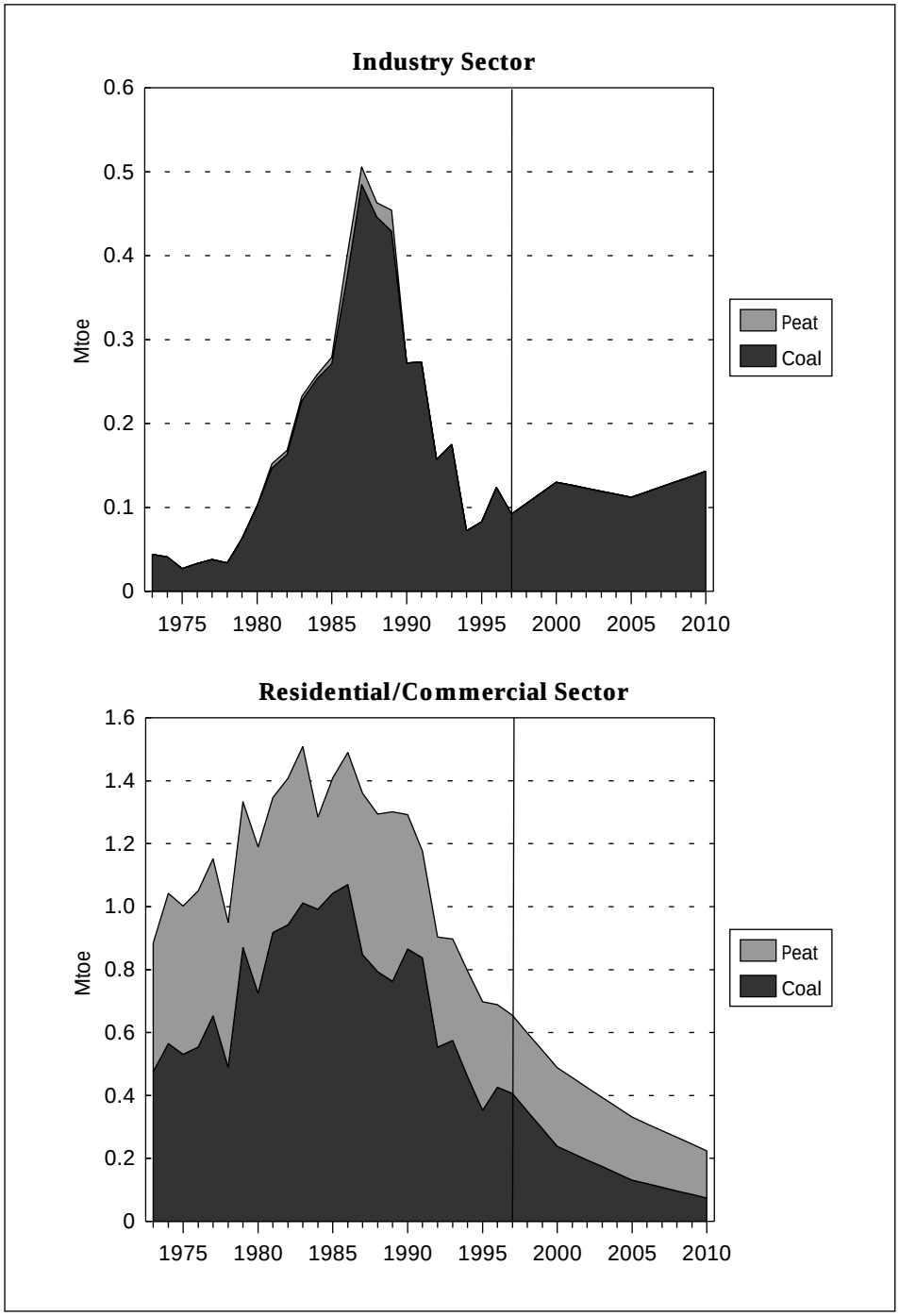
Subsidies

Fuel Allowances

Fuel allowances, applicable to all types of fuels, are payable during the winter months to low-income families to assist with home heating costs. Because of the increased cost of smokeless coal products, principally anthracite, a supplementary allowance is payable to those who use such products in designated smoke-free areas. The annual cost is I£ 8.8 million.

The Department of Social, Community and Family Affairs provides approximately I£ 75 million per year in financial assistance, under various programmes, to elderly

Figure 25
Coal Consumption by Sector, 1973-2010



Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 1998, and country submission.

Table 11
Hard Coal Imports by Origin
(thousand tonnes)

	1980	*1985*	*1990*	*1995*	*1997p*
Australia	2	76	–	121	120
Colombia	–	–	711	979	1 522
Germany	9	67	22	3	1
Indonesia	–	–	18	44	36
Poland	483	737	458	307	373
South Africa	10	70	76	232	198
United Kingdom	276	396	322	104	182
United States	408	331	1 364	1 058	669
Other*	–	241	164	10	46
TOTAL	**1 188**	**1 918**	**3 135**	**2 858**	**3 147**

p preliminary.

* Of which China, Czech Republic, former Soviet Union, Venezuela.

Source: *Coal Information 1997*, IEA/OECD Paris, 1998.

and low-income home owners for purchases of fuel and electricity. Some of the programmes have been in existence for more than thirty years, while others have been introduced more recently. Together, they benefit more than 220 000 recipients.

CRITIQUE

No formal subsidy is paid to produce peat but the industry benefits from considerable support from three principal sources: the Electricity Supply Board through the price of peat, the EU through the capital grant for the new IVO plant, and a capital injection from the Government to Bord na Móna to restructure its debt.

Peat Producer Subsidy Equivalent

The price for peat in energy terms is considerably higher than the price for imported coal in energy terms. Table 12 calculates the subsidy for peat by comparing the price of peat used for electricity generation with the price for the same energy input from imported coal. Since peat production is justified also as an employment measure in addition to security, the table shows the cost of the subsidy per part-time employed person and per employee-year. On the basis of this calculation, the price of peat is currently over 50% higher than an equivalent fuel.

The producer subsidy equivalent of I£ 5.09 per tonne (US$ 7.28 per tonne) is nevertheless far lower than the producer subsidy equivalent for coal in, say, Germany (US$ 125 per tonne) or Spain (US$ 82 per tonne), and only slightly above the residual level of support for coal in the United Kingdom to March 1998 arising from pre-privatisation contract obligations.

The new IVO plant will have a higher conversion efficiency than existing peat-fired plants, so the energy value of the peat will be effectively higher. The conversion efficiency of the new plant does not affect the level of assistance paid to Bord na Móna through the peat price. The cross-subsidy from the Electricity Supply Board to Bord na Móna will continue unless Bord na Móna reduces its costs and/or raises productivity, and reduces the price of peat supplied to the new plant by about 50%.

The total producer subsidy equivalent will in fact rise when the new plant is brought on line until equivalent existing capacity is retired. Of course, to utilise more coal or gas to replace peat would require capital expenditure on new plant but, if a new coal-fired or gas-fired plant were otherwise at least technically equivalent to the new IVO plant, the return on the capital expenditure would be higher because of the lower fuel cost. Building the new peat-fired plant has locked peat into Ireland's energy policy as an income-support mechanism. The solution is less than optimal for the energy sector and could not now be corrected without incurring high stranded costs.

Table 12
Producer Subsidy Equivalent (PSE) for Peat Production, 1997-1998
IEA Secretariat Estimate

Coal (I£)		*Peat (I£)*		*PSE (I£ m)*	*PSE/tonne (I£)*	*PSE per Employee (I£)*	*PSE per Employee Year (I£)*
Price/ tonne	*Price/ toe*	*Price/ tonne*	*Price/ toe*				
34.28	48.98	14.89	74.45	15.28	5.09	6 113	12 226

Notes: The coal price assumed is the average EU steam coal import price paid in 1996 ($US 48.99).
Exchange rate: I£ 1=$US 1.429.
The price of peat is the published price paid to Bord na Móna by the Electricity Supply Board.
Peat production assumed to be 3 million tonnes (1997-98) or 600 000 toe.
Hard coal imports: 1 tonne = 0.7 toe.
Number of employees assumed to be 2 500 (peak part-time workforce during peat harvesting).
Coal is imported by the Electricity Supply Board through its own port near Moneypoint power station (Ireland's only coal-fired power plant). Peat is transported from the bogs to peat-fired power stations, generally located near the bogs. Hence, no assumption need be made for inland transport for coal or peat in existing power stations. Part of the support infrastructure will be a new rail system to deliver peat, and expenditure on bog rehabilitation.

Sources: *Coal Information 1997*, IEA/OECD Paris, 1998.
Bord na Móna, *Annual Report 1997-98*.
Department of Public Enterprise.

For these reasons, while acknowledging the very substantial increase in productivity achieved over the past 10 years by improvement in technology and working systems, it will be important to ensure that pressure continues on Bord na Móna to improve its productivity and to diversify its operations as a means of reducing the need for subsidising employment through production of peat. Existing legislation permits government participation in Bord na Móna to be reduced by up to 50% with ministerial approval and above this level with a resolution of the Oireachtas. The Minister should monitor the market and take the earliest opportunity to reduce government participation as a means of encouraging performance. Because the IVO plant is effectively an instrument of peat policy, it will be necessary to ensure that the Government is not called on to provide direct or indirect assistance to the plant to maintain peat production employment, should the plant run into any commercial difficulties or its commercial strategy change. The Department of Public Enterprise considers that this prospect is unlikely to materialise since the operation of the plant is the subject of a fuel supply contract between Bord na Móna and the developer and to a 15-year power purchase agreement between the developer and the ESB.

In addition to the producer subsidy equivalent, it should be noted that the peat sector as a whole has benefited from about I£ 20 million in EU funding for the IVO plant.

Debt Retirement

The calculation of producer subsidy equivalent for peat shows that cross-subsidisation between the Electricity Supply Board and Bord na Móna has been reduced but not eliminated by the injection of I£ 108 million by the Government into Bord na Móna to enable the Board to repay its unsustainable debt. As a result of the capital injection, Bord na Móna has gradually reduced the price of peat from about I£ 19 to about I£ 15 per tonne currently, i.e. by about 22%. Bord na Móna calculates that the real reduction in the price of peat since 1988 is 35%. The producer subsidy equivalent for peat has consequently been reduced by about I£ 3.75 per tonne. The capital injection was justified on the grounds that Bord na Móna's debt was a stranded cost arising from government encouragement to invest in peat when oil prices were high. Changed circumstances in the energy market left Bord na Móna with an investment with no prospect of making a return. The capital injection transferred the cost of the policy from the company to the Government.

Impact on the Electricity Market

Peat accounts for about 11% of electricity generation currently. The share of peat in the fuel mix will fall as existing plants are retired and the share of electricity output from gas-fired plants increases to meet growing demand. Even so, support

policies inevitably distort competition in electricity markets and result in higher electricity prices. The continuing support for peat will flow through to consumers in the form of higher prices, despite reform of the market, since generators will inevitably seek classification of peat as a public service obligation, which they would not undertake in a fully competitive market. The point of view of the electricity supply industry reinforces the recommendations on peat policy.

Retirement of Existing Peat-fired Plant

The phased retirement of existing peat-fired plants (Ferbane, Rhode, Lanesboro, Shannonbridge and Bellacorick) is envisaged as they reach the end of their useful operational lives. There are several sound reasons to close them. All five plants were designed with an economic life of 25 years. Although some units have been refurbished, most are very old. Three of the four units at Ferbane are 42 years old, and two of the three units at Rhode are 39 years old. These five units account for about 25% of peat-fired capacity and had operated in excess of 250 000 hours by 1994. They have exceeded any reasonable expectation of life. About 75% of the peat-fired capacity is more than 33 years old. Lanesboro, Shannonbridge and Bellacorick have units that are 33 years of age and older, which had operated about 200 000 hours by 1994. The existing plants have net efficiencies ranging from 19.5% to 28.8%. The average net efficiency of the new IVO plant, now under construction, is expected to be 36.7% over its operating life. Greenhouse gas emissions from the less efficient plants are therefore considerably higher than is expected from the new plant.

Offsetting these considerations, the existing plants employ more than 750 people, and the new plant is not expected to create the equivalent number of employment openings. The new plant will have capacity equal to about one-quarter of the total capacity of the existing plants (120 MW compared with 420 MW). The new plant is expected to create 50 jobs in the plant, and 250 full-time and 250 part-time jobs for peat production in Bord na Móna.

A Memorandum of Understanding with the European Commission (12 April 1995), commits the Irish Government to the early development of a programme of phased closure of older less efficient peat-fired plants as they reach the end of their operational lives, and to the refurbishment of other plants to improve their efficiencies from an operational and environmental perspective, in return for assistance to build the new IVO plant. Phased closing of some plants and refurbishment of others is expected to result in a net reduction in greenhouse gas emissions from peat-fired power generation. The agreement was based on Ireland's commitment to limiting growth in carbon dioxide emissions to no more than 20% growth over the level in 1990. The commitment is now greater because of the lower limit in overall greenhouse gas emissions growth which has been accepted by Ireland.

Despite the agreement with the European Commission, there remains some uncertainty about the commitment to, and the timetable for, closures. It is

understood that some older generating units have not been operational for some time. By the end of 2000, 100 MW of capacity (in a total of 415 MW) should be closed. The last plant is to be closed in 2023. Maintaining the existing plants and operating the IVO plant clearly exacerbates difficulties on a number of fronts, including the level of support given by the energy sector to employment creation, the impact on regulatory reform, as well as increasing greenhouse gas emissions. It would be desirable to clarify and confirm a timetable for closing the existing peat-fired plants, and to give consideration to accelerating the closure programme to gain national economic, as well as environmental, benefits.

Greenhouse Gas Emissions

The full cycle of peat production and use has a variety of environmental impacts. So far as greenhouse gas emissions are concerned, there are offsetting effects which make it difficult to determine the net impact. Ditching, draining, harvesting and drying peat reduces methane emissions, while transport and combustion emits carbon dioxide. After exploitation, the peatland may be used for forestry, which would absorb carbon dioxide, or for wetlands, possibly giving rise to methane. So far as the combustion phase of the cycle is concerned, peat combustion is estimated to give rise to 20% more carbon dioxide per unit of electricity produced than coal, and some 45% more than diesel or fuel oil[26]. The effect for other greenhouse gases, and the net effect over the full fuel cycle are not known[27].

Coal

Coal is an important energy source for Ireland, accounting for 15.2% of primary energy supply (in 1997) or nearly twice the contribution of peat. Unlike peat, coal is sourced on the international market from a variety of highly competitive suppliers. There can be little doubt that coal supply is secure and competitively priced.

Coal is under challenge throughout the world on environmental grounds. It has been proposed by consultants to the Department of Public Enterprise that Moneypoint power station, Ireland's only coal-fired power station, could be closed as one effective means of reducing carbon dioxide emissions (see Chapter 4). Closure is considered economic by the consultants. However, coal-fired power is more economic than peat-fired power so that, on the consultants' logic, all peat-fired and coal-fired power generation plants in Ireland could be closed with no economic loss. This would, of course, leave Ireland dependent on gas and almost certainly

26. *Fuel Peat – World Resources and Utilisation*, IEA Coal Research, London, 1993. The comparison with coal is with Russian and Polish coal of unspecified quality.
27. See *Fuel Peat – World Resources and Utilisation*, IEA Coal Research, London, 1993, where work on this subject to 1993 is summarised.

require the construction of a new gas interconnector and/or new domestic gas developments, to compensate for the loss of coal-fired power. Diversity of energy supply is an important means of securing supply, and reliance on gas, even if a second interconnector is built and the Corrib discovery developed, could be judged too risky.

RECOMMENDATIONS

The Government of Ireland should:

- ☐ Confirm a programme to phase out all existing peat-fired power plants and publish a timetable to give effect to the programme, based on the national economic and environmental benefits arising from the closures.

- ☐ Ensure an arm's-length relationship is maintained between the Government and the new peat-fired power plant on issues arising from commercial decisions taken by the plant operators.

- ☐ Seek to develop alternative cost-effective means to promote employment growth in areas currently assisted by peat-fired power plants and Bord na Móna.

- ☐ Objectively identify the net impact on greenhouse gas emissions of the full cycle of peat production, including bogland drainage, peat harvesting and drying, transport, peat combustion and bogland rehabilitation.

9

RENEWABLE ENERGY SOURCES

OBJECTIVES

Ireland's target is to increase electricity generation capacity from renewable and alternative sources of energy to 10% of total installed capacity by 2000. Targets for the period 2010 are to be reviewed in a forthcoming Green Paper on Sustainable Energy. The objectives for renewable energy policy[28] generally are to:

- Strengthen security of supply.
- Obtain supplies from indigenous resources.
- Further diversify energy resources.
- Reduce environmental damage.
- Contribute to the objectives of the national carbon dioxide abatement strategy.
- Contribute to EU targets set out in the Altenar programme[29].
- Ensure that the added value of these indigenous resources is maximised for the country.

RESOURCES

In June 1998, an inventory of Ireland's renewable energy resources, prepared by ESB International and the Energy Technology Support Unit (ETSU), was published with assistance from the Department of Public Enterprise and the European Commission. Ireland's renewable energy resources are estimated to be sufficient to generate 2 500 MW of electricity, sufficient to meet the needs of 2.5 million people. Wind energy and energy recovered from biomass (including waste) provide the bulk of the practicable resources available. The report estimates the resources available on a county-by-county basis. It quantifies electricity potential from wind, hydro, solar, biomass, photovoltaic, tidal, shoreline wave and hot dry rock sources.

28. *Renewable Energy – A Strategy for the Future.*
29. The EU Altenar programme has three core objectives: 1) doubling the use of renewable energy resources from 4% of total energy consumption in 1991 to 8% by 2005; 2) trebling the production of electricity from renewables by 2005; and 3) securing a biofuels market share of 5% of the total vehicle usage by 2005.

CURRENT STATUS OF DEVELOPMENT

Contribution of Renewable Energy to Energy Supply and Electricity Generation

In 1997, renewables contributed 1.8% of total primary energy supply. Combustible renewables and wastes contributed 1.3%, and hydro 0.5%. Other renewables (solar, wind, and other) contributed 4 ktoe or 0.03%. The output share of electricity generation in 1997 for renewables was 4.2%. Hydro contributed 3.4%, combustible renewables and wastes contributed 0.5%, and other renewables (solar, wind, other) 0.3%. The non-hydro renewable share of both total primary energy supply and electricity output are significantly below the IEA average.

Hydro

Hydroelectricity generation has historically made a significant contribution (for example 8.8% of output in 1973). About 75% of viable hydro resources have been exploited. The remaining 25% of resources are in more difficult sites requiring smaller installations.

Non-Hydro

Non-hydro renewables are currently almost exclusively direct use of wood in industry and residences, and small quantities of electricity generated from landfill gas and wind. One demonstration solar photovoltaic plant produces about 20 000 kW per year. Solar technology has not proved of commercial interest apart from minor uses in remote applications. Some geothermal research and development projects started in 1990 to utilise resources in Mallow, County Cork, and evaluate the potential of deep boreholes in Munster and Leinster. Several buildings in Dublin use naturally heated ground water. Geothermal energy use is not expected to grow.

Ireland's first demonstration wind farm in Bellacorick, Co Mayo, was completed in 1992, with an installed capacity of 6.45 MW. By the end of 1998, Ireland's installed capacity from wind stood at 60.4 MW. Interest in wind energy has increased significantly in recent years and a considerable amount of future renewable energy development is expected from this sector.

ALTERNATIVE ENERGY REQUIREMENT COMPETITIONS

The increased use of renewable energy is being encouraged by way of bids under the *Alternative Energy Requirement* (AER) competitions to supply electricity to the utility operator at the bid price index-linked over a maximum fifteen-year contract (except for AER I, which guaranteed a "strike" price). There have been four AER competitions since the launch of the programme in 1994, with an aggregate target of 230 MW of renewables and CHP. Approximately 300 MW of renewable electricity generating capacity have bid successfully for projects under AER I, II and III with targets set for specific technologies. Wind, hydro, waste-to-energy and landfill gas projects have all provided successful bids. No solar project has been supported

under the programme. Interest in the programme has resulted in greater number of successful project bids than expected, but delays in obtaining planning permission for renewable energy plants have slowed the development of installed renewable energy capacity.

The development of wave energy is also important. The Third Alternative Energy Requirement competition invited applications to develop a wave energy to electricity plant not exceeding 5 MW subject to a bid price below 5 pence per kWh. A winner was declared in the competition but ERDF grant-aid was subsequently withdrawn.

AER IV was designed to support the competitive development of CHP in Ireland. Proposers bid their binding price for the electricity subject to a price cap of 3 pence per unit sold. The winning bids ranged between 2.25 pence and 3 pence per kWh. Winning projects are on sites with significant heat loads.

Table 13
Targets for Alternative Energy Requirement Competitions
(MWe)

Category	*AER I*	*AER II*	*AER III*	*AER IV*
Biomass/waste	15	30	7	–
CHP	20	–	–	35
Hydro	10	–	3	–
Wave	–	–	5	–
Wind	30	–	90	–
Total	**75**	**30**	**105**	**35**

Source: Department of Public Enterprise.

Table 14
Price and Other Support Measures for Renewables
(p/kWh)

Technology	*AER I **	*AER II*	*AER III*	*AER IV*	*Other Support*
All	6.1-6.4 (weekdays); 2.4-2.5 (nights and weekends)		2.748**		Price indexed annually based on the consumer price index; prices adjusted to provide higher prices during day and seasonal peaks; tax relief for corporate investments in companies undertaking certified renewable energy projects; fifteen-year contracts.
Biomass/waste		3.6			
Wave			5		
CHP				Up to 3	

* AER I was supported by EU funds of I£ 15 million for capital costs and I£ 70 million for long-term price support. In the event, no capital subsidies were provided to successful projects. Price support is to be recovered from consumers by the Electricity Supply Board.

** Weighted average winning bid price.

Source: *Renewable Energy Policy in IEA Countries, Volume II: Country Reports*, IEA/OECD, 1998.

ELECTRICITY SECTOR

The Electricity Regulation Act 1999 provides for the granting of licences to generate and supply electricity using renewable, sustainable or alternative forms of energy to final customers. Table 15 shows existing installed capacity and an estimate of possible additions arising from continuing government programmes to promote renewables.

Table 15
Small-Scale Generation Plant – Installed and Planned Capacity
(MW)

Year	*CHP*	*Other Thermal*	*Wind*	*Hydro*	*Landfill*	*Biomass/ Gas*	*Wave Waste*	*TOTAL*
1997	93	9	52	10	12			176
1998	85	9	69	11	12			186
1999	110	9	165	14	15			313
2000	115	9	195	15	17	4	1	356
2001	120	9	225	16	19	4	1	394
2002	125	9	255	17	21	4	1	432
2003	130	9	285	18	23	34	1	500
2004	135	9	315	19	25	36	1	540
2005	140	9	345	20	27	38	1	580

Source: *Generation Capacity Requirements to 2005*, a report produced by ESB in consultation with the Department of Public Enterprise, October 1998.

The Government regards the promotion of renewables as primarily an environmental measure, so the environmental aspects of public service obligations contained in Article 3.2 of the EU Electricity Directive will be relied upon to recover the uncompetitive element of the cost of this policy, including the cost of back-up power. The Electricity Transmission System Company will also be required to take account of the environmental impact of different generating installations when dispatching their output. This provision is designed to allow management of emissions within overall national limits in the course of dispatch of generating stations.

TAX INCENTIVES

Section 62 of the Finance Act 1998 provides new tax relief for corporate equity investment in a qualifying company undertaking a qualifying renewable energy project. The relief takes the form of a tax deduction from a company's profits for an investment in new ordinary shares in a qualifying company. The relief is capped at 50% of all capital expenditure (excluding land), net of grants, on a single project up

to I£ 7.5 million. Investment by any company or group of companies in more than one qualifying energy project is capped at I£ 10 million per year. The conditions under which this tax relief is granted are subject to additional detailed regulations.

CRITIQUE

By 2000, the 10% target for the share of renewable energy sources in total electricity generating capacity is expected to be achieved. The Alternative Energy Requirement competitions do appear to have achieved a rapid growth in the role of renewables in Ireland. Encouraging competition within each technology category has succeeded in ensuring that the cost of each wave of investment in renewable technology is comparable with similar projects in other countries. The AER competitions also provide a pointer to the technologies which are likely to be most cost-effective in Ireland (excluding the cost of back-up power). Wind energy has proven to be the technology of choice in the market.

The review of AER I, apart from cost in comparison with conventional sources, listed lengthy planning processes and grid access for renewable-based electricity as the most significant barriers to increased penetration of renewable energy. Grid access has been addressed by ensuring that electricity generated from renewable sources (other than ESB-owned large hydro) is guaranteed priority in dispatch to the grid at a guaranteed tariff. This is the appropriate policy to adopt until renewables can compete more directly with conventional technologies. As costs fall and renewables become more competitive, other market-based mechanisms might be further developed, notably allowing consumers the freedom to choose to pay a premium for electricity generated from renewable sources.

Integration with the grid poses some technical difficulties for the grid operator, and back-up costs because of the need to have reserve capacity to cover variations in supply from, for example, wind machines. These issues are being studied by the Grid Connections Working Group. It will be important both to resolve the technical issues arising, and to assess their economic impact on the system as a whole. Care will be required to ensure that the costs imposed are identified clearly and allocated efficiently and equitably to the users of the system.

The planning process represents a more difficult problem. The inventory of renewable energy resources prepared by ESB International and the Energy Technology Support Unit (ETSU) found that the most significant element of the total resource is wind energy, located for the most part on the west coast in the counties of Cork, Galway, Mayo, Wicklow, Donegal, Kerry and Sligo. These counties also contain a significant proportion of the Special Areas of Conservation identified by the Heritage Council of Ireland[30]. It is likely that planning conflicts over siting for wind energy, in particular, will continue to

30. *Designated Areas: Recent Developments and Renewable Energy*, Paddy Matthews, Heritage Council of Ireland (Irish Energy Centre, Renewable Energy Information Office).

be an issue. Other forms of renewable energy pose fewer siting problems but are also likely to be less cost-effective.

One approach to this problem was suggested by Bord na Móna, which proposed building wind farms on sites no longer exploited by the company for peat production. These sites are less productive so far as the wind resource is concerned but, taking into account the external site value, may well be more cost-effective choices than sites with high landscape value. The selection criterion of the EAR programme could place greater emphasis on the potential for projects to receive planning approval, and due consideration should also be given to landscape values, grid connection costs and back-up costs.

An objective of the Government in developing renewable energy is to promote industrial development through adding domestic value to the resource. In this regard, it may be worth analysing the underlying causes of the fall in prices seen in the four AER competitions. It is likely that the cost has fallen as imported equipment prices have fallen and imported machines have become more efficient. The relative importance of this factor compared with the contribution of the skills and efficiency of Irish manufacturing industry to lowering the cost of renewables, will be important in determining the net impact on domestic industrial development. Moreover, some technologies may well have more flow-on effects for the economy than others. For example, biomass could create opportunities for Irish agriculture.

By indicating the technologies with the most favourable near-term economic benefits, the AER competitions offer a guide to priorities which might be promoted through research and development. Priorities for research and development of particular technologies, particularly the priority assigned to wave power, are discussed in Chapter 10. The AER approach has revealed the priorities suggested by the market; it may be wiser to follow them than to try to anticipate future technology winners by more speculative means.

RECOMMENDATIONS

The Government of Ireland should:

- ☐ Analyse the basis for reduced costs for renewables under the Alternative Energy Requirement programme with a view to determining the net economic benefits to the Irish economy of different renewable technologies.

- ☐ Develop links between priority setting for energy research and development activities, and the renewable energy programme.

- ☐ Consider incorporating trade-offs between location site values, grid integration costs, and optimal physical performance in evaluating future projects to be supported by the renewable energy programme.

10

ENERGY RESEARCH AND DEVELOPMENT

OVERALL POLICY OBJECTIVES

Energy research and development policy in Ireland aims to support general energy and other economic policy objectives:

- Security and diversity of affordable energy supply.
- Sustainable production, conversion and use of energy.
- Increased industrial competitiveness and employment.
- Technological innovation, education and training.

In view of the commitment to limit greenhouse gas emissions to 1990 levels plus 13% in the period 2008-2012, energy policy objectives and initiatives are increasingly being linked to those related to the environment. Consequently, energy research and technological development for sustainable development have particular priority.

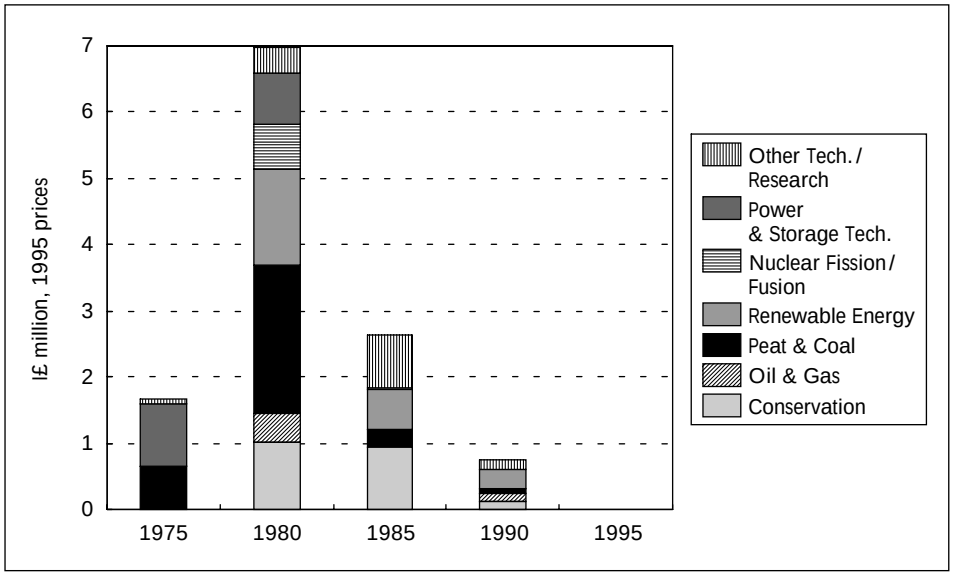
A major Technology Foresight study was launched by the Government in 1998, aimed at examining the likely scenarios and priorities relevant to science, technology and innovation in Ireland over the next fifteen to twenty years. The Energy Panel of the study issued its final report in January 1999. Its findings are discussed below. In parallel, a specific energy research and development strategy is being developed by the Irish Energy Centre, to establish key actions and initiatives for coming years.

MAJOR RESEARCH PROGRAMMES AND PRIORITIES

Energy research and development in Ireland take place mainly within the EU Framework Programme and other activities supported by EU structural funds. Under the current (1994-1999) round of EU structural funding, some I£ 26 million have been made available under the Economic Infrastructure Operational Programme to support developments in the areas of energy efficiency and renewable energy sources in Ireland. A significant proportion of this funding would have a research and development focus, including studies and surveys on energy sources and their national use, new and improved energy technology projects in industry, and projects for the exploitation of new and renewable energy sources.

Other EU-supported programmes in Ireland also have an energy research and development content, although there are no precise details on projects. They include the Research and Technology Initiative, the Basic and Applied Research Grants Schemes, and programmes designed to encourage industry/university collaboration.

Figure 26
Government Energy Research and Development Expenditure



Source: *IEA Energy Technology R&D Statistics 1974-1995*, IEA/OECD Paris, 1997.

TECHNOLOGY FORESIGHT IRELAND: FINAL REPORT OF THE ENERGY PANEL

The Energy Panel was invited to identify the energy technologies and skills relevant to Ireland in the medium to long term. The report of the Energy Panel in January 1999 contains a number of recommendations in response to two strategic questions:

- How would we maximise the benefits to Ireland of innovation in the energy sector?
  by identifying new technologies, research, development and demonstration needs and business opportunities which result from innovation in the energy sector.

- How should we manage and meet Ireland's energy demand up to 2015?
  by examining the energy technology response to Ireland's commitments under the Kyoto Climate Change Protocol, maintaining international competitiveness and addressing security of supply.

The report recommends a collaborative programme focused on four technologies:

Technology I: New and renewable energy technologies for the electricity, thermal and transport markets, especially wave energy, hybrid energy systems, energy storage systems and alternative, environmentally-friendly transport systems.

Technology II: Intelligent consumer energy products (such as photosensitive lighting, motion and heat detectors, and "the intelligent home of tomorrow").

Technology III: Energy-efficient and renewable energy technologies in buildings (such as passive solar heating, daylighting, natural cooling and "active" solar systems).

Technology IV: Optimise the sourcing, distribution and utilisation of energy at all levels of energy consumption.

Technologies I and II are regarded as new technologies where Ireland has "existing strengths" which should be developed and exploited for both energy and commercial reasons. Existing strengths mentioned in the report include the resource base for wave energy, but might also be taken to include more generally the competitive advantages Ireland has in technology-based industry and the educational standards of its workforce. Technologies III and IV are regarded as existing technologies whose enhanced take-up would address some of Ireland's commitment under the Kyoto Protocol.

The Energy Panel considers that, in the long term, Ireland must position itself in those energy technologies which offer the best commercial opportunities to the country. In the Panel's view, these technologies and skills are wave energy systems, hybrid energy systems, energy storage systems, alternative environmentally-friendly transport systems and intelligent consumer energy products. To position itself, Ireland must nurture and build on its expertise in leading-edge energy technologies. New markets opening up for energy products and services are considered by the

Table 16
Cost of Energy Panel Recommendations

Technology	*Cost (I£m)*	*Programme Duration*	*Purpose*
I	20	Three years	Development and demonstration programme.
II	5	Three years	Developing new energy products.
III	24	Three years	Energy Action model, personal tax relief for energy conservation measures in private housing and researching energy conservation potential in the Irish environment.
IV	20	Three years	Tax relief for investment in combined heat and power.
TOTAL	**69**		**Plus cost of enabling policies.***

* Enabling policies considered necessary to support the programme would involve considerable cost, for example, to support new firms developing the key technologies, to provide fiscal incentives for measures such as energy efficiency in buildings, and to provide national coverage for the natural gas network including its extension to the western seaboard to support offshore gas finds.

Source: Technology Foresight Ireland, Energy Panel, *Final Report*, 27 January 1999.

Table 17
Priorities for Expenditure Recommended by the Energy Panel

Priority	*Expenditure over Three Years (I£m)*	*Comment*
Ocean wave energy	7	Favourable wave climate; engineering skills available; position analogous to wind energy.
Hybrid energy systems Energy storage systems	5 5	Reliability of wind and wave energy requires development of storage and hybrid technologies.
Integration of information technology and energy services; new product development	5	Integration of information and energy technology will lower energy consumption, lower energy bills and lower emissions.
Retro-fitting housing for the socially disadvantaged	3	Based on the model of Energy Action, a charity, in ten urban centres.
Personal tax relief for energy conservation measures	18	
Research on energy use in buildings; conservation in Ireland	3	
Tax relief for combined heat and power projects	20	Evaluate application of combined heat and power in all new and commercial, residential and industrial developments.

Source: Technology Foresight Ireland, Energy Panel, *Final Report*, 27 January 1999.

Table 18
Recommendations of the Energy Panel – Enabling Policies Involving Expenditure

Technology I	Fiscal incentives for new and renewable energy technologies. Establishment of an energy emissions trading exchange in the International Financial Services Centre.
Technology II	Development of educational and vocational training systems on energy enterprise and professional skills.
Technology III	Ensure uptake of tax relief for solar energy technologies.
Technology IV	National coverage for the natural gas network including extension to the western seaboard to support offshore gas finds. Upgrade electricity infrastructure, develop international interconnections, decentralise electricity generation, exploit indigenous energy resources. Support for early adoption of advanced energy technologies.

Source: Technology Foresight Ireland, Energy Panel, *Final Report*, 27 January 1999.

Energy Panel to provide huge export potential for these technologies. In the view of the Energy Panel, Ireland should aim to employ 10 000 people in these areas by 2015. The export target should be I£ 300 million.

By implementing the recommended programme, the Energy Panel estimates that Ireland could reduce its energy-related greenhouse gas emissions by between 3.6 million and 6 million tonnes of carbon dioxide per year, offsetting an estimated emissions gap of 6 million tonnes of carbon dioxide which will result from present policies.

CRITIQUE

In 1990 (latest available figures), the Government of Ireland spent about I£ 0.7 million (1995 I£)[31] on energy research and development, or about 20 pence per capita. This low level is comparable with several other IEA countries (for example New Zealand, Portugal and Turkey). Government expenditure is not believed to have risen since 1990. Anecdotal evidence suggests that private expenditure on energy research and development is probably also low, and insufficient to offset the low level of government expenditure.

The low level of expenditure appears inconsistent with Ireland's high level of economic growth, particularly since the level of growth is based on maintaining international competitiveness and, in part, on information technology. Developing new technology for export, containing costs through energy efficiency improvements and developing the means to assist Ireland to achieve its greenhouse emissions target are benefits which might reasonably be expected to flow from spending more on energy research and development.

The Energy Panel report has recommended a massive increase in expenditure with direct expenditure of about I£ 23 million per year over an initial three years. The recommended programme focuses on long-term goals to 2015, so the expenditure in the first three years might reasonably be taken as the first stage of a rolling programme over fifteen years. Additional expenditure is implied for "enabling policies" which the Energy Panel considers would provide the framework for the programme. The cost of these policies is not quantified in the report of the Energy Panel, but the approach of the report would suggest that the Government is expected to provide direct funding and tax expenditures on schemes to encourage and promote new industry. Although the recommended and implied levels of expenditure may appear high, it is useful to recall that Ireland already spends more than I£ 18 million per year in total to maintain security of supply for petroleum products and to protect employment in peat production.

The Energy Panel report could provide a basis for reformulating the energy efficiency programme as well as the energy research and development programme.

31. $US 1.21 million in 1995 prices and exchange rates. *IEA Energy Technology R&D Statistics, 1974-1995*, IEA/OECD Paris, 1997.

More than one-half of the proposed expenditure in the recommendations relates to energy efficiency. The need to review and reformulate the energy efficiency programme is discussed in Chapter 5. Funding for the current energy efficiency programme concludes this year.

While an increase in expenditure consistent with Ireland's strategy for maintaining high economic growth would appear justified, the priorities proposed by the Energy Panel are not necessarily supportable. The recommendations would make a radical change from Ireland's current policy goals, which other IEA Member countries share, that energy research and development programmes should support energy and industry policy goals. The Energy Panel acknowledges that two of the four technology groups it recommends are new technologies. The panel appears to focus on niche markets, where Ireland might develop a comparative advantage by being the first to make breakthroughs. The approach is rational but high-risk if the principal objective is to encourage industrial development.

At least one of the recommended technologies, wave energy, has a mixed history of development in IEA countries. For example, Norway focused much of its efforts in renewables research and development during the late 1970s and early 1980s on wave power, to take advantage of Norway's long coastline and good wave conditions. However, the current status of wave technology and the price of alternative energy sources have led to the conclusion that wave power will not be a realistic power source for the foreseeable future. Work has not progressed in Denmark which has undertaken trials of two offshore 45 kW converters or in Canada and France, which use tidal power but have no plans to expand capacity. Wave energy projects are planned in the United Kingdom, where three wave projects have been awarded contracts in the latest round of Scottish Renewable Orders. The United Kingdom spent some £17 million on wave energy research between 1974 and 1983, but a decision was taken in 1994 to complete that phase of work on wave energy, in favour of technologies which were nearer to commercial deployment. Portugal has undertaken wave resource surveys and is constructing a 500 kW wave plant in the Açores (under the EU's JOULE programme), which is scheduled to commence production in 1999.

The Energy Panel compares its proposal for the development of wave energy with the development of wind energy in Denmark. The comparison may not be valid. Wind energy has a history of hundreds of years in mechanical energy applications (grinding and pumping, for example) and more than two decades of modern development for electrical energy. By comparison, wave energy has no proven applications for power production other than independent units such as beacons[32]. While it has potential, wave energy is at a considerably earlier stage of development than wind energy. If it implements this recommendation of the Energy Panel, Ireland might consider the benefits of collaborating with other interested countries to accelerate the development of wave energy.

32. For example, about 1 000 wave-powered beacon buoys are in operation in Japan. The first wave-powered buoy was put to practical use in 1965 and 1 kW-class buoys are now under development.

It is critically important that energy research and development programmes be developed in collaboration with industry, particularly as one of the objectives is to develop new export industries. The successful development of wind energy in Denmark, and the export industry for wind technology which has developed there, result in large measure from private initiative, supported but not directed by government[33]. The Energy Panel recommends that the Government should proceed by "drawing up a fully costed, clearly defined, time bound implementation programme; engaging the relevant implementing agencies and organisations". Evaluation of the report as a whole should involve industry to establish the extent to which industry would share in funding the recommended programme.

The Energy Panel highlights the general importance of collaboration between government, education and training institutions, industry, researchers and international energy bodies. The Energy Panel might be asked to develop this recommendation, to propose concrete ways in which collaboration might take place on an ongoing basis. In this way, the fourth objective of the Government (technological innovation, education and training) might be taken forward.

RECOMMENDATIONS

The Government of Ireland should:

- ☐ Collate information on energy research and development conducted by government and industry; evaluate the adequacy of the current level of expenditure, the priorities of current programmes, and the extent and effectiveness of collaboration with the private sector, bearing in mind the extent to which the current level and outlook for economic growth in Ireland rest on maintaining a lead in technology and international competitiveness.

- ☐ Respond to the report of the Energy Panel, giving close attention to the full cost of recommendations, including for so-called enabling policies, the willingness of industry to share the cost of implementing the recommendations, and the experience of other countries in funding research on the particular priorities recommended.

- ☐ Seek the views of the Energy Panel on concrete ways in which collaboration between researchers, industry, and education and training institutions might take place on an ongoing basis.

- ☐ Develop a policy on energy research and development which relates energy, environment and industry policy goals to short- , medium- and long-term goals in each of these areas.

33. *Energy Policies of IEA Countries: Denmark — 1998 Review*, IEA/OECD Paris, 1998.

A

ANNEX

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY		1973	1990	1996	1997	2000	2005	2010
TOTAL PRODUCTION		**1.120**	**3.359**	**3.607**	**2.871**	**1.875**	**1.134**	**1.037**
Coal[1]		0.045	0.016	–	–	–	–	–
Peat		1.020	1.411	1.261	0.740	0.802	0.689	0.541
Gas		–	1.872	2.176	1.906	0.770	–	–
Comb. Renewables & Wastes[2]		–	–	0.116	0.162	0.179	0.275	0.275
Hydro		0.055	0.060	0.062	0.058	0.068	0.070	0.071
Solar / Wind / Other[3]		–	–	0.001	0.004	0.056	0.100	0.150
TOTAL NET IMPORTS[4]		**5.901**	**7.353**	**8.403**	**9.562**	**11.215**	**13.559**	**15.660**
Coal[1]	Exports	0.073	0.023	0.017	0.013	0.007	0.006	0.004
	Imports	0.578	2.286	1.883	2.062	1.876	1.941	1.791
	Net Imports	0.505	2.263	1.866	2.049	1.869	1.935	1.787
Peat	Exports	–	–	–	–	0.005	0.004	0.003
	Net Imports	–	–	–	–	–0.005	–0.004	–0.003
Oil	Exports	0.472	0.680	0.836	1.334	1.341	1.341	1.341
	Imports	5.956	5.788	7.060	8.135	8.065	8.563	9.893
	Bunkers	0.092	0.018	0.159	0.153	0.031	0.042	0.052
	Net Imports	5.392	5.090	6.065	6.648	6.693	7.180	8.500
Gas	Imports	–	–	0.483	0.865	2.658	4.448	5.376
	Net Imports	–	–	0.483	0.865	2.658	4.448	5.376
Electricity	Exports	0.002	–	0.016	0.007	..	..	..
	Imports	0.006	–	0.005	0.006	..	..	..
	Net Imports	0.004	–	–0.011	–0.001	–	–	–
TOTAL STOCK CHANGES		**0.168**	**–0.250**	**–0.108**	**0.059**	**–**	**–**	**–**
TOTAL SUPPLY (TPES)		**7.189**	**10.463**	**11.902**	**12 491**	**13.090**	**14.693**	**16.697**
Coal[1]		0.565	2.371	2.000	1.903	1.869	1.935	1.787
Peat		1.020	1.288	1.093	1.052	0.797	0.685	0.538
Oil		5.545	4.871	5.991	6.541	6.693	7.180	8.500
Gas		–	1.872	2.650	2.771	3.428	4.448	5.376
Comb. Renewables & Wastes[2]		–	–	0.116	0.162	0.179	0.275	0.275
Hydro		0.055	0.060	0.062	0.058	0.068	0.070	0.071
Solar / Wind / Other[3]		–	–	0.001	0.004	0.056	0.100	0.150
Electricity Trade[5]		0.004	–	–0.011	–0.001	–	–	–
Shares (%)								
Coal		*7.9*	*22.7*	*16.8*	*15.2*	*14.3*	*13.2*	*10.7*
Peat		*14.2*	*12.3*	*9.2*	*8.4*	*6.1*	*4.7*	*3.2*
Oil		*77.1*	*46.6*	*50.3*	*52.4*	*51.1*	*48.9*	*50.9*
Gas		*–*	*17.9*	*22.3*	*22.2*	*26.2*	*30.3*	*32.2*
Comb. Renewables & Wastes		*–*	*–*	*1.0*	*1.3*	*1.4*	*1.9*	*1.6*
Hydro		*0.8*	*0.6*	*0.5*	*0.5*	*0.5*	*0.5*	*0.4*
Solar / Wind / Other		*–*	*–*	*–*	*–*	*0.4*	*0.7*	*0.9*
Electricity Trade		*0.1*	*–*	*–0.1*	*–*	*–*	*–*	*–*

0 is negligible. – is nil. .. is not available.

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	1996	1997	2000	2005	2010
TFC	**5.416**	**7.732**	**8.811**	**9.306**	**9.770**	**10.973**	**12.861**
Coal[1]	0.520	1.137	0.551	0.499	0.368	0.243	0.217
Peat	0.408	0.427	0.263	0.248	0.250	0.200	0.150
Oil	3.856	4.149	5.251	5.647	5.871	6.649	7.960
Gas	0.103	0.998	1.270	1.336	1.420	1.622	1.864
Comb. Renewables & Wastes[2]	–	–	0.113	0.141	0.139	0.139	0.139
Electricity	0.529	1.021	1.363	1.435	1.702	2.100	2.511
Heat	–	–	–	–	0.020	0.020	0.020
Shares (%)							
Coal	*9.6*	*14.7*	*6.3*	*5.4*	*3.8*	*2.2*	*1.7*
Peat	*7.5*	*5.5*	*3.0*	*2.7*	*2.6*	*1.8*	*1.2*
Oil	*71.2*	*53.7*	*59.6*	*60.7*	*60.1*	*60.6*	*61.9*
Gas	*1.9*	*12.9*	*14.4*	*14.4*	*14.5*	*14.8*	*14.5*
Comb. Renewables & Wastes	–	–	*1.3*	*1.5*	*1.4*	*1.3*	*1.1*
Electricity	*9.8*	*13.2*	*15.5*	*15.4*	*17.4*	*19.1*	*19.5*
Heat	–	–	–	–	*0.2*	*0.2*	*0.2*
TOTAL INDUSTRY[6]	**1.920**	**2.324**	**2.443**	**2.652**	**2.980**	**3.022**	**3.373**
Coal[1]	0.044	0.272	0.124	0.092	0.130	0.122	0.143
Oil	1.662	0.879	0.943	1.047	1.206	1.020	1.072
Gas	0.025	0.787	0.772	0.845	0.868	0.955	1.059
Comb. Renewables & Wastes[2]	–	–	0.072	0.099	0.095	0.095	0.095
Electricity	0.189	0.386	0.532	0.569	0.681	0.840	1.004
Shares (%)							
Coal	*2.3*	*11.7*	*5.1*	*3.5*	*4.4*	*3.7*	*4.2*
Oil	*86.6*	*37.8*	*38.6*	*39.5*	*40.5*	*33.8*	*31.8*
Gas	*1.3*	*33.9*	*31.6*	*31.9*	*29.1*	*31.6*	*31.4*
Comb. Renewables & Wastes	–	–	*2.9*	*3.7*	*3.2*	*3.1*	*2.8*
Electricity	*9.8*	*16.6*	*21.8*	*21.5*	*22.9*	*27.8*	*29.8*
TRANSPORT[7]	**1.406**	**2.031**	**2.704**	**2.904**	**3.024**	**3.745**	**4.824**
TOTAL OTHER SECTORS[8]	**2.090**	**3.377**	**3.663**	**3.750**	**3.766**	**4.206**	**4.664**
Coal[1]	0.476	0.865	0.426	0.406	0.238	0.131	0.074
Peat	0.408	0.427	0.263	0.248	0.250	0.200	0.150
Oil	0.788	1.240	1.605	1.698	1.643	1.886	2.066
Gas	0.078	0.211	0.497	0.492	0.552	0.667	0.805
Comb. Renewables & Wastes[2]	–	–	0.041	0.041	0.044	0.044	0.044
Electricity	0.340	0.634	0.830	0.865	1.019	1.258	1.505
Heat	–	–	–	–	0.020	0.020	0.020
Shares (%)							
Coal	*22.8*	*25.6*	*11.6*	*10.8*	*6.3*	*3.1*	*1.6*
Peat	*19.5*	*12.6*	*7.2*	*6.6*	*6.6*	*4.8*	*3.2*
Oil	*37.7*	*36.7*	*43.8*	*45.3*	*43.6*	*44.8*	*44.3*
Gas	*3.7*	*6.2*	*13.6*	*13.1*	*14.7*	*15.9*	*17.3*
Comb. Renewables & Wastes	–	–	*1.1*	*1.1*	*1.2*	*1.0*	*0.9*
Electricity	*16.3*	*18.8*	*22.7*	*23.1*	*27.1*	*29.9*	*32.3*
Heat	–	–	–	–	*0.5*	*0.5*	*0.4*

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	1996	1997	2000	2005	2010
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**1.766**	**3.145**	**4.172**	**4.348**	**4.812**	**5.584**	**6.081**
OUTPUT (Mtoe)	**0.632**	**1.244**	**1.626**	**1.694**	**1.983**	**2.421**	**2.883**
(TWh gross)	7.348	14.229	18.903	23.057	23.057	28.146	33.526
Output Shares (%)							
Coal	*1.0*	*41.6*	*37.0*	*34.4*	*28.2*	*23.1*	*16.4*
Peat	*23.9*	*15.8*	*11.6*	*10.5*	*10.0*	*10.0*	*9.0*
Oil	*66.3*	*10.0*	*14.2*	*17.6*	*12.7*	*5.4*	*4.8*
Gas	*–*	*27.7*	*33.3*	*33.4*	*43.0*	*53.7*	*61.5*
Comb. Renewables & Wastes	*–*	*–*	*0.1*	*0.5*	*0.6*	*1.3*	*1.1*
Hydro	*8.8*	*4.9*	*3.8*	*3.4*	*3.4*	*2.9*	*2.5*
Solar/Wind/Other	*–*	*–*	*0.1*	*0.3*	*2.1*	*3.6*	*4.7*
TOTAL LOSSES	**1.649**	**2.261**	**2.906**	**3.092**	**3.320**	**3.720**	**3.836**
of which:							
Electricity and Heat Generation[10]	1.134	1.921	2.547	2.654	2.823	3.152	3.183
Other Transformation	0.329	0.042	–0.012	0.048	0.111	0.107	0.107
Own Use and Losses[11]	0.156	0.298	0.371	0.390	0.386	0.461	0.546
Statistical Differences	**0.124**	**0.471**	**0.185**	**0.093**	**–**	**–**	**–**

INDICATORS

	1973	1990	1996	1997	2000	2005	2010
GDP (billion 1990 US$)	23.17	45.53	66.33	73.40	89.66	115.53	141.24
Population (millions)	3.07	3.51	3.62	3.66	3.69	3.81	3.95
TPES/GDP[12]	0.31	0.23	0.18	0.17	0.15	0.13	0.12
Energy Production/TPES	0.16	0.32	0.30	0.23	0.14	0.08	0.06
Per Capita TPES[13]	2.34	2.98	3.29	3.42	3.55	3.85	4.23
Oil Supply/GDP[12]	0.24	0.11	0.09	0.09	0.07	0.06	0.06
TFC/GDP[12]	0.23	0.17	0.13	0.13	0.11	0.09	0.09
Per Capita TFC[13]	1.76	2.21	2.43	2.55	2.65	2.88	3.26
Energy-related CO_2 Emissions (Mt CO_2)[14]	23.2	33.2	36.2	37.6	38.3	41.9	46.7
CO_2 Emissions from Bunkers (Mt CO_2)	0.3	0.1	0.5	0.5	0.1	0.1	0.2

GROWTH RATES (% per year)

	73–79	79–90	90–96	96–97	97–00	00–05	05–10
TPES	3.6	1.5	2.2	4.9	1.6	2.3	2.6
Coal	6.9	9.9	–2.8	–4.9	–0.6	0.7	–1.6
Peat	2.1	1.0	–2.7	–3.8	–8.8	–3.0	–4.7
Oil	2.3	–2.4	3.5	9.2	0.8	1.4	3.4
Gas	–	13.6	6.0	4.6	7.3	5.3	3.9
Comb. Renewables & Wastes	–	–	–	39.7	3.4	9.0	–
Hydro	4.3	–1.5	0.5	–6.5	5.4	0.6	0.3
Solar/Wind/Other	–	–	–	300.0	119.0	15.4	9.6
TFC	4.3	0.9	2.2	5.6	1.6	2.3	3.2
Electricity Consumption	5.8	2.9	4.9	5.3	5.9	4.3	3.6
Energy Production	4.6	7.8	1.2	–20.4	–13.2	–9.6	–1.8
Net Oil Imports	2.9	–2.0	3.0	9.6	0.2	1.4	3.4
GDP	4.9	3.6	6.5	10.6	6.9	5.2	4.1
Growth in the TPES/GDP Ratio	–1.3	–2.0	–4.0	–5.2	–5.0	–2.7	–1.5
Growth in the TFC/GDP Ratio	–0.6	–2.6	–4.0	–4.5	–4.9	–2.7	–0.8

Please note: Rounding may cause totals to differ from the sum of the elements.

Footnotes to Energy Balances and Key Statistical Data

1 Includes lignite and peat, except for Finland, Ireland and Sweden. In these three cases, peat is shown separately.

2 Comprises solid biomass and animal products, gas/liquids from biomass, industrial waste and municipal waste. Data are often based on partial surveys and may not be comparable between countries.

3 Other includes tide, wave and ambient heat used in heat pumps.

4 Total net imports include combustible renewables and waste.

5 Total supply of electricity represents net trade. A negative number indicates that exports are greater than imports.

6 Includes non-energy use.

7 Includes less than 1% non-oil fuels.

8 Includes residential, commercial, public service and agricultural sectors.

9 Inputs to electricity generation include inputs to electricity, CHP and heat plants. Output refers only to electricity generation.

10 Losses arising in the production of electricity and heat at public utilities and autoproducers. For non-fossil-fuel electricity generation, theoretical losses are shown based on plant efficiencies of 33% for nuclear, 10% for geothermal and 100% for hydro.

11 Data on "losses" for forecast years often include large statistical differences covering differences between expected supply and demand and mostly do not reflect real expectations on transformation gains and losses.

12 Toe per thousand US dollars at 1990 prices and exchange rates.

13 Toe per person.

14 "Energy-related CO_2 emissions" specifically means CO_2 from the combustion of the fossil fuel components of TPES (i.e. coal and coal products, peat, crude oil and derived products and natural gas), while CO_2 emissions from the remaining components of TPES (i.e. electricity from hydro, other renewables and nuclear) are zero. Emissions from the combustion of biomass-derived fuels are not included, in accordance with the IPCC greenhouse gas inventory methodology. TPES, by definition, excludes international marine bunkers. INC-IX decided in February 1994 that emissions from international marine and aviation bunkers should not be included in national totals but should be reported separately, as far as possible. CO_2 emissions from bunkers are those quantities of fuels delivered for international *marine* bunkers and the emissions arising from their use. Data for deliveries of fuel to international *aviation* bunkers are not generally available to the IEA and, as a result, these emissions have not been deducted from the national totals. Projected emissions for oil and gas are derived by calculating the ratio of emissions to energy use for 1997 and applying this factor to forecast energy supply. Future coal emissions are based on product-specific supply projections and are calculated using the IPCC/OECD emission factors and methodology.

B

ANNEX

INTERNATIONAL ENERGY AGENCY
"SHARED GOALS"

The Member countries* of the International Energy Agency (IEA) seek to create the conditions in which the energy sectors of their economies can make the fullest possible contribution to sustainable economic development and the well-being of their people and of the environment. In formulating energy policies, the establishment of free and open markets is a fundamental point of departure, though energy security and environmental protection need to be given particular emphasis by governments. IEA countries recognise the significance of increasing global interdependence in energy. They therefore seek to promote the effective operation of international energy markets and encourage dialogue with all participants.

In order to secure their objectives they therefore aim to create a policy framework consistent with the following goals:

1 **Diversity, efficiency and flexibility within the energy sector** are basic conditions for longer-term energy security: the fuels used within and across sectors and the sources of those fuels should be as diverse as practicable. Non-fossil fuels, particularly nuclear and hydro power, make a substantial contribution to the energy supply diversity of IEA countries as a group.

2 Energy systems should have **the ability to respond promptly and flexibly to energy emergencies.** In some cases this requires collective mechanisms and action: IEA countries co-operate through the Agency in responding jointly to oil supply emergencies.

3 **The environmentally sustainable provision and use of energy** is central to the achievement of these shared goals. Decision-makers should seek to minimise the adverse environmental impacts of energy activities, just as environmental decisions should take account of the energy consequences. Government interventions should where practicable have regard to the Polluter Pays Principle.

4 **More environmentally acceptable energy sources** need to be encouraged and developed. Clean and efficient use of fossil fuels is essential. The development of economic non-fossil sources is also a priority. A number of

* Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom, the United States.

IEA Members wish to retain and improve the nuclear option for the future, at the highest available safety standards, because nuclear energy does not emit carbon dioxide. Renewable sources will also have an increasingly important contribution to make.

5 **Improved energy efficiency** can promote both environmental protection and energy security in a cost-effective manner. There are significant opportunities for greater energy efficiency at all stages of the energy cycle from production to consumption. Strong efforts by governments and all energy users are needed to realise these opportunities.

6 **Continued research, development and market deployment of new and improved energy technologies** make a critical contribution to achieving the objectives outlined above. Energy technology policies should complement broader energy policies. International co-operation in the development and dissemination of energy technologies, including industry participation and co-operation with non-Member countries, should be encouraged.

7 **Undistorted energy prices** enable markets to work efficiently. Energy prices should not be held artificially below the costs of supply to promote social or industrial goals. To the extent necessary and practicable, the environmental costs of energy production and use should be reflected in prices.

8 **Free and open trade** and a secure framework for investment contribute to efficient energy markets and energy security. Distortions to energy trade and investment should be avoided.

9 **Co-operation among all energy market participants** helps to improve information and understanding, and encourage the development of efficient, environmentally acceptable and flexible energy systems and markets worldwide. These are needed to help promote the investment, trade and confidence necessary to achieve global energy security and environmental objectives.

(The Shared Goals were adopted by IEA Ministers at their 4 June 1993 meeting in Paris.)

C

ANNEX

GLOSSARY AND LIST OF ABBREVIATIONS

In this report, abbreviations are substituted for a number of terms used within the International Energy Agency. While these terms generally have been written out on first mention and abbreviated subsequently, this glossary provides a quick and central reference for many of the abbreviations used.

bcm	billion cubic metres.
b/d	barrels per day.
cal	calorie.
CHP	combined production of heat and power; sometimes, when referring to industrial CHP, the term "cogeneration" is used.
EU	The European Union, whose members are Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden and the United Kingdom.
GDP	gross domestic product.
GJ	gigajoule, or 1 joule $\times 10^9$.
GW	gigawatt, or 1 watt $\times 10^9$.
kl	kilolitre (1 kilolitre = 6.289 bbl).
kcal	kilocalories
LNG	liquefied natural gas.
LPG	liquefied petroleum gas; refers to propane, butane and their isomers, which are gases at atmospheric pressure and normal temperature.
mcm	million cubic metres.
Mt	million tonnes.
Mtoe	million tonnes of oil equivalent; see toe.
MW	megawatt of electricity, or 1 Watt $\times 10^6$.
MWh	megawatt-hour = one megawatt $\times$ one hour, or one watt $\times$ one hour $\times 10^6$.
PPP	Purchasing power parity: the rate of currency conversion that equalises the purchasing power of different currencies, i.e. estimates the differences in price levels between different countries.

TFC	total final consumption of energy; the difference between TPES and TFC consists of net energy losses in the production of electricity and synthetic gas, refinery use and other energy sector uses and losses.
toe	tonne of oil equivalent, defined as 10^7 kcal.
TPES	total primary energy supply.
TW	terawatt, or 1 watt $\times 10^{12}$.
TWh	terawatt $\times$ one hour, or one watt $\times$ one hour $\times 10^{12}$.
UNFCCC	United Nations Framework Convention on Climate Change.