

ERTDI Programme 2000 – 2006, Phase 2

ERTDI Desk Study

Study: Investigation into why existing environmental technologies are underused

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APPENDICES TO
FINAL REPORT

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APPENDIX I: ETAP ACTIONS as outlined in EU Communication on ETAP, 2004

GETTING FROM RESEARCH TO MARKETS				
No.	Action	Who?	When?	How?
1	Increase and focus research, demonstration and dissemination. Improve coordination of relevant programmes. (PA1)	Commission, Member States, EIB	2004-2005	FP, ERA-NET, Article 169, Relay Centres, LIFE Programme, Structural Funds, GMES, national and regional programmes
2	Establishing technology platforms (PA2)	Commission, stakeholders, EIB	2004-2007	FP6 (pilot phase), FP7 (implementation of the Strategic Research Agenda), EU Info Points and centres
3	Establishing European Networks of technology testing, performance verification and standardisation (PA3)	Commission, testing centres, CEN	From 2004	FP6 and FP7
4	Develop an EU catalogue of existing directories and databases on environmental technologies	Commission, EEA	2005	FP6, EEA initiatives
5	Ensure that new and revised standards are performance-related	Commission, Member States, standardisation bodies, CEN, CENELEC	From 2004	Dialogue with CEN, CENELEC, others
IMPROVING MARKET CONDITIONS				
No.	Action	Who?	When?	How?
6	Develop and agree on performance targets for key products, processes and services (PA4)	Commission, Member States, EU Institutions, stakeholders	2004-2007	IPP, eco-design of EuP, voluntary agreements, policy initiatives, regulation
7	Mobilising financial instruments to share the risks of investing in environmental technologies (PA5)	Commission, EIB, EBRD, financial sector	2004-2007	European technology start up facility, SME guarantee facility, ETS Financial Facility, JI/CDM technical assistance facility, JREC venture capital, EIB Global Loan instrument, EIB contribution to EU Growth initiative, EIB Innovation 2010 initiative
8	Public/private partnerships	Commission, Member States, stakeholders	2004-2005	Dialogue with relevant stakeholders, including financial institutions
9	Promote new business niches	Commission, Member States, stakeholders	2004-2005	Financing innovative projects
10	Financial instruments for renewables and energy efficiency technologies	Commission, Member States, stakeholders	2004-2005	Dialogue with relevant stakeholders, including financial institutions
11	Measures in support of	Commission,	2004-	

	ecoindustries	European Business and Innovation Centres, Member States, stakeholders	2005	Dialogue with the sector and financial institutions
12	Promote socially and environmentally responsible investment	Commission, Member States, stakeholders	2004-2005	Dialogue with financial institutions
13	Dissemination of good practices among financial institutions	Commission, Member States, European trade associations	2004-2005	Dialogue with financial institutions
14	Identification of opportunities to integrate environmental technologies when capital stock is replaced	Commission, Member States, stakeholders	2004-2005	FP6 prospective studies
15	Review operational criteria of the Structural Funds	Commission, Council, European Parliament	2005	Structural Fund programming after 2006
16	Review state aid guidelines (PA6)	Commission and Member States	2004-2007	Guidelines for environmental State aid
17	Encourage systematic internalisation of costs through market-based instruments	Commission, Member States, regional governments	From 2004	Open Method of coordination, Communication on environmental taxes and charges
18	Review environmentally harmful subsidies (PA7)	Commission and Member States, regional governments	2004-2005	Communication on the use of market-based instruments and subsidies, in particular based on OECD report
19	Encourage procurement of environmental technologies (PA8)	Commission, Member States, National and local authorities, business	From 2004	Directive on energy savings, IPP initiatives
20	Life cycle costing promotion	Commission, Member States, National and local authorities	From 2004	Guidelines for procurement using Life-cycle costing approach, making use of the forthcoming handbook on greener public procurement, where appropriate
21	Investigation of technology procurement	Commission, Member States	2004	Report
22	Raise business and consumer awareness (PA9)	Commission, National, regional and local authorities, trade associations, NGOs	2004-2005	Networking of innovative local initiatives, IPP product declarations, support to CSR related initiatives
23	Provision of targeted training (PA10)	Commission, Member States, regional and local authorities, industry organisations, training bodies	2004-2007	Information exchange, national and regional training strategies, ESF, Marie Curie Fellowships
ACTING GLOBALLY				
24	Promotion of environmental technologies in Developing	Commission, Member States,	2004-2007	S&T Agreements, Development co-operation

	Countries	developing countries, EIB, international institutions, civil society, private sector		and international agreements, country strategies, Regional technology centres, Kyoto mechanisms, WSSD Initiatives, Global Environment Facility (GEF), Biodiversity Clearing House, EIB facilities
25	Promoting responsible investments in and use of environmental technologies in developing countries and countries in economic transition (PA11)	Commission, Member States, ETPO, STIC, EBRD, EIB, private sector, World Bank, export credit agencies, OECD	2004-2007	OECD guidelines on multinational enterprises, OECD Recommendation on export credits, Doha Development Agenda, regional/bilateral trade agreements
MOVING FORWARD				
No.	Action	Who?	When?	How?
26	Regular Review of the Action Plan	Commission	2006, then every 2 years	Report to European Council and European Parliament
27	European Panel on Environmental Technologies	Commission and stakeholders	2004-5	Analysis of existing initiatives, exchange of information
28	Open Method of Co-ordination	Member States, Commission	2004-7	Exchange of best practice, developing indicators, establishing guidelines and timetables.

APPENDIX II: Overview of the current status of environmental technologies in Ireland, the EU and Other Countries

Introduction

This Appendix details many of the initiatives that have been put in place by the EU and in individual countries (both inside and outside the EU). It gives some examples of best practice and innovative technologies. It looks at some of the best programmes in place to increase the uptake on existing technologies – in particular those that can be replicated in Ireland. It is intended to complement the Main Report of this Study – in that report many of these initiatives are summarised and other issues are also considered.

Much of the focus is on good example case studies, describing specific current technologies (with examples of future potential technologies also given), giving details of hard technologies (with information also on processes, good practices and materials) – these are often shown in boxes. The Appendix aims also to describe initiatives and programmes designed to ensure that such technologies are applied and that their uptake can be maximised.

Since the range of environmental technologies is so wide and the potential use of such technologies so varied, it was considered worthwhile by the project team to divide them into logical groups. This was done according to the use or environmental area at which these technologies are aimed. Thus the team divided the technologies and their related information into 10 subject areas as follows:

- Waste
- Agriculture
- Energy
- Transport
- Climate change
- Air
- Water
- Products
- Industry
- Chemicals

From a regional perspective the analysis of each of these subject areas is divided into information from the European Union generally, then specific to individual countries both inside and outside the EU.

Within each subject area, some core issues were also identified and targeted. Thus for example, within waste, the technologies regarding recycling were highlighted. Similarly, for water there was a focus on eutrophication; for transport it was biofuels etc.

When examining the broad scope of environmental technologies, and with a view to recommending policies, programmes and actions in the Main Report, it was necessary to first establish a framework of approach. With this in mind the study has examined initiatives from a threefold perspective: regulatory, economic and information based, as follows:

Regulatory

Regulation and legislation is known to be an effective tool used by national and local government to boost the protection of the environment and promote the practices and technologies necessary for such protection. The research contained in this report focused on both the legislation that has been applied as well as how it has been applied. It also analyses several policies and programmes in relation to each of the subject areas described.

Economic

Economic instruments such as the plastic bags levy have had success in several countries. These form the basis of many supportive initiatives with regard to environmental technologies, especially promoting the concepts of producer responsibility and when trying to improve the performance of the general public.

Awareness/Information

Very often the reason for a low uptake of an environmental technology or approach is the lack of awareness or understanding of better alternatives. That is why the EU and several countries have invested heavily in supporting awareness raising programmes and schemes as well as relevant research.

The approach taken can be shown in Figure 1 below:

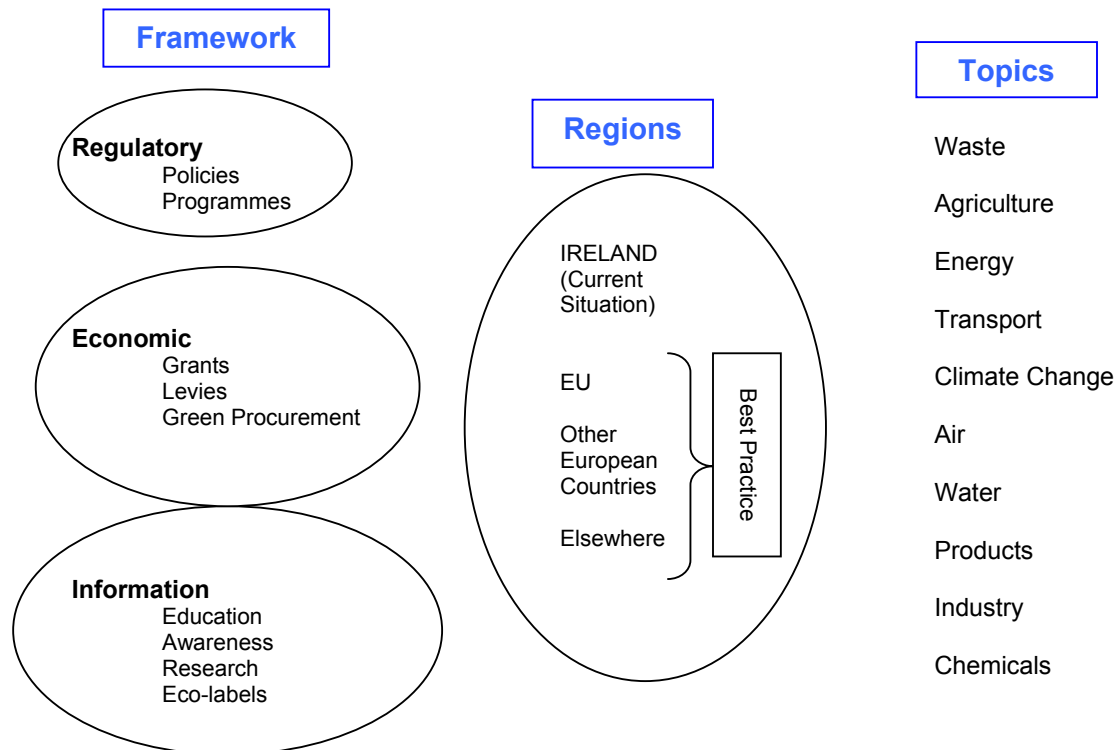


Figure 1: Framework, Regional and topical approach taken

1. Waste

1.1 EU initiatives

1.1.1 Regulation and policy

The European Union (EU) has published policies, programmes, legislation and publications on waste in general and several specific waste streams including: batteries, biodegradable waste, electrical and electronic equipment (WEEE), end of life vehicles (ELVs), mining, PCBs/PCTs, polyvinyl chloride (PVC), sewage sludge, waste oils, titanium oxide, asbestos and packaging waste¹. Further programmes are also in place in relation to specific waste management methods such as incineration and landfilling as well as issues relating to the transport of waste, integrated product policy and sustainable use of resources.

The EU *Thematic Strategy on the Prevention and Recycling of Waste* was launched in 2005². The Commission has proposed revising the 1975 Waste Framework Directive to set recycling standards and to include an obligation for Member States to develop national waste prevention programmes. This revision will also merge, streamline and clarify legislation, contributing to better regulation. This revised Directive will encompass hazardous waste and waste oils, and replace previous Directives related to those streams. The *Thematic Strategy on the Prevention and Recycling of Waste* and the *Thematic Strategy on the Sustainable Use of Natural Resources* are two of the seven 'thematic' strategies required under the 6th Environment Action Programme (2002-2012).

The Thematic Strategy on the Prevention and Recycling of Waste aims to develop a more "life cycle" thinking approach to waste in Europe to reduce the environmental impacts of resource use and provide a yardstick to assess policy effectiveness. The strategy also aims to stimulate action at a local level and to assist life cycle thinking through guidance, information and further research.

EU waste policy is based on a concept known as the waste hierarchy, which prioritises the different options for managing waste from 'best' to 'worst' from an environmental perspective:

1. Prevent waste in the first place
2. Reuse the product
3. Recycle or compost the material
4. Recover the energy by incineration
5. Dispose of the waste in a landfill

EU policies and programmes are designed to support new methods and technologies which aid the best options of the waste hierarchy, while also reducing the environmental impact of other options. A major aim of the EU is now to strengthen recycling activities by setting standards. In some cases the EU has suffered from a history of dirty recycling, for example the production of contaminated compost. This has had a negative impact on markets because of a fall in consumer confidence. The setting of quality standards will improve the technologies used for recycling and support the development of an EU market for secondary (recycled) materials.

In the case of biodegradable waste the EU supports any biological treatment technology which has the following advantages:

- composting contributes towards efforts to tackle the greenhouse effect, as it diverts biodegradable waste from landfilling, where it would produce methane, a powerful greenhouse gas;
- the use of compost in agriculture is a way of maintaining or restoring the quality of soils because of the unique properties of the humified organic matter contained in the compost itself;
- the use of compost in horticulture and in home gardening is a valid substitute for peat, thus reducing the rate of exploitation of bogs and wet lands;
- anaerobic digestion is a means of producing 'green energy', with the possibility of obtaining a residue that, after an appropriate aerobic phase, can be used as a soil improver. For those biodegradable wastes that are suitable for anaerobic digestion, this biological treatment combines the advantages of composting with the production of energy.

¹ <http://europa.eu.int/comm/environment/waste/index.htm>

² <http://europa.eu.int/comm/environment/waste/strategy.htm>

1.1.2 Information/Awareness Raising

One method of promoting better technologies in relation to waste is awareness raising. The EU is a large scale publisher in promoting such awareness. One such publication, for example, outlines best practice for composting and waste separation.³ This aims to provide information to local authorities across Member States to assist them in introducing successful and cost-effective home composting and biodegradable waste-separation schemes in their localities.

In that report, for example, in the Barcelona region the successful composting technology is outlined as follows:

Successful composting technology initiative

In the central composting plant, the biodegradable fraction is pre-treated by tearing the bags in which it is contained and mixing the waste with garden waste using an agricultural mixer. In a parallel line, sewage sludge is mixed with wood waste. Both mixes are then introduced in composting tunnels. There are currently three tunnels in the plant, and three more are planned to be built in the short term, with a total volume of 280 m³ and a usable volume of 210 m³. The tunnels take two to three days to be filled, and the mix spends between 10 and 14 days composting. The conditions in the tunnels are controlled centrally, in terms of air flow, temperature, oxygen, carbon dioxide, etc., by means of probes into the composting mix from above, and air aspirators and ventilators. The tunnels are equipped with bio-filters made of compost or vegetal recirculated material. The equipment in the tunnels and central control system are designed by the company operating the composting plant. Over 16,000 tonnes per annum of this waste are recovered by this facility alone with plans for further expansion.

The EU uses several other methods of awareness raising besides such best practice examples. Through its main environment website⁴ and links to other websites, events, brochures etc. the EU is raising awareness and facilitating the use of newer and better technologies in relation to waste management as well as other environmental issues.

The European Topic Centre on Resource and Waste Management (Topic Centre of European Environment Agency)⁵ is a major portal in the dissemination of best practice and better environmental technologies in relation to waste. The Topic Centre also carries out research and generates vital data on waste issues that can inform and guide future EU policies and programmes.

Another EU funded method of dissemination and support are the Innovation Relay Centres (IRC). The mission of the IRCs is to support innovation and transnational technological co-operation in Europe with a range of specialised business support services. IRC services are primarily targeted at technology-oriented small and medium-sized enterprises (SMEs), but are also available to large companies, research institutes, universities, technology centres and innovation agencies. The first Innovation Relay Centres were established in 1995 with the support of the European Commission. The aim was to create a pan-European platform to stimulate transnational technology transfer and promote innovation services. Over the past five years the IRCs have been of assistance in over 12,500 technology transfer negotiations, and have helped more than 55,000 client companies to meet their technology needs and to exploit their research results. Today, 71 regional IRCs span 33 countries – 25 EU Member States, Bulgaria, Romania, Iceland, Israel, Norway, Switzerland, Turkey and Chile. Most IRCs are operated by consortia of qualified regional organisations such as Chambers of Commerce, Regional Development Agencies and university Technology Centres. Altogether, almost 220 partner organisations are involved, ensuring wide geographic coverage. One of the many services offered by IRCs is a showroom for new technologies, including environmental technologies⁶. These Technology Offers are published in collaboration with the CORDIS Technology Market Place. Every week through its Technology Marketplace service, CORDIS publishes examples of technology offers from the best and most recent results of EU funded research and development projects.

One example of an environmental technology relating to waste with future potential chosen from the showroom is as follows:

³ European Commission Directorate-General for the Environment *Success stories on composting and separate collection*. CEC, 2000.

⁴ http://ec.europa.eu/dgs/environment/index_en.htm

⁵ <http://waste.eionet.eu.int/>

⁶ <http://irc.cordis.lu/showroom/>

New Recycling Technology

A French electrochemistry team working on the remediation of Chromated Copper Arsenate-treated wood offers new research results on chemical and electrochemical recycling of washing effluents. The team is looking for commercial agreement and technical assistance with a company interested in conducting a pilot plant for remediation of CCA-treated wood and a company interested in re-use of the cleaned wood in new materials (technical, scientific advices regarding conception, set-up).

The remediation of Chromated Copper Arsenate (CCA) treated wood is a challenging problem in many countries, since this material cannot be incinerated at its end life without endangering environmental safety. The wet process being promoted would contain the following steps:

1. Grinding of CCA-treated wood in order to get saw dust or wood chips.
2. Heating the wood particles in an acid solution. This step may be a batch or a continuous process.
3. Separation of the hot washing effluents from the cleaned wood particles.
4. Concentration of the washing effluents with membrane technologies (this is an optional step).
5. Electrochemical and/or chemical treatments of the washing effluents that contain chromium, copper and arsenic elements.
6. Separation of solid wastes and reuse of the effluent in the remediation process.
7. The cleaned wood particles contain low levels of CCA. Without drying they may be reused in the fabrication of concrete wood or other wooden materials.

The laboratory already has precise data regarding the reduction rate and the concentration of the CCA effluents.. The recycling of washing solutions allows the development of a wet remediation process for CCA-treated wood. The overall process implicates cheap technologies working at low temperature in safe conditions (at present the main competitor technology for remediation of CCA-treated wood is a thermal treatment leading to charcoal. This technology, which works at a controlled temperature in order to avoid arsenic dissemination with the fumes, needs costly equipments). The overall process allows direct reuse of the cleaned wood particles in some materials.

Other private organisations such as the International Solid Waste Association (ISWA) are also active in the promotion of waste related technologies. The ISWA is "an international, independent and non-profit making association, working in the public interest to promote and develop sustainable waste management worldwide. ISWA is open to individuals and organisations from the scientific community, public institutions, public and private companies, consultants, and manufacturers, from all over the world working in the field of and interested in waste management."⁷ The ISWA organises conferences, brokerage events, dissemination, publications etc. promoting environmental technologies relating to waste.

1.1.3 Grant Aid (Economic Instruments)

The EU is also active in the promotion of improved environmental technologies through several research and demonstration programmes, the main one of which is the LIFE Environment Programme. Several LIFE Environment projects have focused on waste related issues. The LIFE programme plays a key role in contributing to the development of innovative waste prevention and management projects. Between 1996 and 2003, LIFE Environment funded 141 projects on different aspects of waste management and prevention ranging from industrial waste on construction sites, to community composting, to recycling of electronic and electrical waste.⁸ The total investment planned by those projects (many are ongoing) is €279,415 million for a Community contribution of €86,821 million (that is 31% of total costs on average). The "leverage" capacity of this type of project is especially important, as €1 invested by the EU will be matched by over €2 from other private and public funds. The management of industrial or other special waste draws the highest number of projects (26), which reflects the diversity of problems created by many industrial processes. The second main field is that of biodegradable waste (20 projects), covering projects related to animal slurry, waste from forestry exploitation and agriculture, etc. Recycling of plastic and wrapping waste is the third major field of activity (18 projects) and work in this field has been growing steadily in recent years.

⁷ <http://www.iswa.org/>

⁸ European Commission *LIFE FOCUS / A cleaner, greener Europe: LIFE and the European Union waste policy* Office for Official Publications of the European Communities 2004

Some examples of new environmental technologies relating to waste that have been developed and demonstrated with support from LIFE funding include:

Some Environmental Waste related Technologies supported by LIFE

In Sweden the Svenska Retursystem further developed the concept of recyclable packaging by creating an integrated logistics system that works for not only transporting produce, but also for other commodities such as dairy products, meat and poultry.

In Belgium the port authority of Antwerp developed an integrated monitoring and management tool for seaport waste management based on an electronic mapping system that monitors waste flows in Belgian ports throughout each phase of port and port related activities.

In Germany a company specializing in the transformation of waste raw materials into new products, has found a way to clean Europe's beaches by collecting the flotsam and jetsam along the coast of Denmark and transforming it into natural products such as poured heat insulation. The company works in partnership with research and regional technology institutions, tourism associations and SMEs throughout the European Union.

In Italy an SME specializing in research and development for innovative environmental technologies designed waste-based reinforcement materials (WBRM), a process which transforms the fine fly ash produced in the waste incineration process from a toxic substance into a powerful reinforcing material for textiles, cement and plastic products.

In Finland Tampere University Hospital created the first model in the country for recycling plastic used in hospitals, in collaboration with 3 other hospitals in the country, a regional solid waste management company and experts from the plastics industry.

1.2 Initiatives in Other Countries

There are many initiatives and programmes in several countries regarding waste management environmental technologies. Again these can be classified as being policy/regulatory, economic or information/awareness based. Usually countries and regions implement a range of initiatives from all three of these categories to create a maximum impact. Some of these are outlined below.

1.2.1 United Kingdom

A number of programmes have been implemented in the UK, one being the advice and assistance provided through Envirowise⁹. In addition to generic themes of waste minimisation, packaging, solvents, cleaner technology, water and measurement & benchmarking, Envirowise has produced several industry sector specific "how to do it" guides, benchmarking guides and case studies.

Other support and advice documents and initiatives have been provided through the Environment Agency, the Department of Trade and Industry, the Scottish Environmental Protection Agency, the Chartered Institution of Wastes Management.

WRAP (the Waste & Resources Action Programme) was established in 2001 in response to the UK Government's Waste Strategy 2000 to promote sustainable waste management. WRAP is set up as a not-for-profit company limited by guarantee by DEFRA, the DTI, and the devolved administrations of Scotland, Wales and Northern Ireland. WRAP supports new technologies and innovative waste management techniques as well as developing recycling standards. By investing significant amounts of money in research and demonstration, WRAP has significantly aided the development of environmental technologies as well as helping to increase waste recycling amounts in the UK¹⁰.

⁹ <http://www.envirowise.gov.uk>

¹⁰ <http://www.wrap.org.uk>

Environmental Technology Supported by WRAP

One example of an environmental technology supported by the WRAP programme relates to the process of separating brominated flame retardants (BFRs) from waste electrical and electronic equipment (WEEE) polymers. The work indicates that the Creasolv process for extraction of brominated flame retardants from WEEE polymers has potential to be commercially viable in the UK context at a throughput of 10,000tonne/year. The Creasolv process was originally developed by Fraunhofer IVV in Germany and has been modified further in the course of this project.

The Creasolv process will remove most BFR types from styrenic WEEE polymers. Work done for this project has shown that styrenic polymers constitute over half of collectable WEEE polymers and that they contain the great majority of the BFRs found in WEEE thermoplastics. It has not been tested with the newer BFR types such as brominated epoxy oligomers because these are not yet found in significant quantities in real WEEE.

A second process called Centrevap has also been developed in the course of this project and tested at technical scale. Tests have shown that it cannot achieve significant reductions in BFR content. However it does offer good potential as a robust, flexible and relatively cost-effective process for removal of insoluble impurities down to submicron size from a wide range of polymer types.

Both processes should be able to compete with landfill disposal or incineration (£35/te gate fee) as treatment methods for segregated polymer streams, Creasolv for BFR removal, and Centrevap for removal of other insoluble impurities. They will compete with export of the BFR-containing polymer outside the EU (current sales value of around STG£100/te) if the finished high grade compounded recyclate can be sold at about 80% of virgin compound price.

Environmental impact comparisons conducted during the project indicated that both of the recommended processes have a net environmental gain across all environmental impact categories and that the proposed treatment routes are a substantially better environmental option than landfill and incineration with energy recovery.

1.2.2 Initiatives in Netherlands, Austria, Denmark and Flanders

A study of initiatives and programmes being implemented in four regions: Austria, Denmark, Flanders and the Netherlands was carried out by the Clean Technology Centre and may be described as either economic, communication/information or regulatory based¹¹. These are summarised in Table 1.1:

¹¹ Coakley, Tadhg Cunningham, Dermot *Assessment and Development of a Waste Prevention Framework for Ireland* EPA 2003

Table 1.1: Waste related initiatives in Netherlands, Denmark, Austria and Flanders

REGIONS	INSTRUMENTS		
	Communication/Information	Economic	Regulatory
Netherlands	<ul style="list-style-type: none"> - Awareness raising programmes, especially for consumers and SMEs - Programmes to create a knowledge base and support injunctions, regulations, bans, collection schemes etc. - Technical support schemes for industry - Market development programmes for recyclable materials - Green public procurement 	<ul style="list-style-type: none"> - Environmental based taxes - Producer responsibility - Rate differentiated domestic waste charges - Landfill and incineration taxes - Producer responsibility programmes - Financial supports and grants for infrastructural improvements - Economic rewards for good behaviour – exemption from taxes etc. 	<ul style="list-style-type: none"> - Injunctions and bans - Self regulation – covenants and voluntary agreements
Denmark	<ul style="list-style-type: none"> - Research - Information provision on the objectives of the Waste Management Plan - Training of key stakeholders - Life-cycle assessment tools - Green accounts, guidelines & manuals - Eco-labels and product declarations - Green guides (environmental consultants in communities) - Green public & private procurement policies 	<ul style="list-style-type: none"> - Green taxes and charges including <ul style="list-style-type: none"> - Product taxes and charges, tax differentiation, effluent taxes and charges, user fees, administration charges - Subsidies <ul style="list-style-type: none"> - Grants, soft loans, tax allowances - Deposit-refund schemes <ul style="list-style-type: none"> - Reusable items, disposals 	<ul style="list-style-type: none"> - Regulating products (e.g. chemicals in products) - Industrial Permits etc. - Enforced Segregation - Deconstruction of buildings (not demolition) - Landfill bans
Austria	<ul style="list-style-type: none"> - Sector Specific Guidelines - Information and Public awareness campaigns - Training of and actions by Eco-consultants and waste-consultants - Green public procurement - Research 	<ul style="list-style-type: none"> - Environmental grants and subsidies - Economic supports for research 	<ul style="list-style-type: none"> - Legislative support for green public procurement - Requirement of companies to appoint waste officers and develop waste management plans - EMAS Regulation - Voluntary agreements for old tyres, PVC products, packaging and ELVs - Regulations on demolition waste and excavated soil; packaging; WEEE; biogenous waste
Flanders	<ul style="list-style-type: none"> - Widespread series of research campaigns - Advice and consultancy centres for business and government - Series of guidelines documents for industry - Local authority campaigns to support measures - Eco teams - Campaigns in schools 	<ul style="list-style-type: none"> - Differential charging for household waste - Landfill charges and taxes - Incineration charges and taxes - National government subsidies to local government - Grants schemes to business organisations - Grants to individual companies 	<ul style="list-style-type: none"> - Mandatory separation of household and commercial waste – collection by authorities - Take back or duty of acceptance for certain waste streams – agreements - Environmental covenants between central government and municipalities - Landfill bans for specific streams - Stricter incineration standards

1.2.3 Canada

Eco-Peinture was formed in Canada by members of the paint industry in 1997 and began by funding paint and paint container recovery in 1998 on a voluntary basis. This was expanded to meet the mandates of new legislation in 2001. The legislation applies to paints sold in retail outlets, but does not include paint used by artists. The programme aims to meet specific recovery and reclamation targets; the long-term target is a 75% recovery rate and 100% reclamation (of paints collected) through the reuse and recycling of used paints and containers. A fee of \$0.25 on containers sold in the Quebec market funds the programme. These funds are used to process the paints for recycling and reuse, to pay for a small amount of disposal, to perform research and development activities, and to support the development of municipal collection programs.

About 70% of the paint and containers collected come from municipal programs and 30% come from collection through retailers. Most of the paint collected is processed for sale as used paint, or is used as raw material to make paint from recycled content. The program started on a voluntary basis in 1998 and was expanded to meet the mandates of the regulation in 2001.

Figure 1.1 shows the growth of paint recovery in this region since 1994, in particular since the inception of the legislation in 2000/2001¹²:

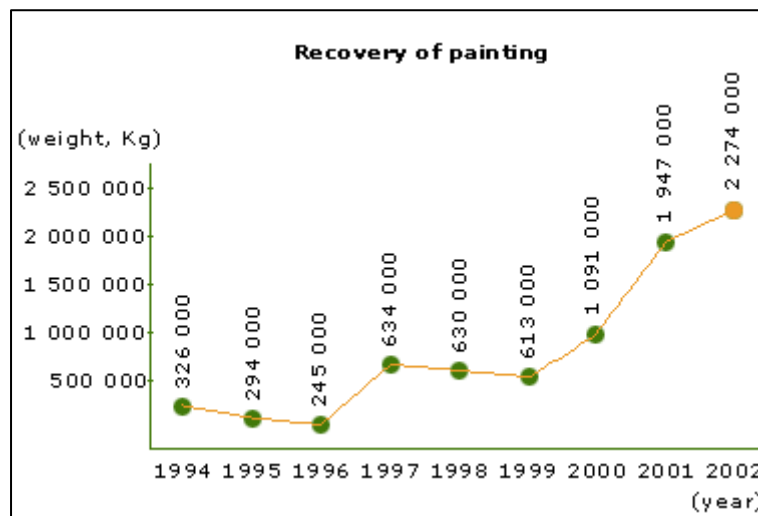


Figure 1.1: Paint Recovery in Canada 1994 - 2002

1.2.4 Australia

WasteNet¹³ is managed by the Municipal Waste Advisory Council, a standing committee of the Western Australian Local Government Association with delegated authority to represent the Association in all matters relating to solid waste management. The website was established in 2001 as a source of information for people interested in waste issues and waste information.

WasteNet promotes new environmental technologies and techniques from programmes of interest to Local Government officers. These are usually proven technologies or techniques that have been successful in one or more regions and have potential for replication. Some of these include:

¹² www.ecopeinture.ca

¹³ <http://www.wastenet.net.au/>

- Used Oil Collection Infrastructure Program
- Resource Recovery Rebate Scheme (RRRS)
- IRIS - A tool for investigating Integrated Resource Recovery System
- The Strategic Waste Initiatives Scheme (SWIS)
- Household Chemical Waste (HCW) Program

1.3 Initiatives in Ireland

1.3.1 Introduction

A wide range of initiatives have been implemented in Ireland regarding waste over several years, through legislation/ policy, economic, awareness/information based instruments.

These can be summarised in Table 1.2 below:

Basis	Instrument
Policy/ Legislation	Preventing and Recycling Waste – Delivering Change National Waste Prevention Programme Markets Development Group National Strategy on Biodegradable Waste National Hazardous Waste Management Plans (1 and 2) Local/Regional Waste Management Plans (2 editions) Waste Management Acts, 1996, 2001 Several Waste Management Regulations Environmental Protection Agency Act, 1992 Protection of the Environment Act 2003 IPPC Licensing North-South Co-Operation for Waste Management Office of Environmental Enforcement (OEE) Waste Permitting and Licensing Current and future EU legislation Local Authority Landfill Bans
Economic	Plastic Shopping Bags Levy Landfill Levy and Landfill Charges Environment Fund Use related waste charges Producer responsibility initiatives for packaging, WEEE, ELVs, Farm Films, C&D waste etc.
Awareness/ Information	Race Against Waste It's Easy to Make a Difference Local Authority programmes ENGO local programmes Enterprise Ireland programmes (www.envirocentre.ie) ENFO ERDTI Programmes CGPP Programmes DEHLG Reports on LA21 etc. EPA National Waste Databases 1996 - 2004 EPA Reports and Documents CTC Reports and Documents Forfás Reports etc.

Table 1.2: Waste related initiatives in Ireland

Several studies and reports have been commissioned to assess the current situation and recent developments regarding waste in Ireland. These include:

- The nature and extent of unauthorised waste activity in Ireland (EPA) 2006;
- Reviews and updates of regional and local authority waste management plans (Various) 2006;
- The national waste prevention programme first annual report 2004/2005 (EPA) 2005;
- National hazardous waste management plan implementation committee annual report (EPA) 2004;
- National waste prevention programme outline work plan 2004 to 2008 (EPA) 2004;
- ERTDI study: assessment and development of a waste prevention framework for Ireland final report (EPA/CTC) 2004;
- Waste management – Taking stock and moving forward (DEHLG) 2004;
- National Strategy on Biodegradable Waste Draft Strategy Report (DEHLG) 2004;
- National overview of waste management Plans (DEHLG) 2004;
- National Waste Database (EPA) 2004
- National Hazardous Waste Management Plans 2001 and 2007

1.3.2 Legislation/Policy Instruments

A large volume of policy documents and strategies have been published in Ireland regarding waste management. Many of these have potential in the promotion and support of current and upcoming environmental technologies. Supporting legislation has been enacted to implement these policies and again these support environmental technologies and improved waste management practices. *Preventing and Recycling Waste – Delivering Change (2002)* in particular was a seminal policy document and initiatives such as the *National Waste Prevention Programme*, *Markets Development Group* etc. were developed as a result.

Another critical piece of legislation, *The Environmental Protection Agency Act, 1992* led to the setting up of the EPA and initiated the large amount of work in which the EPA have been active since then. In terms of waste management, the issue of enforcement is always an important element. Enforcement can lead to reduced illegal activity and fly-tipping and a move up the waste hierarchy towards more environmental technologies that aid recycling and prevention. One initiative in particular, the setting up of the Office of Environmental Enforcement (OEE), can have important effects in this regard.

EPA's Office of Environmental Enforcement (OEE)

The Office of Environmental Enforcement was set up in 2003 to bring about improved compliance with environmental legislation in Ireland and to ensure that those who flout environmental law and cause environmental pollution as a result of their actions are held to account. The OEE, in conjunction with other Public Bodies with environmental regulatory authority, established an enforcement network in 2004. The participants include all local and public authorities, state agencies and Government Departments with responsibilities for the implementation and enforcement of environmental legislation in Ireland.

The network's objective is to foster co-operation between the various bodies involved in the enforcement of environmental legislation so that a higher and more consistent standard of enforcement is achieved throughout the country.

The OEE commissioned a major report in 2005 *The Nature and Extent of Unauthorised Waste Activity in Ireland*. The information gathered during the course of this investigation was used to prepare an action plan to deal with unauthorised waste activity in Ireland. The specific actions required to deal with this problem are set out in this report. The aforementioned network will implement and build on these actions.

Following this report, Minister Dick Roche said:

“There are clear signs that we are getting to grips with our unauthorised waste problems...In the case of backyard burning and illegal fly-tipping, a zero tolerance approach is really the only approach! I would in this instance ask that efforts be made to educate the general public as to the dangers of handing waste over to fly by night cowboys – producer responsibility begins at home.”

Mr. Dara Lynott, Director, EPA’s Office of Environmental Enforcement, said

“Tackling illegal waste activity is a top priority for the Office of Environmental Enforcement and members of the enforcement network. Members of the network have come together today from all corners of the island of Ireland to focus on new initiatives to detect and prosecute illegal waste activities.”

“We’re sending out a strong and clear message today to those involved in illegal waste activities, that their actions will not be tolerated.”

Addressing the conference, Garda Assistant Commissioner Callinan said,

“Being conscious of the threat posed by illegal waste activities to Ireland’s economic and social environment, we in An Garda Síochána are committed to working with the EPA and other statutory agencies in preventing and detecting this type of illegal activity.

1.3.3 Economic Instruments

Economic instruments can have a major influence on environmental behaviour and in support of environmental technologies and better environmental performance. Several of these have been applied in Ireland in recent years including the very successful Plastic Shopping Bags Levy. In a recent visit to San Fransisco, Minister Noel Dempsey shared the experiences of Ireland with officials from that region.

Plastic Shopping Bags Levy

“The 15-cent levy, which I introduced on 14th March 2002, has raised €51 million to date and has helped rid our environment of plastic bags which were a visible and persistent factor of litter pollution in our towns, countryside and along the Irish coastline,” he added.

“My meeting with Environment Officials gave me the opportunity to provide them with my insights into the introduction of the levy in Ireland,” he said. “For example our original estimate that €11 million per annum would be raised from the levy, has been exceeded with €17.5 million collected in 2005,” said Dempsey.

“The introduction of the levy also had other tangible benefits, for example the use of disposable plastic shopping bags has been reduced by approximately 93% since its introduction. Prior to the introduction of the levy 1.2 billion disposable plastic bags were given away free by retailers, plastic bags used to account for 5% of our litter, while now they account for only 0.2% of litter,” he added.

“Revenues raised from the levy are going to an Environment Fund which is used to fund environmental projects such as ‘bring banks’ and new civic amenities which are proving immensely popular with the public and are contributing to our much improved recycling performance,” said the Minister.

“Ireland is one of six nations – Australia, Bangladesh, Italy, South Africa and Taiwan – who have levy taxes or enacted bans on plastic shopping bags. It is only a matter of time before that number increases as countries, states and cities become more and more aware that the prevalence of plastic bags suggests that we are careless of our environment, and of the environmental image they convey,” concluded Minister Dempsey.¹⁴

¹⁴ Dempsey Shares Expertise on Plastic Bag Levy with San Francisco Environment Officials – press release from Department of Communications, Marine and Natural Resources website, 11 March 2006

A producer responsibility programme relating to packaging waste is being implemented by REPAK. This is Ireland's first voluntary initiative between industry and the Government, designed to meet industry's producer responsibility obligations under the EU Directive on Packaging and Packaging Waste (94/62/EC) and the subsequent Waste Management (Packaging) Regulations 1997. The REPAK scheme has aided the increase in packaging waste recovery apparent in Ireland in recent years.

Figure 1.2¹⁵ shows these increases:

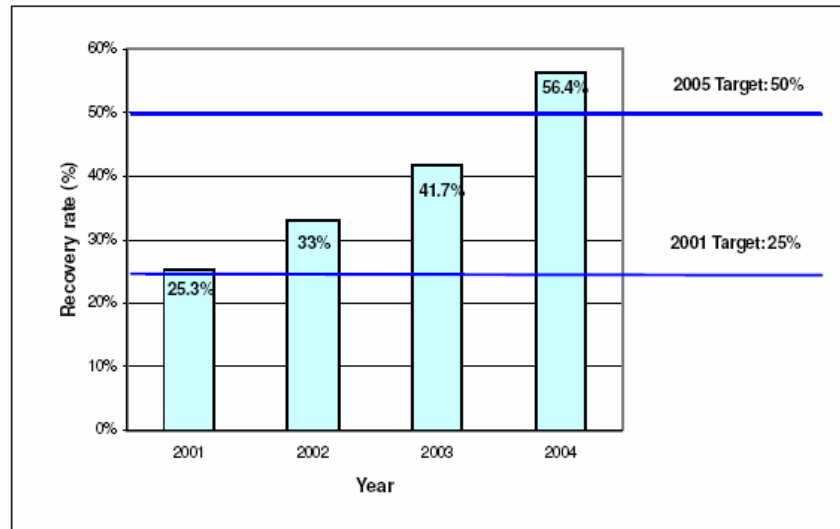


Figure 1.2: Packaging Waste Recovery in Ireland from 2001 to 2004

Another successful economic instrument, which has aided recycling of farm film plastic waste, is the Waste Farm Plastics Collection Scheme which was set up in 1997. This scheme is paid for by Irish farmers through a small additional charge included in the price of silage sheeting and bale wrap plastic. Over 40,000 tonnes of farm plastics have been recovered and recycled since its inception.

More recently, producer responsibility initiatives have been set up for C&D waste, WEEE, ELVs and chewing gum. Other initiatives are being considered for newsprint and tyres.

1.3.4 Awareness/Information Instruments

Awareness raising is an important action in the move towards a higher take up of environmental technologies. In Ireland several national, regional and local awareness raising campaigns have been initiated to improve environmental awareness in relation to waste issues.

The main national initiative is the *Race Against Waste* campaign. Since its inception in 2003 this scheme has achieved a high level of brand recognition and put environmental issues in both the media and public eye.

¹⁵ EPA National Waste Report 2004 2005

The Race Against Waste

This national awareness and communications campaign¹⁶ was launched in 2003 by the Department of the Environment, Heritage & Local Government. Its aim was to raise awareness of waste issues and to change behaviour among people at home and at work in order to reduce the amount of waste being produced and increase recycling and composting.

The campaign:

- works closely with Environmental Awareness Officers in all of the local authorities, who work locally with householders, schools, businesses and community groups
- provides advice and information directly to the public through a lo-call telephone information line and email, both operated by Environmental Scientists
- encourages communities to minimise, recycle and compost their waste through the national Tidy Towns competition's Race Against Waste module
- runs a programme of action for business, including nationwide seminars, in partnership with the Chambers of Commerce of Ireland
- informs the public through an on-going public relations campaign in national and local press and media
- raises awareness through an extensive advertising campaign on TV, radio, press and outdoor.

The Race Against Waste campaign also aims to generate change through:

- A media campaign which will continue to turn awareness into action by showing how to recycle cans, paper, glass and what to do about unwanted "Junk Mail"
- Continuation of the Small Change Programme for business
- Community involvement through the Tidy Towns network
- New programmes of action in partnership with organisations such as government offices, third level colleges, hospitals, prisons, transport providers, hotels, local authority buildings and others.

Green Schools

Green Schools is an international environmental education programme that promotes and acknowledges long-term action for the environment in schools. The programme in Ireland is a joint partnership between *An Taisce* (the National Trust for Ireland) and local authorities. Around 1,800 Irish schools are currently participating in the programme, and 180 have been awarded the prestigious Green Flag award. Over 7,000 schools are taking part in the programme internationally.

ETAP Research

With relation to environmental technologies, the most focused programme of research has been initiated by the EPA as part of its ERTDI Research programme in 2005. Table 1.3 shows technology specific or subject specific projects that have received funding and are underway under the 2005 ETAP call. These should greatly aid the promotion of environmental technologies in Ireland.

¹⁶ See www.raceagainstwaste.ie

Title	Organisation
E-Diesel: Benefits and Barriers	Sustainable Energy Solutions
Investigation Into Why Existing Environmental Technologies Are Underused.	Clean Technology Centre
Energy Efficiency Improvement of Wastewater Treatment Processes Using Process Integration Techniques	University of Limerick
Guidelines On How To Take A Pilot Project To Market	Circa Group Europe
Integrated research programme into membrane separation process technology	Cork Institute of Technology
A complete water and pollutant balance for a constructed wetland treating wastewater from a dairy processing plant (WETBALANCE)	University College Dublin
Development of an alum sludge based constructed wetland system for improving organic matter and nutrients removal in high strength wastewater	University College Dublin
The use of mesoporous silicas to absorb and separate metals and nanoparticles from aqueous or organic solutions	University College Cork
Trace Radical Absorption through Cavity-Enhanced Spectroscopy (TRACES)	University College Cork
High-rate anaerobic digestion as a core technology for sustainable treatment of municipal and low-strength industrial wastewaters	NUI Galway
Nitrogen removal from slaughterhouse wastewater by means of simultaneous nitrification and denitrification (SND) in modified sequencing batch biofilm reactor systems (SBBR).	NUI Galway

Table 1.3: 2005 ETAP related ERTDI projects

1.4 Summary and Conclusions

It is clear that many initiatives and instruments are being applied to promote environmental technologies relating to waste in the EU, Ireland and other countries. It is also clear that the uptake of these technologies is increasing.

In Europe, one of the targets of the 5th Environment Action Programme was to reduce the generation of municipal waste per capita per year to the average 1985 level of 300kg by the year 2000 and then stabilize it at that level. Recent data would indicate that this target is far from being reached and the trend is in the opposite direction. Figure 1.3 shows¹⁷ this trend whereby municipal waste generation rates in western Europe are growing, moving towards 600kg per person per year (almost double the target) while those in central and eastern Europe are lower and decreasing slightly.

¹⁷ European Environment Agency *The European Environment State and Outlook 2005* EEA 2005
Note: WE = Western Europe; CEE = Central and Easter Europe

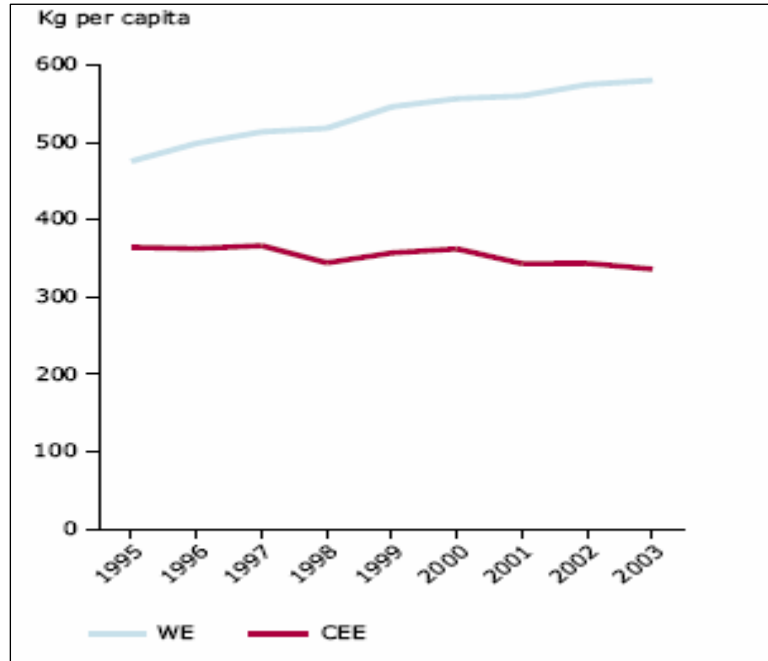


Figure 1.3: Waste arisings in Europe 1995 to 2003

Thus it can be seen that the need for environmental technologies and better resource efficiency in Europe is urgently required to reduce these amounts.

The performance of individual member states is shown in the Table 1.4¹⁸. This shows that with some exceptions, there has been a solid growth in waste arisings in most Member States from 1995 to 2003.

¹⁸ *ibid.*

Western Europe (municipal waste generation in kg per capita)									
	1995	1996	1997	1998	1999	2000	2001	2002	2003
Austria	437	516	532	533	563	579	577	611	612
Belgium	443	440	474	470	475	483	461	461	446
Denmark	566	618	587	593	626	664	660	667	675
Finland	413	410	447	466	484	503	465	456	450
France	500	509	516	523	526	537	544	555	560
Germany	533	542	556	546	605	609	600	640	638
Greece	306	344	372	388	405	421	430	436	441
Ireland	513	523	545	554	576	598	700	695	735
Italy	451	452	463	466	492	502	510	519	520
Luxembourg	585	582	600	623	644	651	648	653	658
Netherlands	548	562	588	591	597	614	610	613	598
Portugal	391	404	410	428	432	447	462	454	461
Spain	469	493	513	526	570	587	590	587	616
Sweden	379	397	416	430	428	428	442	468	470
United Kingdom	433	510	531	541	569	576	590	599	610
Iceland	914	933	949	967	975	993	1 011	1 032	1 049
Norway	624	630	617	645	594	613	634	675	695
Western Europe	476	499	513	518	546	556	560	575	580

Table 1.4: Per capita municipal waste in Europe

The increase in Ireland, from 513 kg per person per year to 735kg is of special concern.

With regard to the treatment of these growing waste volumes in Ireland, recent data¹⁹ has shown significant increases in recycling and decreases in landfilling – this can be seen in Figure 1.4. Thus environmental technologies and techniques are being applied for segregation, separate collection and recovery.

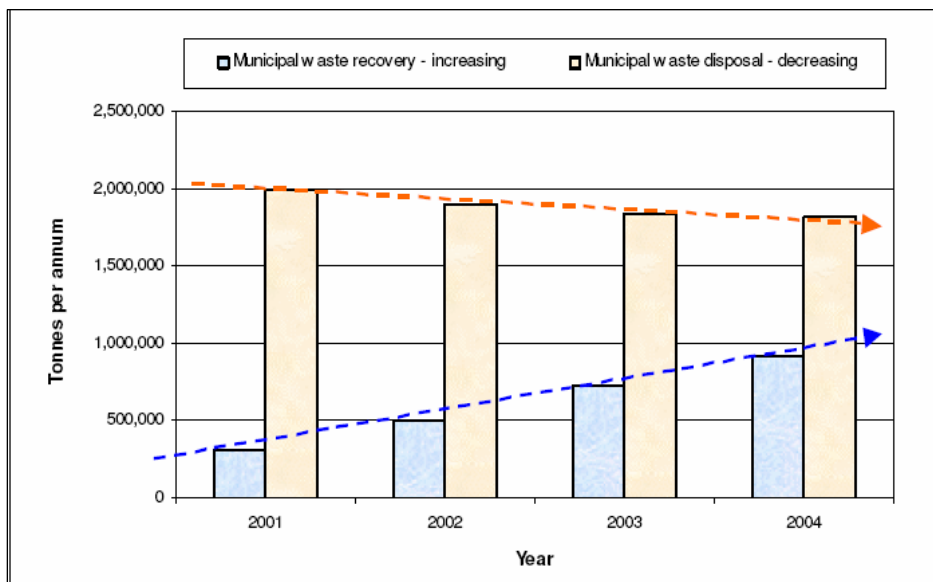


Figure 1.4: Waste recovery in Ireland 2001 - 2004

¹⁹ EPA National Waste Report 2004 2005

While the actual quantity of municipal waste landfilled has decreased by 0.8% since 2003, the quantity of material recycled has increased by 26.5% in the same period. This has a positive effect on the municipal waste recovery rate. This results in an overall increase in municipal waste recovery from 28.4% in 2003 to 33.6% in 2004, a significant improvement.

The quantity of municipal waste recycled in 2004 was 893,248 tonnes, a recycling rate of 32.6%. With a national target of 35% municipal waste recycling by 2013, Ireland is well on the way to achieving this. However, there is no room for complacency – Ireland is still far behind other Member States with regard to recovery and recycling and further progress is required, both in terms of quantities and of the quality of the recovery.

One matter of concern with regard to waste related environmental technologies is the strong dependence on recycling infrastructure abroad for processing recyclable waste streams generated in Ireland (with the exception of wood) and this dependence has grown in recent years. Since the closure of old processing facilities for glass steel and paper, a large quantity of these materials is exported for reprocessing. In 2004, a total of 480,802 tonnes of metals were exported for reprocessing predominantly to Spain (72.4%) and the UK (22%). The UK was the principal destination for paper reprocessing, accounting for 41% of the total, while a significant quantity, accounting for 23%, was exported to Asia.

For this reason Ireland needs to move toward greater independence with regard to waste treatment and recovery. The work of the Market Development Group should be actively supported, from a financial and human resource point of view and progress should be measured by new and increased recycling of waste in Ireland. However, it should be noted that clean, segregated recyclable materials are a sought-after resource which are traded freely under EU law. With regard to hazardous waste, a higher percentage of this stream is exported for treatment and disposal (there is still some recovery and treatment in Ireland) and Ireland's self sufficiency is low.

2. Agriculture

2.1 Introduction

About 50% of the European Union's (EU's) land is farmed.²⁰ This highlights the importance of farming for the EU's natural environment. Farming and nature exercise a profound influence over each other. Farming has contributed over the centuries to creating and maintaining a variety of valuable semi-natural habitats. Today these shape the majority of the EU's landscapes and are home to many of the EU's richest wildlife. Farming also supports a diverse rural community that is not only a fundamental asset of European culture, but also plays an essential role in maintaining the environment in a healthy state.

The links between the richness of the natural environment and farming practices are complex. While many valuable habitats in Europe are maintained by extensive farming, and a wide range of wild species rely on this for their survival, agricultural practices can also have an adverse impact on natural resources. Pollution of soil, water and air, fragmentation of habitats and loss of wildlife can be the result of inappropriate agricultural practices and land use. EU policies, and notably the common agricultural policy (CAP), are therefore increasingly aimed at heading off the risks of environmental degradation, while encouraging farmers to continue to play a positive role in the maintenance of the countryside and the environment by targeted rural development measures and by contributing to securing farming profitability in the different EU regions.

This pollution potential, as well as the demands that agriculture puts on finite resources and energy means that the application of environmental technologies is vital in this sector. Agriculture also has great potential in the development of renewable energy sources and fuels.

As can be seen from the information below, the level of uptake of environmental technologies and best practice in agriculture varies greatly from country to country. Several supports and initiatives have been implemented widely and these continue, especially in Europe with changes in the Common Agricultural Policy. Ireland too has implemented a number of policies, but the continuing dependence on nitrates and phosphates, the energy intensity of Irish agriculture and the relative low uptake on organic farming leaves room for improvement.

2.1.1 Potential Impacts

The potential for agriculture to impact on the environment and nature is widespread and varied. All the following areas are considered as part of EU regulations and policy and are monitored regularly with a view to trends:

- **Water use:** Agriculture can have a high demand on water use for livestock and irrigation. The irrigable area in the EU-12²¹ increased from 12.3 million ha to 13.8 million ha between 1990 and 2000, i.e. by 12%²².
- **Input use and water quality:** Nutrient surpluses, as measured by gross nitrogen balance, have generally decreased in the EU-15 between 1990 and 2000. Current nutrient surpluses range from 37 kg N/ha in Italy to 226 kg N/ha in the Netherlands, with four EU Member States showing surpluses above 100 kg N/ha/year (Netherlands, Belgium, Luxembourg and Germany). Since 1990, nitrogen surpluses increased in Spain (47 %) and Ireland (22 %). This increase in Ireland is of special concern and shows the need for implementation of the Nitrates Directive here. Regional concentrations of livestock linked to intensive pig and dairy production are found in the west of Germany, the Netherlands, Belgium, Brittany, northwest and northeast Spain, the Italian Po valley, Denmark, the west of United Kingdom and southern Ireland.
- **Land use, farm management (practices) and soils:** areas most at risk to soil erosion are in Spain, Portugal, Greece and Italy, however with over grazing in Ireland this has

²⁰ European Commission DG Agriculture *Agriculture and the environment* 2003

²¹ Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Luxemburg, Portugal, Spain, the Netherlands, the United Kingdom

²² European Environment Agency *Agriculture and environment in EU-15 – the IRENA indicator report* 2005

also been an issue. In 2000 approximately 56% of the EU-15 arable land was covered 70% of the year. 24% of the arable land was covered 80% of the year.

Human and animal health can be negatively affected through direct exposure (e.g. industrial workers producing plant protection products and operators applying them) and indirect exposure (e.g. via their residues in agricultural produce and drinking water, or by exposure of bystanders or animals to spray drift) to pesticides. Soil and water may be polluted via spray drift, dispersal of pesticides into the soil, and run-off during or after cleaning of equipment, or via uncontrolled disposal.

- **Climate change and air quality:** While agriculture contributed around 10 % of total greenhouse gas emissions in EU-15 in 2002 it can also function as a sink for CO₂. The main greenhouse gases emitted by agriculture are nitrous oxide and methane, both of which have a far greater global warming potential than carbon dioxide. Agriculture also consumes fossil fuels for farm operations, thus emitting carbon dioxide. Emissions of greenhouse gases by the agriculture sector — methane and nitrous oxide — have fallen by 8.7 % between 1990 and 2002. Within the EU-15, emissions of ammonia from agriculture have also decreased by 9 % between 1990 and 2002 but the sector still provides more than 90 % of total ammonia emissions. In 2003 agriculture contributed 3.6 % of total renewable energy produced and 0.3 % of total primary energy produced in the EU-15. The potential for agriculture, with the help of environmental technologies to produce energy is discussed in more detail in the energy chapter and is significant.
- **Biodiversity:** Extensive farming systems are important for maintaining the biological and landscape diversity of farmland, including Natura 2000 sites. Such systems have been threatened, however, by two different trends: intensification and abandonment. The decline in the proportion of 'mixed livestock' farms by about 25 % from 1990 to 2000 is particularly significant since these farms are often associated with high biodiversity and landscape quality and form part of high nature value (HNV) farmland. HNV farmland areas are mainly found in Mediterranean regions, upland areas in the United Kingdom and Ireland, mountain areas and parts of Scandinavia, and are estimated to cover around 15–25 % of total agricultural area in the EU-15. The majority of farmland birds have suffered a strong decline from 1980 to 2002. This decline has levelled off in the 1990s but species diversity remains at a very low level in intensively farmed areas.

2.2 European Union

The balance between competitive agricultural production and environmental protection is a core objective of the European Union and several regulations, policy documents and initiatives have been implemented to meet this goal.

2.2.1 Legislation/Policy Instruments

Common Agricultural Policy

Two major reforms of the CAP in the 1990s have taken increasingly into account the importance of the environmental dimension of farming. Several regulations have been issued to support these reforms.

The **reforms of 1992** marked a turning point in EU agricultural policy, not least in terms of integration of environmental concerns. Guaranteed prices for cereals, beef and veal were reduced and production limits continued or implemented for some commodities. Direct aid payments to farmers were introduced. Some important, specific measures to encourage environmentally friendly farming were enacted, for example: the agri-environmental regulation; and, the introduction of extensification premiums paid to beef producers claiming payments for low cattle stocking densities.

The **1999 CAP reform — part of the 'Agenda 2000'** package of EU reforms — pursued these initiatives further. In addition to further reforming market support it reorganised the CAP into two areas of activity:

- market policy (known as the ‘first pillar’ of the CAP);
- sustainable development of rural areas (the ‘second pillar’).

Integration of environmental requirements into the 1999 CAP reforms has been achieved via two major pieces of legislation. One, known as the ‘horizontal regulation’ (so-called because it covers all direct payments established under the CAP), requires account to be taken of environmental aims in the implementation of first pillar measures; the second — the rural development regulation consolidates earlier agri-environmental measures and adds to them, thereby covering the second pillar of the CAP.

Central to the new approach are the concepts of ‘cross compliance’, ‘direct income support’, ‘good farming practice’ and ‘modulation’.

Agenda 2000 maintained the nature of the agri environment schemes as being obligatory for Member States, whereas they are optional for farmers and implemented by contract. Member States are also required to set out codes of good farming practices in their rural development plans (under the second pillar).

The decoupling of payments from production and the replacement with a single payment is also expected to have a positive effect with the reduction of the environmental effects of intensive farming such as water pollution through over usage of fertilizer, over-grazing and reduction in methane emissions through lower animal numbers.

In regards to rural development policy, compliance with minimum environmental standards above Good Farming Practices (GFP) is compulsory in order to obtain any agri-environmental payments. GFP is the type of farming that a reasonable farmer would follow in the region concerned. This includes at least compliance with the Community and the national environmental legislation. GFP entails, for example, compliance with the requirements of the Nitrates Directive and the use of plant protection products. Good farming practice would obviously involve the use of environmental technologies that reduce environmental impact.

2.2.2 Information/Awareness Raising

The raising of awareness of environmental issues relating to agriculture is primarily achieved through industry groups and representatives in Member States and is outlined further below. However, the European Commission is also active in this regard.

The IRENA operation

To improve, develop and compile agri-environment indicators at the appropriate geographical level, the IRENA (Indicator Reporting on the integration of Environmental concerns into Agricultural policy) project was in 2002. The project is a collaborative effort between the Directorates General for Agriculture, Environment, Eurostat, Joint Research Centre and the European Environment Agency which is responsible for the co-ordination.

The IRENA operation has resulted in the following outputs:

- 40 indicator fact sheets and their corresponding data sets;
- an Indicator Report (“Agriculture and environment in EU-15 – the IRENA indicator report”) providing a comprehensive overview of the interactions between agriculture and the environment in the European Union (EU-15) based on the indicators developed and the DPSIR (Driving forces – Pressures – State – Impact – Responses) framework. Several thematic agri-environmental “storylines” are used to illustrate indicator results and to review the effects of farming on the environment. These are: water use and water resources; water quality and agricultural fertiliser and pesticide use; land use and soil; climate change and air quality and, landscape and biodiversity;
- an Indicator-based Assessment report on the integration of environmental concerns into the CAP.

The starting point of work in the IRENA operation was the set of 35 indicators defined in COM (2000) 20 and the assessments made by COM (2001) 144 concerning their state of development

and required further work. Building on the indicator work, IRENA regularly presents agri-environmental relationships using the Driving force — Pressure — State — Impact — Response (DPSIR) model. These relationships can be seen in the Figure 2.1.

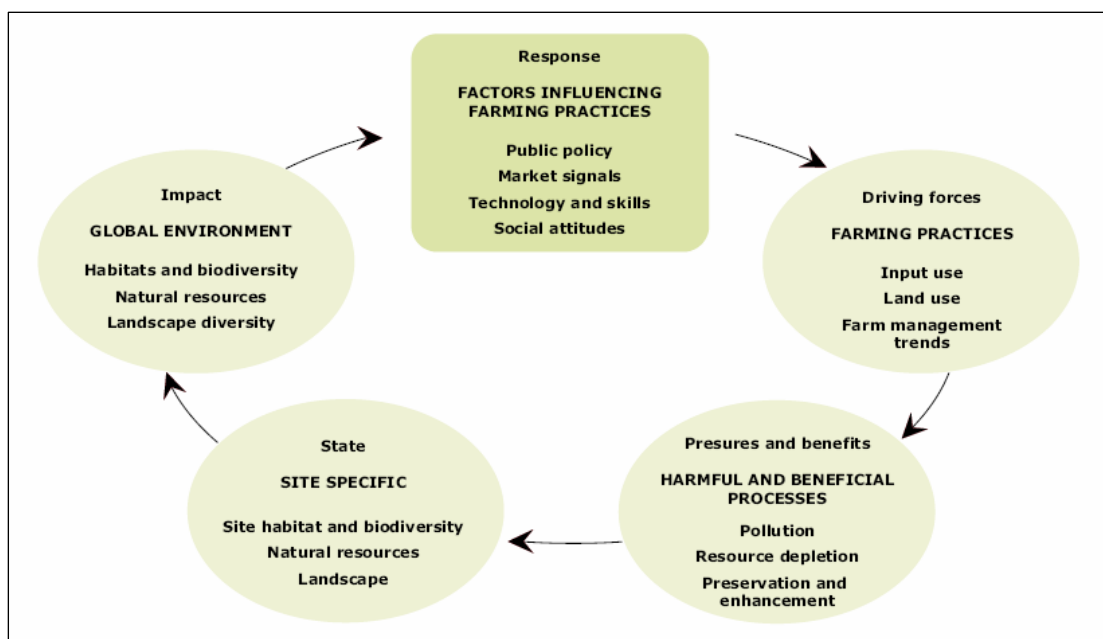


Figure 2.1: Overview of ARENA initiative

2.2.3 Grant Aid (Economic Instruments)

The European Union does recognize that where society asks farmers to accomplish environmental objectives beyond the reference level of good farming practices, and the farmer incurs, as a result, a cost or loss of income, society must pay for the environmental services provided through agri-environmental measures. Farmers who commit themselves, for a five-year minimum period, to adopt environmentally-friendly farming techniques that go beyond usual good farming practice, receive in return payments that compensate for additional costs and loss of income that arise as a result of altered farming practices. These programmes are usually implemented by Member States as described below.

2.3 Irish Initiatives

2.3.1 Introduction

Land usage in Irish agriculture is dominated by cattle and sheep with only 9% for tillage and 91% for grass, hay and rough grazing²³. The monitoring and regulation of the Irish agriculture sector is the responsibility of the Department of Agriculture and Food (DAF). In conjunction with government agencies it is also responsible for the provision of information and advice to the agricultural sector. As with all environmental issues the Department of the Environment is also involved in the regulation of this sector.

Agricultural sources accounted for some 300 of the 591 slightly polluted locations on Irish rivers surveyed in the 1998 - 2000 period, and for 213 of the 519 moderately polluted sites²⁴. Thus, agriculture accounts for 46% of these polluted river sites, which, in the vast majority of cases, are

²³ Department of Agriculture and Food 2003

²⁴ EPA Ireland's Environment Chapter 12: Eutrophication of Inland and Estuarine Waters 2004

impacted by eutrophication effects. In terms of the river channel length that is affected by eutrophication, 46% and 45% in the slight and moderate (eutrophic) categories, respectively, were due to agricultural sources in the 1991–1994 period.

As improved sewage treatment works are installed and industrial point sources are subjected to tighter controls, it is likely that the proportion of air and water pollution due to agriculture will increase if measures are not implemented to improve the current situation.

Over 70% of phosphorus reaching inland waters emanates from agricultural sources. The fact that almost half of Irish river channel length is impacted by agricultural eutrophication is not surprising when it is considered that phosphorus from agricultural sources accounts for over 70% of the total anthropogenic load to freshwaters in Ireland.

The situation in rivers would be worse but for the fact that a significant proportion of the phosphorus loss from agriculture occurs during the winter months. Plant and algal growth rates are lower in winter and therefore the resultant eutrophication impact is not as severe. The accumulation of phosphorus in lake, estuarine and marine sediments, however, occurs during such winter export 'events' and this build-up is a cause for serious long-term concern if sediments become saturated with phosphorus. This is especially so in the case of lakes that are subjected to large phosphorus inputs during the winter months, because lakes will retain most of this phosphorus loading in their sediments.

Over-fertilisation of grassland soils is widespread. A major long-term research project undertaken by Teagasc over a 30-year period demonstrated that more than three-quarters of all the phosphorus that was applied to grassland soils accumulated in the soil.

The Water Framework Directive requires that all the rivers, lakes, estuaries and ground waters have to be restored to good status by 2015. This results in a certain urgency in the attainment of this task. Therefore the importance of initiatives both compulsory and voluntary is essential to reduce the pollution risk to the water course. Water quality in general is discussed in greater detail in another chapter of this report.

2.3.2 Regulation and policies

Nitrates Directive

The Nitrates Directive (91/676/EEC) – *Council Directive of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources* – was adopted in 1991. This has the objective of reducing water pollution caused or induced by nitrates from agricultural sources and preventing further such pollution, with the primary emphasis being on the management of livestock manures and other fertilisers.

In order to limit the losses linked to agricultural activities, the main types of actions that the Nitrates Directive promotes (in Annexes II - Codes of Good Practice, and III - Actions Programmes) include:

- Crop rotations, soil winter cover, catch crops, in order to limit leaching during the wet seasons.
- Use of fertilisers and manure, with a balance between crop needs, N inputs and soil supply, frequent manure and soil analysis, mandatory fertilisation plans and general limitations per crop for both mineral and organic nitrogen fertilisation.
- Appropriate nitrogen spreading calendars and sufficient manure storage, for availability only when the crop needs nutrients, and good spreading practices.
- "Buffer" effect of non-fertilised grass strips and hedges along watercourses and ditches.

Water Pollution Act

This act enables local authorities to tackle pollution of farms by prescribing specific measures designed to stop or prevent such pollution. Each local authority can establish agricultural bye laws to tackle problem pollution activities. At present five counties in Ireland have implemented agricultural bye-laws and requirements under these bye laws include establishment of nutrient

management plans, specified deadlines for the spreading of manure and the recording of quantities of all fertilisers and chemicals. The provision of powers on a local level to local authorities in relation to the important issue of water pollution enables greater monitoring and subsequent control of the impact of agriculture in that region.

The practice of local authorities carrying out farm surveys assesses those farms which are of significant risk to the environment. These surveys are mainly concentrated on areas of non compliance and it has been found in some counties that pollution has improved in these areas, as a result of farm surveys and greater co-operation with the agricultural sector²⁵.

The control of phosphorus and its compounds is required under EU Dangerous Substances Directive and is covered under the Water Pollution Act – Article 4(4) of the Local Government (Water Pollution) Act, 1977 (Water Quality Standards for Phosphorus) Regulations, 1998 (S.I. 258 of 1998). These regulations require that water quality be maintained or improved based on baseline levels set out by the EPA in the review period 1995–1997. Current monitoring has found that, in the case of rivers, the water quality at 61.8% of the monitoring stations nationally is compliant with the Regulations. This represents an increase of 1.1% in compliance from the previous reporting period. A total of 56.8% of river stations meet the biological targets of the Regulations. This represents a decline of 1.4% in the number of stations meeting the biological targets of the Regulations from the previous reporting period (1998-2000).

Waste Plastic Recycling Programme

The Waste Management (Farm Plastics) Regulations 1997-S.I. No. 315 of 1997, updated 2001, places obligation on all manufacturers, importers and suppliers of farm plastics, in the form of silage sheeting and vane wrap, to arrange for the collection and recovery of waste farm plastics. This is also discussed in the chapter on waste. It is proposed to extend the scheme to other waste streams such as fertilizer bags and chemical containers.

Waste farm plastics recycling scheme are operated in a number of countries including Scotland and the UK. However these schemes operate on a voluntary basis with payment by farmers to remove the plastics. A similar scheme to the Irish model is currently being developed by the UK and would also be based on producer responsibility for collection²⁶.

IPPC Licencing of Intensive Pig and Poultry facilities:

Under the Environmental Protection Agency Act, 1992 and the Protection of the Environment (POE) Act 2003 intensive pig and poultry facilities are required to operate under an IPPC licence issued by the Environmental Protection Agency (EPA). IPPC licencing by the EPA is aimed at controlling pollution from these more intensive sectors of agriculture. Strict limits are applied to each facility in regard to emissions to all media. Another positive feature of the licence is that a Nutrient Management Plan is required for all facilities reducing the risk on pollution on the water course through manure spreading. The EPA has to date issued 94 new and revised intensive farming licences with 3 facilities currently applied for new licences.

2.3.3 Grant Aid (Economic Instruments)

Farm Waste Management Scheme

The principal objective of the Scheme is to assist farmers meet new requirements under the European Communities (Good Agricultural Practice for Protection of Waters) Regulations 2005 (S.I. No. 788 of 2005). These Regulations give legal effect to Ireland's National Nitrates Action Programme under the EU Nitrates Directive.

The scheme provides grant-aid for facilities for the collection and storage of animal excreta, soiled water and other farmyard manures. It also covers the use of new equipment for the application of these materials to farmland. It has been found through farm surveys that slurry

²⁵ Environmental Protection Agency *Phosphorus Regulations National Implementation Report*, EPA 2005

²⁶ DEFRA- <http://www.defra.gov.uk/Environment/waste/topics/agwaste.htm>

storage deficit is a major problem for Irish farms with estimations that 85% of dairy and specialist beef farms have a slurry storage deficit, with the majority of farms having a 50-75% deficit. The upgrading of on-farm infrastructure will enable farmers to meet the necessary storage capacity for slurries and ultimately reduce the risks of effluent runoff from poorly constructed and managed storage facilities, and the possible leakage into the water course

Rural Environment Protection Scheme (REPS)

REPS is a scheme which rewards farmers for carrying out their activities in an environmentally friendly manner. The main objectives of the scheme are:

- To establish farming practices production methods which reflect the increasing concern for landscape protection, conservation and wider environmental issues
- To protect wildlife habitats and endangered species of flora and fauna
- To produce food of a high quality in an extensive and environmentally friendly manner.
- To carry out farming activities for a five year period in accordance with an agri-environmental plan prepared in accordance with the Scheme document and agri-environmental specification

Farmers involved in the REPS scheme are required to have an agri-environmental plan, specific to their own farm prepared by a registered planner. This outlines specific environmental measures to be undertaken in their facility. REPS incorporates eleven basic environmental measures which are of benefit to all natural resources and include:

- use of a nutrient management plan prepared for all areas of the farm
- adoption of an appropriate grassland management plan for all areas of the farm to deal with over grazing
- protection and maintenance of all watercourses and wells
- retainment of all wildlife habitats
- maintainment of all farm and field boundaries
- the elimination of all herbicides, pesticides and fertilizers in and around hedgerows, lakes, ponds, rivers and streams
- protection of features of historical and/or archaeological interest
- produce tillage crops: without burning straw or stubble; leaving a specified field margin uncultivated where no nutrients or sprays are applied;
- become familiar with environmentally friendly farming practice

Farmers receive an annual premium per hectare and can receive further payments for meeting other conditions such as the setting aside of land for 20 years and the farming of land in areas of special conservation, natural heritage or water sensitive areas.

REPS is co-financed 75% by the EU and 25% by the Irish Exchequer. The scheme which has been in operation since 1994 is currently in its third installment, REPS 3. REPS 3 has an increased emphasis on biodiversity in comparison to REPS 2 and encouragingly has had an increase in uptake with 48000 farmers currently involved in the scheme.

The need for participants of REPS to undertake a nutrient management plan is of vital importance in the fight against the pollution of waterways and will be of primary benefit in the obtainment of compliance with the Nitrates Directive.

Participants in the scheme are required to undertake a specified number of hours of training with subsidies paid upon its completion.

An evaluation of REPS has found that REPS farms continue to support similar stocking rates to the non-REPS counterparts while utilizing significantly less fertilizers²⁷. Monitoring of the Lough Derg and Lough Ree catchment areas through the Lough Derg and Lough Ree Monitoring and Management Project suggests a significant relationship between the water quality improvement in this area and the implementation of REPS measures. It was found that 63% of the measured river quality improvement in this catchment area occurred in areas of high REPS uptake, where these areas occurred for only 27.8% of the overall catchment area. Further analysis is needed to evaluate the actual benefit of the REPS scheme in water pollution prevention.

One area of further concern is the fact that REPS is not attractive to the more intensive agricultural operations which exert the most pressure on the environment. Further studies on incentives to encourage these large farms to participate in REPS should be carried out. Alternatively increased monitoring of these facilities through farm surveys by local authorities should be encouraged. The inclusion of other categories of intensive agriculture farms such as dairy and livestock farms under IPPC licensing should also be investigated.

2.3.4 Awareness / Information

The promotion and awareness of different legislation, initiatives and measures is carried out by DAF. This is achieved through a number of measures;

- the publishing of information in leaflet forms distributed through regional offices
- publications of ads highlighting schemes in farming and agricultural publications and
- the direct circulation to farmers of important information.

Under the Agenda 2000 agreement, all farmers receiving payments under various direct payment schemes must practice farming in accordance with certain environmental requirements. In response to this requirement the Department of Agriculture and Food published a Good Farming Practice booklet in 2001 which was circulated to all farmers.

It is estimated that some 130,000 farmers will be subject to GFP in the period 2000 – 2006. Semi-state research agencies such as Teagasc (see below) and farmer representative groups such as the Irish Farmers Association (IFA) also provide outlets for information to the agricultural sector.

The IFA also publishes advisory information and promotes environmental initiatives for its members. The recent agreement with Airtricity (a provider of wind powered electricity in Ireland) to obtain reduced electricity rates for their members is one example of an indirect environmental measure undertaken by the farming community.

Printing of ads highlighting schemes in farming and agricultural publications is also a method of supplying information to the agricultural community.

In specific schemes such as REPS the necessity to carry out a minimum number of hours of training and the publication of leaflets highlighting extra benefits to be achieved for undertaking more environmentally friendly practices above those required in the REPS plan such as organic farming and biodiversity measures.

Teagasc

Teagasc provides integrated research, advisory and training services for the agriculture and food industry in Ireland. Teagasc has developed close alliances with research, advisory and training agencies throughout the world in order to identify and promote best practice.

Around 75% of Teagasc's yearly budget comes from the Irish exchequer and EU funding with the balance generated from earned income. Some 40% of the budget is devoted to research with the remainder split half and half between advisory and training services

Teagasc employs over 1,500 staff at over 100 locations throughout Ireland.

²⁷ Regan, Sean *REPS Review and Outlook Based on Teagasc National Farm Survey* Teagasc, 2002

- Research services are provided by 200 research scientists and 300 research technicians at nine dedicated centres.
- There are 550 advisors and regional specialists located at regional, county and local offices.
- The eight colleges and local training/research centres are staffed by college lecturers, technicians and education officers.

Teagasc with its countrywide teams of enterprise advisers, planners and environmentalists supported by specialist and research staff provide a comprehensive range of environmental services. These include:

- **Rural Environment Protection Scheme (REPS)**, Planning and Support Services (described above)
- **Nutrient Management Planning - Nutrient Management Planning** aims to protect the quality of water resources by avoiding pollution from agriculture. Teagasc advisory staff are trained in Nutrient Management Planning (NMP) and can provide plans to meet the needs of local authorities and for tax relief.
- **Biodiversity/Natural Heritage** - Teagasc advisory services focus on increasing awareness of biodiversity. This includes the importance of designated areas from an environmental point of view and how to adapt farming practices to protect them
- **Schemes of Investment Aid for Farm Waste Management and Dairy Hygiene** - Teagasc advisers play a role in ensuring that farmers can avail of these schemes by offering an advisory and planning facility to eligible farmers
- **Farmyard Planning and Design** - Teagasc advisers have extensive experience of the planning and layout of new buildings. Teagasc advisers will design buildings that are cost effective, have minimal adverse impact on the environment and meet current criteria in relation to animal welfare

Teagasc also carries out environmental research to reduce the impact of agriculture on the environment. The aim of the programme, carried out at Johnstown Castle Environment Research Centre, is to provide the necessary technical information to support the implementation of the sustainability concept in agriculture and provide the scientific basis for environmental conservation. The goal is to develop farming systems that allow farmers optimise production efficiencies while minimising the impact on the environment.

The programme focuses on quantifying the environmental response of various agricultural systems, including organic systems; quantifying the relationship between soil and fertiliser nutrients and grassland and crop responses and formulating guidelines for sustainable use of all nutrient sources in agriculture; and applying modelling to assess the environmental risk of agricultural activities in different geographic locations.

EPA Research

An in-depth knowledge of soil conditions is of utmost importance in regard to the prevention of pollution of waterways by minerals used in agriculture. This information is of critical importance in the determination of such issues as the nutrient uptake by crops and the pathways of nutrients through the soil in different weather conditions. Through an in depth knowledge of these factors specific nutrient plans can be developed for areas reducing the over application of manure and artificial fertilizers.

Due to the importance of this knowledge a wide number of projects have been funded by the Environmental Protection Agency with a combined budget of over €1.2 million. These projects which are being undertaken by semi-state advisory groups and third level institutions include;

- The establishment of a national soils database
- Regulation and assessment of N-mineralization in grassland soil
- Eutrophication from Agriculture Sources (Phosphorus and Nitrogen) – Environmental Soil P test

EPA funded research has also been undertaken in regard to a number of environmental areas of agricultural interest. These are primarily concerned with the treatment of animal waste and the production of biofuels and energy crops. Outlines of these research programs are listed below:

- ***Energy Crops - Have They a Future?***

This research undertaken by Teagasc looked at the use of the different biofuels in Ireland. In comparison to other European countries such as Austria, France, Denmark and Germany where biofuels usage are established industries, Ireland has made little progress on these areas. This research identified a number of input materials such as easily obtainable waste materials and also details the acreage of biofuels needed to meet particular demands

- ***Opportunities for Biomass as Fuel***

This report outlines the opportunities for biomass fuel in Ireland. Short term sources such as agricultural and wood wastes are identified along with recommendations on suitable incentives such as a “carbon premium” payment of €45/ha for biofuel production on eligible land under the CAP reform.

- ***A biotechnological system for production of value-added products, bioethanol and methane from non-animal food wastes with emphasis on hygiene aspects.***

- ***Environmentally Sustainable Conversion Options for Large Volume Organic Wastes***

The aim is to develop innovative practical cost-effective treatment/ technologies/ management systems for large volume priority organic wastes that will minimise and abate the impact of land spreading activities.

- ***Environmentally Sustainable Conversion Options for Large Volume Organic Wastes***

The objectives of the project were to develop and evaluate the market potential of a range of compost fertiliser products derived from mixtures of separated pig slurry solids and other biodegradable wastes. It was undertaken by a consortium of public organisations and private businesses with 50% co-funding from the EPA and DEHLG.

It was found that the addition of mineral fertilizers such as sulphate of ammonia, rock phosphate and sulphate of potash was needed to stimulate nutrient ratios. It was found that the final material was of a suitable consistency to be used commercially and was viewed to have many admirable properties

The EPA has also prepared a discussion document on the suitability of anaerobic digestion for waste management: *Anaerobic Digestion: Benefits for Waste Management, Agriculture, Energy, and the Environment*. This paper discussed the merits of Anaerobic Digestion (AD) for agricultural waste management with the production of a substance with a lower pollution potential and higher plant uptake than raw slurries. It also highlights the production of biogas as a clean energy source and the benefits of this practice in regards to meeting targets set for the Nitrates Directive, Kyoto Protocol and Renewable Energy²⁸. The report determined that a centralized AD facility, with suitable support measures would be viable.

²⁸ <http://www.epa.ie/NewsCentre/ReportsPublications/DiscussionPapers/FileUpload,6077,en.pdf>

Sustainable Energy Ireland²⁹ has also investigated the area of Anaerobic Digestion with a pilot plant on a 200 dairy cow farm. Based on estimates for the selling prices of excess electricity, hot water and compost as well as reduced waste costs the facility was deemed to be financially viable with a payback of 3 years.

All of the above environmental technologies related to agriculture have potential to reduce the environmental impact of that sector and begin to produce renewable energy sources.

Alternative Crops

Farmers are being urged to consider growing alternative crops that have potential in non-food sectors. Such crops can be suitable for energy purposes, for fuel and more recently for building materials. One use of wool, for example, is in insulation for housing and it has many advantages over other non-renewable insulation materials³⁰.

Some Irish farmers now grow hemp under licence for use as insulation material in buildings³¹.

Hemp – a sustainable crop

Henry O'D Thompson, owner of OldBuilders, a contracting company with specialist skills in lime mortar plastering and eco-friendly hemp applications, is behind the move to hemp.

Based in Birr, Co Offaly, the restoration and conservation company has just finished a hemp and timber frame extension to an old cottage restoration in the Ring Gaeltacht, near Dungarvan, Co Waterford. They also used hemp for insulation in a workshop and sunroom in Dunlavin, Co Wicklow, and an office building in Clones, Co Monaghan. Their next project is an octagonal house in Tulla, Co Clare. Growing hemp could be a substantial cash crop alternative for Irish farmers, as EU subsidies for other products are phased out, according to Mr Thompson.

"In France, thousands of hectares are now dedicated to hemp production. We are being left behind," he said.

He explained that for farmers to grow hemp, a licence is required. But, in order to obtain one, an end use for the product must be specified. A processor is sufficient, but none exists in Ireland because demand is minimal. This is due to the high cost of the materials, which must be imported, and the high labour needs. About 40% of the current price of hemp in Ireland is shipping cost.

"OldBuilders believes that hemp has a viable future in mainstream construction, and we are making a strong financial commitment, with the assistance of financial partners and Offaly LEADER in mechanising the hemp building process," said Mr Thompson.

He said it was regrettable that hemp has not been widely supported in Ireland as it has been by the French and other European governments. "Hemp grows to maturity in 100 days. It is an ideal rotation crop, and conditions the soil for future crops, with its long root system. Because of the dense growth, it kills off weeds below it, reducing the need for herbicides in any follow up crops."

He said a hemp crop requires little if any pesticides, herbicides and fungicides. It is both bio-degradable and non-toxic, and can typically grow where cereals are produced.

Hemp could replace many of the needs for cotton. Mr Thompson said the use of hemp in construction has been led by the French for the last 10 years. Some 5,000 to 6,000 houses have been built in Europe, with hemp used for insulation. The use of hemp fibres in plaster has its origins going back to the Romans. "The use of lime and organic materials was widely used in Ireland prior to the arrival of the Normans, when timber frame building was the common form for non-ecclesiastical buildings," said Mr Thompson.

He said hemp is one of the world's strongest natural fibres. It has been used to make cloth and rope for over 10,000 years. "Indeed, archaeologists believe hemp to be the first plant grown for reasons other than food. Hemp can be used to make virtually anything that is currently made out of cotton, timber or petroleum. In America, the original Levi's jeans were made from hemp. George Washington and Thomas Jefferson both grew hemp. Jefferson drafted the Declaration of Independence on hemp paper. Until 1883, more than 75% of the world's paper was made with hemp," he said.

²⁹ Renewable Energy Best Practice Case Study – Irish Energy Centre, Renewable Energy Information Office
Anaerobic Digestion at Ballyshannon Farms

³⁰ www.sheepwoolinsulation.ie

³¹ *Irish Examiner Farming Supplement* Thursday April 6, 2006

2.4 Other Countries

2.4.1 European Union

Figure 2.2³² shows the expenditure by type from the European Agricultural Guidance and Guarantee Fund (EAGGF) for member states of the EU – 15. From this it can be seen that four methods of expenditure have been measured. The main support for agriculture is through agri-environment schemes, which are prominent in Sweden, Austria, Italy and Finland. The support of less favoured areas is also strong in Greece, Finland, Portugal and Ireland. Support for forestry is also strong in Spain Portugal, UK and Ireland – in the case of Ireland this is unsurprising as the relative land cover (between 9% and 10%) is quite low. All of the above measures are not widely used in very intensive and small agricultural area countries such as Belgium, Netherlands, and Denmark, as well as in Greece.

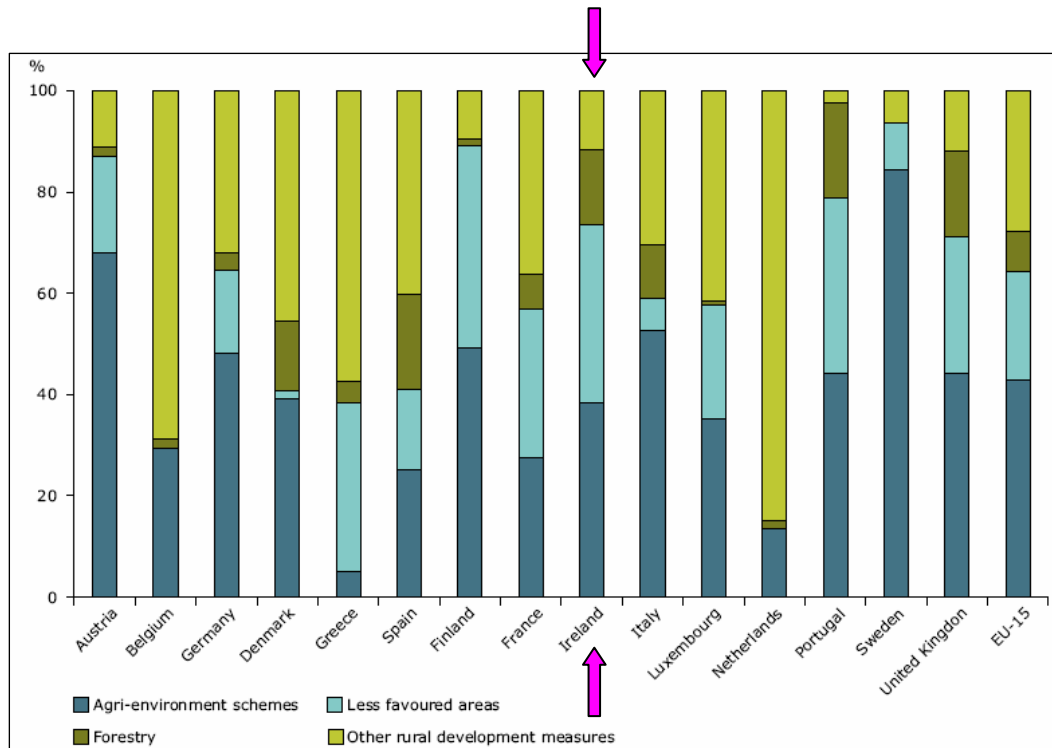


Figure 2.2: Total EAGGF-Guarantee expenditure by type of rural development measure (2003)

Figure 2.3³³ shows the share of agricultural area (UAA) enrolled in agri-environment schemes between 1998 and 2002. Though each country has different aspects to their environment such as number of farms, landscape and population and correspondingly have different needs for the funds available under the European Agricultural Guidance and Guarantee Fund it can be seen that those countries that provide a large proportion of their budget to agri-environmental schemes have significantly above average proportion of agriculture land involved in agri-environmental schemes. Luxembourg is the only country not supporting this measure and it must be presumed that other factors such as legislation or policies have resulted in the high uptake.

³² European Environment Agency *Integration of environment into EU agriculture policy — the IRENA indicator-based assessment report*. EEA, 2006.

³³ *ibid.*

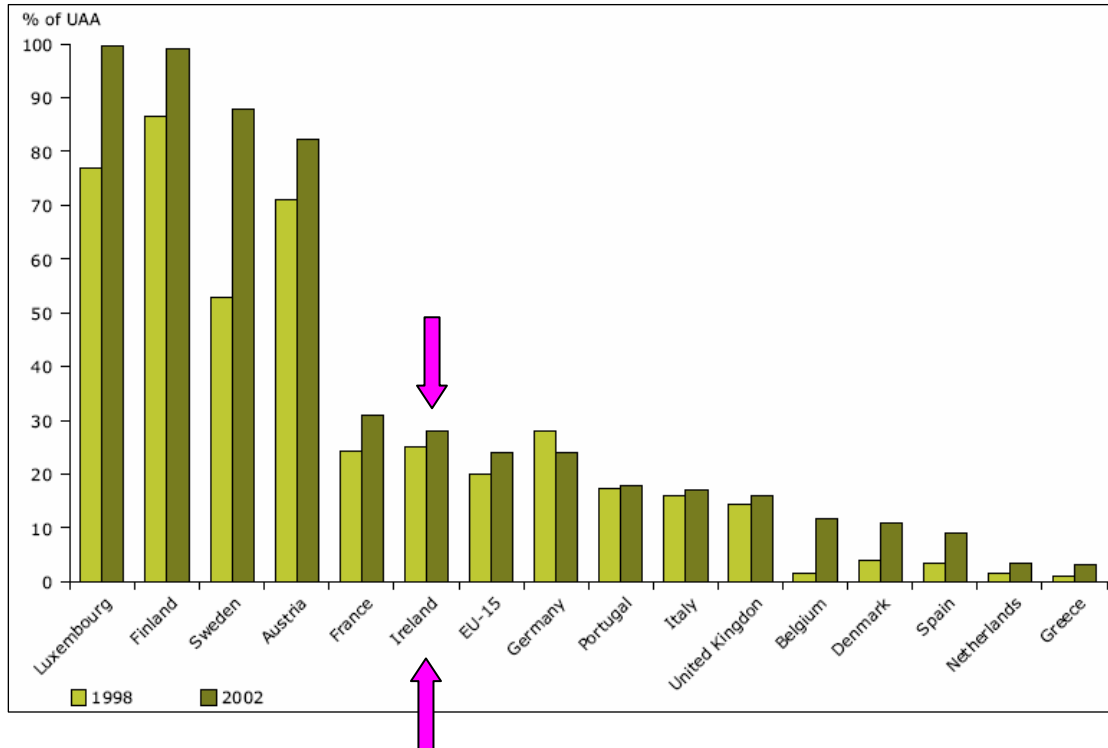


Figure 2.3 Share of agricultural area (UAA) enrolled in agri-environment schemes (1998–2002)

With regard to organic farming the following Table 2.1³⁴ shows the level of uptake of this environmentally friendly option. From this table it can be seen that Austria has the highest level of take-up and Cyprus, Poland and Ireland are among the lowest. Some supports in Austria regarding this take-up are discussed further below.

EU countries	As of	Areas under organic farming (ha)	%	No. of Organic farms	%
Austria	31/12/2004	344,916	13.5	19,826	11.2
Belgium	31/12/2003	24,163	1.73	688	1.1
Cyprus	31/12/2004	180	0.13	45	
Czech Rep.	31/12/2004	263,799	6.2	836	2.2
Denmark	31/12/2004	159,915	5.94	3,166	5.5
Estonia	31/12/2004	46,016	5.17	746*	1.9
Finland	31/12/2004	162,024	7.31	4,983	6.6
France	31/12/2004	540,000	2	11,025	1.7
Germany	31/12/2004	767,891	4.5	16,603	4.1
Greece	31/12/2003	244,455	6.24	6,028	0.7
Hungary	31/12/2004	128,690	2.2	1,420	3.7

³⁴ Federal Ministry of Agriculture, Forestry, Environment and Water Management *Organic Farming in Austria* 2005

Ireland	31/12/2003	28,514	0.65	889	0.6
Italy	31/12/2004	954,361	6.2	40,965	1.9
Latvia	31/12/2004	48,000	1.94	764	
Lithuania	31/12/2004	42,000	1.21	1,171	1.7
Luxembourg	31/12/2003	3,002	2.00	59	2.0
Malta	2003	14		20	
Netherlands	31/12/2004	48,155	2.17	1,469	1.4
Poland	31/12/2004	82,730	0.5	3,760	0.2
Portugal	31/12/2003	120,729	3.17	1,196	0.3
Slovakia	31/12/2004	53,091	2.4	117	1.6
Slovenia	31/12/2004	23,280	4.6	1,400	1.6
Spain	31/12/2004	733,182	2.9	17,688	1.4
Sweden	31/12/2003	225,776	6.83	3,562	4.2
United Kingdom	31/12/2004	690,269	4.39	4,010	1.7
EU total as per 28/8/05		5,735,152	3.47	142,436	1.5

Table 2.1 Organic Farming levels in EU

2.4.2 United Kingdom

The Department of Environment, Food and Rural Affairs (DEFRA) provides a number of agri-environment issues, schemes and initiatives. These are aimed at improving the water quality, climate changing gas emissions and land quality.

Environmental Stewardship is a new agri-environment scheme which provides funding to farmers and other land managers in England who deliver effective environmental management on their land. The scheme is intended to build upon the success of previous schemes such as the **Environmental Sensitive Areas Scheme** which has been largely successful in its primary objective of maintaining biodiversity, landscape and historic areas. The environmental stewardship scheme has three levels with increasing complexity of measures and corresponding increased funding.³⁵

The contribution of agriculture to green house gases primarily through methane emissions from sheep and cattle is an area which has been researched by DEFRA. A document titled *Climate Change and Agriculture in the United Kingdom* summarises the results of seven years of research on the impacts of climate change compiled by a group of 13 research organisations and explains the likely implications for the agricultural industry. It provides information on the new climatic and market conditions that may be experienced and enables farmers to consider strategies that will maintain or enhance their ability to anticipate climate change in their decision-making and take steps to reduce emissions of greenhouse gases.

The UK also operates a number of schemes to encourage farmers to grow biomass crop. **The Energy Crops Scheme (ECS)** provides establishment grants for two energy crops, short-rotation coppice (SRC) and miscanthus, and aid to help growers set up producer groups. However this scheme stipulates that grants will only be paid if the farmer can prove that they have or will have an energy end use for the crops.

³⁵ http://www.defra.gov.uk/erdp/pdfs/esaspdfs/monitoring_april_03_exec.pdf

The UK Pesticides Safety Directorate set up a pilot scheme to investigate the best practice for processing applications for alternative control products in 2004. The scheme covered pheromone products, plant extract products and products containing a biological organism.

This encouraged and assisted applications for alternative control products. Three products successfully gained approval:

- a pheromone to control codling moth in apple and pear orchards,
- a virus for protection from damage caused by virulent Zucchini Yellow Mosaic Virus (ZYMV) infection of Cucurbits, and
- a fungal agent for the control of *Sclerotinia sclerotiorum* and *Sclerotinia minor* on susceptible protected and outdoor agricultural, horticultural and ornamental crops.

Following the success of the pilot scheme, a permanent Biopesticide scheme was launched in March 2006 to facilitate more alternative products to enter the market. Key elements of the scheme are:

1. The appointment of a 'Biopesticide Champion' (Lisa Moakes), who will provide initial contact for product innovators/manufacturers, and help them through the approval process.
2. The provision of specific guidance to applicants (via free pre-submission meetings) identifying the best way forward. Potential applicants are encouraged to contact the scheme at the earliest possible stages of product development.
3. The provision of more accessible information on the regulatory process with a new Biopesticide area on our website. This will be developed considerably over the coming months.
4. Reduced costs for evaluations.

Novel feed trials prevent methane production in livestock³⁶

The Rowett Research Institute in Aberdeen, UK, has devised a method which is hoped will reduce methane emissions in cows and other animals. Methane is a powerful greenhouse gas, with 32 times the global warming potential of carbon dioxide. A single cow can produce up to 500 litres of methane per day, mostly through belching the gas.

The institute has developed a feed additive which cuts the quantity of methane produced by the animals by 70% in trials on sheep. The additive, fumaric acid ($C_2H_2(CO_2H)_2$), effectively reduces the production of methane by trapping hydrogen before methanogenic microbes are able to turn it into methane.

The trials have exceeded the expectations of the group, and it has subsequently submitted a patent for a commercial feed. The Rowett Research Institute has previously carried out research on reducing livestock methane gas emissions with funding from the EU's Fifth Framework Programme.

Dr John Wallace, who led the research, said: 'This is great for the environment, but it's a win-win situation as the farmer also benefits because the energy in that methane is retained in the animal's body. It means the animals grow 10 per cent more efficiently. For every kilogramme of feed they consume, they produce 10 per cent more body weight.'

The team hopes that the results noted in sheep will be replicated in cows, and that thanks to the positive impact on the bodyweight of livestock, farmers will be persuaded to invest in a feed that will have a positive impact on the environment.

2.4.3 Germany

The German region of Baden-Württemberg has introduced a floristic field method in its agri-environment scheme (the 'MEKA programme') to additionally reward farmers according to the plant diversity of grassland sites. The method, co-initiated by BirdLife Germany, ensures that farmers receive extra agri-environment payments for grassland sites that contain at least four

³⁶ http://www.rowett.ac.uk/press/Reducing_Methane_JWallace.htm

plant species from a catalogue of 28 species. To simplify identification, the catalogue includes only herbal species but no grass species since these are more difficult to identify.

The farmers receive a leaflet with colour pictures of all mentioned species in order to identify these themselves. A reward of €50 per hectare is given if at least four of the species are found along a diagonal transect (one metre wide) of the plot, which has been divided into three pieces (each piece must contain the species). The site can also be divided into smaller plots according to natural boundaries. The farmers submit the information on their species-rich grassland in the frame of their scheme applications.

However, a control system with spot checks is maintained by the regional authorities. In spite of initial skepticism among farmers and authorities, the new approach has been introduced successfully and effectively encourages farmers to better incorporate nature conservation objectives into their grassland management

2.4.4 Denmark

Since 1985, a number of national action plans have been implemented in Denmark to reduce nitrate leaching from agriculture. The main instruments to ensure the objectives of the Danish action plans are met are:

- mandatory fertiliser and crop rotation plans at farm level, with limits set on the nitrogen amounts that can be applied to different crops, and
- statutory norms that set maximum values for the utilization of nitrogen in manure assumed to be plant available.

These two instruments have been reinforced several times, for example with the 1991, 1998 and 2000 restrictions of the norms for the utilization of nitrogen in manure. In addition, a large effect has been achieved through improved feeding regimes, which has had a remarkable effect on the utilization of animal feedstuffs. Throughout the period, N-regulations were designed in close dialogue with researchers and farmers' associations, and were followed-up by information campaigns, extension services and education. Also, extensive strategic research programmes have been supported. The ability to design the regulatory approach to nitrogen use in a manner whereby crop and animal production is affected as little as possible is a main achievement of this bottom-up approach of continuous dialogue.

2.4.5 Japan

Japan has committed itself to the greater use of Biomass energy utilisation through the creation "Biomass Nippon Strategy". This includes measures for the inclusion of animal wastes as biomass in the strategy.

Commitments have been made to promote ongoing environmental education in the area of biomass in agriculture. Awareness of biomass opportunities in the public has also been raised through public information service organizing symposia, and preparing and distributing of pamphlets/posters. This has been ongoing since 2002.

2.4.6 Canada

Environmental stewardship is the foundation for long term health and vitality of the Canadian Agriculture sector. Canada's success in agriculture is based on a foundation of industry innovation, scientific research and public policy that encourages farming to be more productive while keeping the land healthy. Since the first experimental farms were established over 110 years ago, Canada has become one of the world's most important food producers with a world-wide reputation.

In Canada, measures to manage atmospheric emissions of potentially harmful substances, including those from agricultural sources, are administered largely at the provincial and local levels of government.

Canada's commitment to the incorporation of environmental practices in agriculture is highlighted by the inclusion of the environment as one of the five complementary elements of its Agriculture Policy Framework for sustainability and profitability

A number of research projects have been undertaken by the Research branch of the department of agriculture and agri-food. These include:

- The development of an anaerobic treatment system that uses biotechnology to deodorize and stabilise swine manure slurry
- Study to minimize the loss of nitrogen during manure composting resulting in a higher value product and reduced air emissions

2.4.7 Austria

Austria is the leading exponent of organic farming in the EU. There are presently 19,826 organic farmers in Austria (end-2004 count). 11.2 % of all farmers are thus organic farmers. 13.5 % of the utilised agricultural area is cultivated according to organic criteria. There are four main reasons for this success³⁷:

1. The idealism and commitment among organic farmers
2. Subsidies for organic farmers
3. Trade (shop) chains support
4. Ecological awareness among consumers

Austria has been allocating grant subsidies for organic farming since 1991. The introduction of this form of government aid was a major contribution in restructuring agriculture on the basis of ecological and social criteria. After joining the EU, Austria has been able to further increase its aid to organic farmers within the framework of the European Union's agri-environmental subsidisation programmes. As a compensation for the environmental services they render, Austria's organic farmers in 2004 received approximately €89 million from the agri-environmental programme ÖPUL for the measure "Organic Farm Management"; half of the money was provided by the European Union and the rest was divided between the Federal Government and the Provinces at a ratio of 60:40. In 2004, Austrian farmers received a total of €157 million from the entire environmental programme out of which 19,272 organic farmers received economic aid. Subsidies are granted also in other fields. Organic farmers receive approximately 18 % of the funds from the investment subsidy for stables which are particularly well-suited for animals.

³⁷ Federal Ministry of Agriculture, Forestry, Environment and Water Management *Organic Farming in Austria* 2005

3. Energy

3.1 Europe

In Europe 80% of the energy consumed is from fossil fuels – oil, natural gas and coal. A significant and increasing proportion of this comes from outside the EU. Dependence on imported oil and gas, which is currently around 50%, could rise to 70% by 2030³⁸. In addition the global demand for energy is increasing. World energy demand (and CO₂ emissions) is expected to rise by 60% over the next 25 years. Global oil consumption has increased by 20% since 1994 with a projected growth of 1.6% per annum. In addition many of these fossil based fuels are concentrated in a small number of countries (50 % of Europe's gas comes from Russia, Norway and Algeria). All of these factors will increase the EU's vulnerability to supply cuts or higher prices resulting from international crises. In addition there is the global need to burn less fossil fuels in an effort to arrest and reverse global warming.

It is clear that Europe must act urgently, especially as new technologies and policies take years to come into effect. The way forward is recognised as needing a combination of energy savings through more alternative energy sources (particularly renewables within the EU), efficient energy use and international cooperation. Some of the key issues as set out by the EU are detailed below³⁹:

3.1.1 Imports remain essential

The EU keeps strategic stocks of fuel to reduce its vulnerability to problems on world markets, but long-term security of supply also means ensuring the EU is not over-dependent on a few countries for supplies, or that dependence is compensated for by close co-operation. Currently there is a growing relationship with Russia, a major source of fossil fuels and potentially of electricity. Cooperation with energy trading partners, and notably developing or emerging economies, includes investment and transfer of know-how in production and transport because working together for a free flow of gas, oil and power can be mutually beneficial.

The EU and 11 countries of southeast Europe in late 2004 agreed to set up an Energy Community in which the rules on energy will be the same everywhere. This will be good for security of supply because interconnections to the EU's sources of supply often pass through these countries. It will also make markets more efficient. This will help lower the price of power supplies throughout this area and lead to a release of government funds currently used to subsidise all power prices to support targeted assistance for those who really need it.

3.1.2 Changing the fuel mix

To reduce dependence on imports and cut pollution, the EU must become a low-carbon economy using less fossil fuel in industry, transport and the home, and making use of renewable energy sources to generate electricity, heat or cool buildings, and fuel transport, particularly cars. This presupposes an ambitious switch to **wind** (particularly offshore wind), **biomass**, **hydro** and **solar power** and **bio-fuels** from organic matter. The following step will be to become a hydrogen economy. A European Hydrogen and Fuel Cell Technology Platform is drafting a blueprint for the eventual transition.

3.1.3 Caring for the environment

Caps on the amount of emissions of carbon dioxide (CO₂) EU industry can emit into the atmosphere now apply to industry (The EU's Emissions Trading Directive will cap CO₂ emissions from a range of industrial sectors covering 46% of EU emissions⁴⁰). Companies who exceed their emissions allowance trade with others who have not used up all their allowance. This will

³⁸ CEC, *A European Strategy for Sustainable, Competitive and Secure Energy, Green Paper*, EU Commission, 2006

³⁹ http://europa.eu.int/pol/ener/overview_en.htm

⁴⁰ <http://www.ieta.org/ieta/www/pages/getfile.php?docID=1528>

encourage more efficient energy use and above all cut pollution and keep the promises the EU has made in the Kyoto Protocol on climate change and reversing global warming.

3.1.4 Saving energy by using it more efficiently

One of the primary methods of curbing Europe's reliance on fossil fuels is seen as promoting energy efficiency which has the potential to reduce energy use by 20%⁴¹. In addition this would equate to 50% of the EU's necessary CO₂ emission reductions. A number of EU initiatives have been initiated:

- Directive on the Energy performance of buildings
- Directive on the promotion of Cogeneration
- Ecodesign directive
- Proposal of a directive on energy services and end-use efficiency
- A new programme – “Intelligent Energy – Europe”

Energy performance of buildings directive

The EU adopted this Directive in 2003. The principal objectives of the Directive are⁴²:

- To promote the improvement of the energy performance of buildings within the EU through cost effective measures;
- To promote the convergence of building standards towards those of Member States which already have ambitious levels.

Measures include:

- Methodology for calculating the energy performance of buildings;
- Application of performance standards on new and existing buildings;
- Certification schemes for all buildings;
- Regular inspection and assessment of boilers/heating and cooling installations.

Standards like these have the potential to cut 25% of the demand by 2020. Some European countries realised the potential savings prior to the introduction of the Directive and have made significant savings.

Denmark building labelling

From 1997, a new energy-labelling scheme for large and small buildings took effect. There was a 20% improvement in energy intensity between 1994 and 2005. In June 2005 new energy requirements for the building regulations of small houses and for the general building regulations were published. The new requirements came into force January 1, 2006. All new buildings must be labelled to ensure fulfilment of the requirements. The new action plan calls for tightening the energy requirements in the building code by 25-30 % from 2006 and a further 25 % from 2010. The new action plan calls for a general target for reducing energy consumption in all sectors (not transport) of 1.7% per year until 2013.

Grant provisions totalling € 135 million are made each year to improve energy efficiency. There are subsidies for pensioners with low income. There are other grants to promote central heating.

⁴¹ CEC *Doing more with less: Green Paper on energy efficiency*, CEC, 2005

⁴² <http://www.defra.gov.uk/ENVIRONMENT/energy/internat/ecbuildings.htm>

Cogeneration

The Combined Heat and Power Directive entered force in February 2004⁴³. It sets harmonised standards for measuring “good-quality” cogeneration, which is defined as combined heat and power generation leading to at least 10% energy savings when compared with separate production. Gas-fired co-generation plants produce both electricity and heat, mainly in the form of steam. This maximises the use of the gas and is also environmentally friendly because gas produces less CO₂ than other fossil fuels. The Directive was to have been transposed by Member States by the end of March 2006. All have yet to fully complete the move, however, mainly because a committee in Brussels has failed to agree a key set of reference values used to determine whether a CHP plant qualifies as good quality. A set of provisional reference values will be confirmed through the EU’s comitology procedure in May 2006, three months late⁴⁴.

Ecodesign Directive⁴⁵

The Directive on the eco-design of Energy-using Products (EuP), such as electrical and electronic devices or heating equipment, provides coherent EU-wide rules for eco-design and ensures that disparities among national regulations do not become obstacles to intra-EU trade. The Directive does not introduce directly binding requirements for specific products, but does define conditions and criteria for setting, through subsequent implementing measures, requirements regarding environmentally relevant product characteristics (such as energy consumption) and allows them to be improved quickly and efficiently. Products that fulfil the requirements will benefit both businesses and consumers, by facilitating free movement of goods across the EU and by enhancing product quality and environmental protection. The Directive constitutes a breakthrough in EU product policy and introduces many innovative elements together with concrete application of the principles of the “better regulation” package.

EU funding

The EU has provided funding for energy research in the EU's Sixth Framework Programme for Research and Technological Development. In addition, the EU is spending €200 million from its Intelligent Energy for Europe programme between 2003 and 2006 to support research into energy saving, energy efficiency, renewable energies and the energy-related aspects of transport. The focus is on research programmes that help strengthen security of supply, fight climate change and make industry more competitive.

3.1.5 The single energy market

A competitive energy market helps efficient energy use. In the past, national gas and electricity markets were separate ‘islands’ within the EU, where supply and distribution were essentially in the hands of monopolies. Now, markets have been opened up to competition and national borders in energy markets are disappearing, though the European Commission would like to see even faster progress.

The EU facilitates competition with funding to connect isolated networks and improve cross-border interconnections, both within the EU and with supplier countries. For their part, all suppliers have guarantees under single energy market rules that they can have access to the distribution grid and pipeline networks of other EU countries and that they will pay a fair price for access.

All businesses and many consumers are already free to choose their own supplier of gas and electricity. All other consumers will be by mid-2007. The additional competition comes with additional protection. This also safeguards against power cuts. Cost-cutting by competing suppliers should not result in under-investment, so that consumers in remote areas or on low

⁴³ <http://www.environmentdaily.com/articles/index.cfm?action=article&ref=16154>

⁴⁴ <http://www.environmentdaily.com/articles/index.cfm?action=article&ref=20701&searchtext=cogeneration&searchtype=All>

⁴⁵ http://europa.eu.int/comm/enterprise/eco_design/

incomes are not regarded as too small or too far away to bother about, and that there will always be someone to step in seamlessly if a supplier goes out of business.

3.2 The future European Policy on Energy

In light of concerns with regard to security of energy production and supply, on 8 March 2006 the European Commission published a Green Paper on developing a common, coherent European Energy Policy. Some of the key issues involved are⁴⁶:

- Internal market → towards a fully competitive internal energy market
- Internal energy supply policy → solidarity among Member States
- Energy mix → diverse, efficient & sustainable
- Environment → integrated approach to tackling climate change: energy efficiency, renewable & low carbon energy production
- Energy technology & innovation → strategic approach
- External relations → coherent external energy

One of the main challenges will be to generate a common European wide policy. Due to the growing dependence of most countries on imported fossil fuels each will have individual agendas⁴⁷.

3.3 EU Information/awareness raising

One method of promoting better technologies in relation to energy is awareness raising, particularly with regard to **energy efficiency**. For example the EU has established the Sustainable Energy Europe campaign which is designed to help the EU meet its energy policy targets⁴⁸. The 4 year plan aims to increase public awareness of the potential of sustainable energy and has a campaign fund of €3.7 million. Measures included in the campaign are annual sustainable energy awards, a website and an annual conference. The campaign also aims to develop energy partnerships. An example of one awareness programme being run is given below.

The Bright Buy Initiative: A best practice platform for public sector energy efficient lighting.

Lighting uses almost a third of the energy consumed in buildings. The Commission itself estimates that 24 million tonnes of CO₂ could be saved annually from lighting products alone in the domestic and tertiary sector. The bulk of this should come from non-domestic sources, particularly public authorities that spend between 14 and 16 % of EU GDP on public procurement each year. However a large number of Europe's public purchasers are still new to "Energy Efficiency" and "Green Procurement" and will need a steer in the right direction not only to the areas where they can make potential savings but also towards potential support mechanisms and initiatives to enable them to "Make the Switch" in practice. Under the SAVE field of 'Intelligent Energy Europe Programme' (Type 3 actions), the European Lamp Companies Federation (ELC) in partnership with Energie-Cities, CEMR, WWF and CELMA, will organise THE BUY BRIGHT INITIATIVE. This two day platform and networking event planned for 30th and 31st May 2006 will initiate a process to ensure a tailored exchange of experiences looking at practical and workable solutions to help public purchasers and procurement officers make the RIGHT purchasing decisions and be BRIGHT in investments that concern lighting.

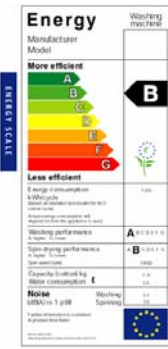
⁴⁶ http://europa.eu.int/comm/energy/green-paper-energy/doc/2006_03_08_gp_slide_presentation_en.pdf

⁴⁷ http://europa.eu.int/comm/energy/green-paperenergy/doc/2006_03_08_gp_slide_presentation_en.pdf

⁴⁸ <http://www.sustenergy.org>

Labelling of Domestic Appliances

Since the beginning of the 1990s, the compulsory labelling of a whole series of domestic appliances has made it possible to inform consumers of the consumption level of these appliances and encouraged industry to make them more economical. The Commission now intends to increase the number of the appliances covered by this European legislation. The Commission also proposes that measures be taken to reduce the electricity wasted in stand-by mode. More and more appliances incorporate this function which can represent up to 7% of electricity consumption in homes. Measures should be taken to encourage people to consume less electricity at peak hours and in times of shortages, for example, by using a meter which could inform consumers of the cost of their consumption in real time.



3.3.1 Awareness campaigns in other countries

Individual countries have also launched a number of awareness schemes. These are often done in conjunction with power companies and target the domestic market.

Japan: Top runner programme. Now being considered by Sweden

Appliance energy-efficiency standards were first introduced in Japan, in 1979, under the Energy Conservation Law as a reaction to the oil shocks. Refrigerators and household air-conditioners were the two appliances chosen for the first energy performance standards. Standards for refrigerators were removed in 1984 since all manufacturers have already exceeded efficiency targets. In 1994, new appliances were added to the list including fluorescent lamps, televisions, heat pumps, copiers and computers.

The Energy Conservation Law has been revised in June 1998 to reinforce previous standards. It established the Top-Runner Programme in which the energy performances of the most efficient products supplied domestically are used to set up the next efficiency standards. Products included in the Top Runner Programme are passenger cars and trucks, air conditioners, fluorescent lights, refrigerators, TV, VCRs, photocopiers, computers and hard-disk drives.

Germany: "Bright NRW" was a joint energy efficiency programme, initiated and co-funded by the German Ministry of Economics and carried out by 80 utility companies. With different local marketing strategies, but all beneath the same logo, the utilities distributed compact fluorescent lamps (CFL) among their household customers. Four types of programme were carried out:

1. free give away of the CFLs without any condition other than the recipient being a domestic customer;
2. free giveaways with certain condition (e.g. three free CFLs for every energy efficient household appliance bought)
3. Vouchers worth different sums which could be redeemed in local shops;
4. a marketing programme to convince householders of CFLs without any financial incentives.

Within 6 months half a million CFLs had been distributed with an estimated saving of 553MWh and more than 320,000 tonnes of CO₂ emissions.

3.3.2 Renewable Energy Incentives in Other Countries

In its 1997 White Paper the EU specified a target of 12% minimum penetration by renewables into the energy market by 2010⁴⁹. This was expanded upon in 2001 to specify that electricity

⁴⁹ <http://europa.eu.int/scadplus/leg/en/lvb/l27023.htm>

generation from renewables would be increased from 14% (2000) to 21% (2010) and that biofuels in the transport sector would increase their share in the 25-member EU from less than 1% (2000) to 5.75% (2010). According to an EU publication by 2001 renewables had a 6.1% share of the energy market, up from 5.4% in 1997⁵⁰.

According to the report, the situation varies considerably from one Member State to another. In general, countries can be divided into three groups having made different amounts of progress as regards renewable energy:

- Germany, Denmark, Spain and Finland have implemented an energy policy which should enable them to reach their national targets;
- Austria, Belgium, France, Ireland, the Netherlands, the United Kingdom and Sweden have begun adopting policies and measures which would also allow them to achieve their national targets;
- Greece and Portugal must improve their policies since these will not enable them to reach their targets.

In terms of different sources of renewable energy used for electricity production, it seems that the EU should concentrate on developing wind, solar and biomass technologies.

- **Wind energy:** the European wind industry has 90% of the world equipment market. Germany, Spain and Denmark alone account for 84% of European production capacity.
- **Biomass:** the development of biomass technologies is hampered by the lack of policy coordination and insufficient funding. Only Denmark, Finland and the United Kingdom are experiencing significant growth rates for this energy source. However, in most of the new Member States there is a sound potential for the use of biomass to generate both electricity and heat.
- **Photovoltaics electricity (solar):** photovoltaic output is still limited; however, this energy form could in the long term be developed to a greater extent in the EU. This will only be possible if a reliable political framework is created allowing companies in the photovoltaic sector to make their investments profitable.

In general, renewable energy technologies are not cost competitive with fossil fuel technology in the electricity generating market or the retail electricity market. There are indications that this is due to the comparatively low level of investment in developing such technologies relative to that, for example, in fossil fuel or nuclear technologies. Although technological advances have made enormous strides in recent years in some technologies (wind in particular), for the present renewable energy technologies other than large scale hydro, can only be deployed commercially if support measures are applied. Market intervention for this purpose is justified on the basis that market prices for electricity generated from fossil fuels do not reflect the full economic costs of generation.

3.4 Incentives for Renewable Energy Production

Several incentives promoting the expansion of renewable energy production are available or are being contemplated throughout the European Union (though there is no pan-European scheme). These include price support mechanisms, financial incentives/subsidies, tax incentives, tax exemptions (where specific energy taxes apply), guaranteed sale of electricity to the national grid, third party access, green certificates, net metering and branding of "green electricity". Member States have also sought to address administrative and technical issues such as planning rules and arrangements for access to electricity grids and have introduced targeted information campaigns aimed at developers and members of the public. Some of the support measures are detailed below in the Table 3.1⁵¹.

⁵⁰ CEC *The share of renewable energy in the EU, COM (2004) 547*. CEC, 2004.

⁵¹ Department of Public Enterprise *Green Paper on Sustainable Energy*, DPE, 1999

Table 3.1: Incentive Schemes for Renewable Energy Sources (RES)

Incentive scheme	Description
Feed in Tariff (FIT) system	<p>This is a national public service obligation system whereby grid operators must purchase electricity produced from renewable energy sources (RES) at a predetermined price for a specific RES. In Germany and Spain (which have been major success stories in the use of PV and wind [contributing 78% of photo voltaic (PV) increase between 1993 and 1999]) they noted that fixed feed-in tariffs were a central element to give long term stability to renewable investors (in the way of prices). Over time they are slowly reducing the level of such support, thus taking into account the technological learning curve and promoting a self sustaining renewable business sector. This system promotes investment while limiting abuse of the system⁵².</p> <p>This system has proven effective in some countries in bringing about a rapid increase in the quantity of energy produced from renewable sources. However, it contains no direct incentives for efficient production of energy. It can, therefore, represent an inefficient procurement mechanism and can enable efficient producers to enjoy supernormal profits with the cost being borne by electricity consumers.</p>
Competitive Tendering system	<p>This is a public service obligation system similar to that described above but different in that prospective renewable energy producers are invited to submit competing tenders for the sale of a predefined quota of electricity to the national grid. Bidders who pass technical and commercial evaluation and who submit the lowest prices for the sale of electricity are guaranteed sale for their output to the national grid for a fixed period (e.g. 15 years). The competitive nature of these schemes exerts downward pressure on the direct costs of electricity generated from renewable sources. This system was used by France and Ireland though both have now initiated a change towards FIT.</p>
Green Certificates	<p>A green certificate is an official cert proving that a specified amount of “green” electricity (from RES) has been generated. Green certificates represent the environmental value of renewable energy generated. The certificates can be traded separately from the energy produced. The underlying principle is that renewable energy producers are rewarded by the State with green energy certificates. Energy providers employing polluting technologies are obliged to offset the damage done by purchasing a predetermined amount of green energy certificates from environmentally neutral energy producers. Thus the system generates a secondary market in green certificates and a revenue stream for renewable energy providers. This scheme has been recently introduced in Sweden in an effort to promote biomass in CHP and heat markets as well as the switch over from nuclear to renewable electricity. Currently electricity generation contributes only 5% of the country’s total CO₂ emissions but with the phasing out of nuclear it is hoped that renewables can fill the void.</p>
Green Pricing schemes	<p>This is based on the principle that some consumers are willing to pay more for electricity which is produced in an environmentally neutral manner from renewable energy sources (i.e. green electricity) and that green electricity is currently more expensive to generate. Consumers can usually choose to purchase all or a percentage of their electricity at a premium price. The electricity supplier, in return, guarantees that each unit of electricity paid for at the premium price corresponds to a unit entering the electricity supply network from a renewable energy power plant. One of the advantages of this scheme is that it can create a market for electricity from renewable sources where none existed. As such it is used extensively at the beginning of renewables introduction into markets but tends to be phased out as they achieve a foothold in the market.</p>
Net metering	<p>The concept of net metering is that individual users install small scale renewable energy power plants to meet some or all of their electricity needs and pass any</p>

⁵² *Review of renewable energy development in Europe and the US*, Imperial College London, Centre for Energy Policy and Technology, 2003

	<p>excess electricity to the mains grid. By means of a two way meter any electricity fed into the mains grid is credited to the individual's electricity account and in this way, the individual user benefits from net billing for consumption. There are a number of variations to this type of scheme. Germany's 1000 roofs programme (and more recently 100,000 roofs programme) used this principle to promote initial investment in the PV industry and then to increase the photo voltaic (PV) market after the initial success and technological improvement. Net metering has also been successfully promoted by the US (36 states have net metering provisions)⁵³, Denmark, Greece and Sweden as a means of encouraging small scale renewable energy power production.</p>
Energy / Carbon tax	<p>Energy and carbon taxes on the consumption of fossil fuels are designed to reflect the economic costs of negative externalities which are not taken into account in current market prices. Energy generated from renewable sources is exempt from such taxes and its relative competitiveness is thus enhanced. The environmental policies of an increasing number of Western European countries have implemented taxes based on the carbon or energy content of the energy products (Sweden, Norway, The Netherlands, Denmark, Finland, Austria, Germany and Italy)⁵⁴. Several other countries, like Switzerland, France and the United Kingdom, are currently discussing proposals for their implementation.</p>
Tax based incentives	<p>These incentives are designed to increase the availability of investment capital for the commercial exploitation of renewable energy. In general, the system operates on the basis of tax deductions for individual and corporate investments in renewable energy projects. Personal tax incentive schemes also encourage local involvement (through investment) in renewable energy projects. The advantage of tax incentives is that it allows them to be targeted to specific technologies and investor groups. They can be made strong in the early stages of renewable industry development and gradually phased out as the domestic renewable industry matures and becomes self sustaining. In general international experience has shown that successful tax incentives⁵⁵:</p> <ul style="list-style-type: none"> • Must be of sufficient size, scope and length to be effective in influencing renewable energy investment and consumption decisions; • Should be tailored according to the stage of renewable energy industry development in a country; • Must be carefully designed to account for interactions with other government policies and energy market conditions • May require other supportive policy initiatives to create and sustain a healthy renewable energy sector.

CO2 instruments in Switzerland

Switzerland's government approved two fiscal instruments to cut carbon dioxide emissions on 23 March 2006. A CO₂ tax of €23 per tonne will be imposed on most fossil fuels from January. A separate climate levy of up to 1.6 centimes per litre will apply to petrol and diesel. The measures are being introduced to bolster Swiss efforts to comply with its Kyoto protocol commitment to limit greenhouse gas emissions. The levy on transport fuels is being introduced for a two-year trial period. If it has not helped bring down emissions sufficiently by the end of 2007 it could be extended, though possibly only to diesel.

⁵³ <http://www.serconline.org/netmetering/background.html>

⁵⁴ <http://www.rec.org/REC/Programs/SofialInitiatives/Ecolnstruments/GreenBudget/GreenBudget6/carbon.html>

⁵⁵ Energy Foundation China Sustainable Energy Program *International Tax Incentives for Renewable Energy: Lessons for Public Policy*, Centre for Resource Solutions. EFCSEP, 2005,

Finland incentives for bioenergy

Finland is the leading user of bioenergy in the European Union. Part of Finland's success is due to large availability of biomass contained within the country. Energy from biomass accounts for about 26% of the total energy output, with oil coming in only at about 25%. Of this energy output, 20% of the total electricity output used in Finland comes from bioenergy.

The current strategy of the Finns to increase biomass use includes technology funding, availability of grants for new technologies, tax allowances for the production of renewable energies, energy wood harvesting and wide information dissemination. In addition Finland is a world leader in the development and user of biomass combustion technologies.

3.4.1 Technologies and Associated policies

Table 3.2 highlights some of the energy related technologies and the associated policies that have been successful in other countries.

Table 3.2: Technologies and associated policies in different countries

Country	Leading technology areas	Policy mix	Grants, soft loan and other details
Austria	High growth in biomass heat and power, solar thermal	Feed in law first on a regional basis, now national. Fiscal incentives & capital subsidies have been the key to biomass growth	'Kommunalkredit' bank provides low interest rate loans for up to 30% of renewable energy projects. Finance available for district heating by regional or local authorities.
Germany	Largest installed wind capacity and fastest wind rate of installation internationally. Recent slow down in expansion reflects onshore saturation and reduced feed in tariff. Largest PV capacity in EU	Feed in laws rigorously defended and highly differentiated by technology. Both capital subsidy and high feed in rate for PV. Demand for PV grants outstripped loans. Incentives to encourage local ownership.	100,000 roof programme provides 50% of PV installation. KfW and DtA provide low interest rate loans for 100% of renewable energy projects.
Finland	Largest increase in biomass power	Fiscal (tax exemptions on biomass and wind) and capital subsidies (solar thermal)	
Spain	Large growth in wind and PV installation. Second to Germany in both	Feed in laws, regional level capital subsidies and favourable loans for wind	Subsidies for approved small scale renewable energy projects. Low interest loans for between 70-96% of total investment costs approved
Sweden	Strong growth in biomass district heating and CHP. Some progress in off shore wind	Capital subsidies available for wind and biomass. Energy tax exemptions in place. RPS scheme introduced in 2003. Has the potential to deliver rapid RES deployment at lower prices than FIT	Carbon taxes of €28/t CO ₂ in 1991 increased to €84 in 2003 for heating fuels incentivised biomass and district heating

Denmark	Wind: largest manufacturer, highest proportion of electricity supply internationally; large increases in biomass CHP	Feed in tariff laws, strong community investment incentives; Fiscal incentives-high energy tax which renewables get rebate; Strong R&D support and capital subsidies.	Feed in tariffs are valid for 10 years. Soft loans for biomass (16%), biogas (30%), solar thermal heat (30%) and heat pumps (15%)
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3.4.2 Renewable Energy Policies in Europe

There have been several renewable energy policy changes in EU 25 in recent years⁵⁶.

Most significant recent changes

The years 2002 to 2004 have seen some major changes in renewable energy support programmes in a few EU member states. Austria, France, the Netherlands and Slovenia have introduced new feed-in systems. Sweden has introduced a renewables obligation for end users, linked to a green certificate system. Ireland has issued large tender rounds for wind energy and has now changed to a new feed in system (REFIT). Spain has introduced very attractive feed-in tariffs for solar thermal electricity generation. Denmark has changed most of its formerly successful schemes.

RES targets

The EU Renewable Electricity Directive is the leading policy document for national target setting with respect to renewable electricity. Only a few countries have set selective targets for renewable heat and no clear national targets have been set for biofuels.

Status of the renewable energy market

Renewable electricity production has continued to increase significantly in recent years. Most countries, however, are still behind their targets. High growth rates are being experienced and are expected to continue for wind energy, especially offshore in the medium term. Growth in biomass is taking off, but still lagging behind expectations in most countries. Especially in the new member states large unexploited potentials for biomass exist. PV is growing at constantly high rates and growth even accelerated after the introduction of the new feed-in tariffs in Germany. Geothermal energy (excl. heat pumps) and small-scale hydropower have grown only a little. Most of the environmentally sustainable potential for large-scale hydropower has been exploited (in particular in the EU-15), however there is some remaining potential for refurbishments. Significant growth rates are expected in the medium term for solar thermal electricity generation as well as wave and tide energy. Active solar thermal heat generation is expected to continue to grow substantially by 15-20% annually. The use of biofuels is growing steadily in selected countries.

Main supporting policies

Renewable electricity

The feed-in tariff scheme is still the main choice of renewable electricity support. Countries that have seen large increases in the deployment of renewables resulting from a feed-in tariff scheme have continued to use the system. These include Germany, Spain, Greece and Portugal although the latter two have had a smaller increase in installed capacity. Other countries have changed their former system into a (partial) feed-in system (France, Austria, Slovenia and the Netherlands) or are considering introducing such a system (Ireland).

⁵⁶ Ragwitz, Mario et al. *FORRES 2020: Analysis of the renewable energy sources' evolution up to 2020* Fraunhofer Institute 2005

Certificate systems are becoming increasingly popular and are linked to different support schemes. The UK, Italy and Sweden have linked theirs to a renewables obligation; the Netherlands to its combined policy of feed-in tariffs and tax exemptions (until January 2005) and Belgium to its guaranteed minimum tariffs and renewables obligation. In 2006 the Czech Republic introduced an obligation for renewable electricity, while Poland is considering the introduction of a certificate system to support its already existing obligation scheme.

Renewable heat

Almost all countries have implemented compensation schemes and/or tax exemptions to support renewable heat. These mainly concern solar thermal panels and small scale biomass heating. Only Denmark has introduced an obligation scheme (to support solar heating in planned large buildings).

Biofuels

Austria, the Czech Republic, Finland, France, Germany, Italy, Poland Spain and Sweden have introduced tax exemption for biofuels. Other countries have so far only directed limited R&D funds at supporting biofuels, but have not yet introduced direct support.

Major issues

- Political uncertainty resulting in the withholding of new renewable energy investments represents a major barrier to further renewable energy deployment. This is particularly valid for Denmark, Austria, the Netherlands, Finland, and to some extent for Italy and Sweden.
- Grid connection rules and planning issues still remain an obstacle in many countries. Tender schemes are hampered by their stop-start nature and the uncertainty of winning a bid. Some countries still face problems of social acceptance, especially for biomass and large-scale wind projects.
- A sufficient level of support is necessary for good progress in renewable energy deployment. The high feed-in tariffs and solid investment schemes – both used in several countries - are still the main success factors, followed by high and long-term targets of obligation systems. Tax exemptions are the only success factor behind strong growth in biomass heat and liquid biofuels. France has seen the largest change in market interest in new RES deployment as a direct result of its new programme with high feed-in tariffs.

Interesting new success factors have appeared recently, including the redistribution of the buyout revenues in the UK renewables obligation system, high penalties in Belgium and the mandatory disclosure of fuel mix in Austria.

France

France has the highest renewable energy production of any EU country, helping it lower emissions and augment energy security; 98% of French renewable energy comes from hydropower and biomass, sources developed for their cost advantages rather than as a result of government support. Policy-driven support for non-hydro renewables has thus far not resulted in substantial renewable capacity, at least in relation to other countries. This may change in the future as the government has announced a number of ambitious goals to expand the use of renewables. Installations below 12 MW can receive above market feed-in tariffs and those above 12 MW can bid for long-term electricity sales contracts. The government is encouraged to look at the experience of other countries that used the bidding system to support renewables (e.g. Ireland and the UK) where the preferred contracts often failed to lead to sufficient installed capacity. Plant siting is key to the future of renewables in France, particularly for wind plants. The government must respect the desires of local communities but effectively weigh them against the national benefits that renewable energy technologies can bring.

United States

Many incentive schemes exist in various American states. The Database of State Incentives for Renewable Energy (DSIRE) is a comprehensive source of information on state, local, utility, and selected federal incentives that promote renewable energy. DSIRE now includes state and federal incentives for energy efficiency⁵⁷.

Canada

Canada has a number of federal as well as regional renewable energy promoting incentives. Renewable Energy Deployment Initiative (REDI) (Dec 2003) has a number of incentive programs for businesses to use solar thermal technologies⁵⁸. Currently REDI will supply 25% of the purchase price and installation consists of a qualifying solar air or water heating system, to a maximum contribution of \$80,000. It also has a retrofit program for homeowners, that includes solar DHW systems and PV systems. The funding level is based on the energy improvements (as a percent above a base level) of the home. Funding is extremely low - typically \$50 - \$100 for most solar installations. On a local level, in British Columbia the Social Service Tax Act provides an exemption for prescribed energy conservation material and equipment that prevent heat loss from a building, for prescribed residential energy efficient furnaces, boilers and heat pumps, for prescribed alternative energy sources, and for natural gas and propane conversion kits for internal combustion engines.

3.5 Ireland

3.5.1 Recent IBEC assessment

Recently the business and employers group IBEC warned that Ireland is more vulnerable than any other country in Europe to a future energy supply crisis⁵⁹. According to IBEC this is due to three major factors:

- the scale of our reliance on imported energy,
- our inadequate infrastructure and
- our lack of a national energy strategy

Figures indicate Ireland's energy supply struggled to meet demand in 2005. Additional capacity due to come on stream over the next two years should alleviate the situation, however it is clear that additional infrastructure will be required after this period. Given the long lead time associated with putting additional capacity in place decisions must be taken now to ensure that the necessary capacity is in place by 2009, otherwise our security of supply could be at risk.

IBEC noted that Ireland is around 90% dependent on imported energy. The main imports are oil, which accounts for nearly 60% of our total primary energy requirement (TPER) and natural gas accounting for a further 25%. By 2007 over 60% of electricity generation will be fuelled by gas. It is clear that this reliance on imports makes it imperative that we become more self-sufficient and broaden our fuel mix. The potential of indigenous energy supplies, including renewables and conventional fuel discoveries, such as the Corrib Gas Field, must be maximised if we are to achieve an acceptable energy supply balance. An additional report by Forfás noted that Ireland is one of the most vulnerable countries to the fluctuating price of oil. It further adds that if we do not introduce viable options it could have serious effects on Ireland's long term economic competitiveness⁶⁰.

⁵⁷ <http://www.dsireusa.org/>

⁵⁸ http://www.rev.gov.bc.ca/ctb/publications/bulletins/sst_011.pdf

⁵⁹ <http://www.ibec.ie/ibec/press/publications/doclib3.nsf/vwEconNews/73EE4D3F8B12FD8B80257106003A02D0?OpenDocument>

⁶⁰ Forfás *A Baseline Assessment of Irelands Oil Dependence*, Forfás, 2006

In addition IBEC also expressed its mounting concern at the very real threat posed by rising energy costs. As Ireland has some of the highest energy costs in Europe, business customers are spending far more on their energy bills and this is placing them at a disadvantage against international competitors. With gas and electricity prices rising in excess of 25% and 20% respectively for large customers in 2006, the Government must take immediate action if the competitiveness of Irish business is to be regained.

IBEC has proposed a six point plan to tackle these issues:

- The publication by the Government of a National Energy Policy
- Development of an all-island energy market
- Development of indigenous sources, in particular the Corrib Gas Field
- The provision of additional generating capacity
- The requirement for additional Interconnection both North-South and East-West.
- Additional support for research and development in alternative energy sources

3.5.2 Ireland: Renewable Energy

Current Status

Ireland's contribution to its Total Primary Energy Requirement (TPER) by renewables grew from 1.8% in 1990 to 2.2% in 2004 (in 2003 it was 1.9%)⁶¹. Though the absolute renewable capacity increased by 94% over that time (from 168 ktoe to 325ktoe), due to the increase in TPER the overall market share only increased by 0.4%. The split of the various renewable energy forms is shown in Figure 3.1.

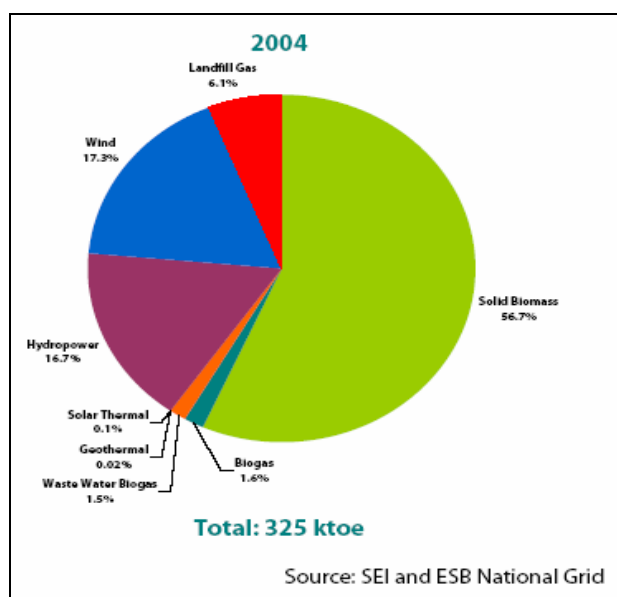


Figure 3.1: Sources of Renewable Energy in Ireland in 2004

In 2004 the largest contribution of renewable energy to TPER was from solid biomass (largely used in the wood processing industry which has increased its share from 58% (1990) to 76% (2004)), followed by wind, hydropower, landfill gas, biogas, waste water biogas, solar thermal and geothermal. In 2004, wind was the second largest contributor to TPER overtaking hydro for the first time. However, overall, relative to other European countries Ireland has performed poorly since 1990.

⁶¹ Sustainable Energy Ireland *Renewable energy in Ireland: 2005 Update*, SEI. <http://www.irish-energy.ie/index.asp?locID=70&docID=-1>

As part of Ireland's EU commitment to help achieve a 12% target of total energy consumption from renewable sources by the year 2010, Ireland must increase its overall renewable contribution to electricity demand to 13.2% and achieve a major improvement on past performance between 1990 and 2002 as Figure 3.2⁶² shows.

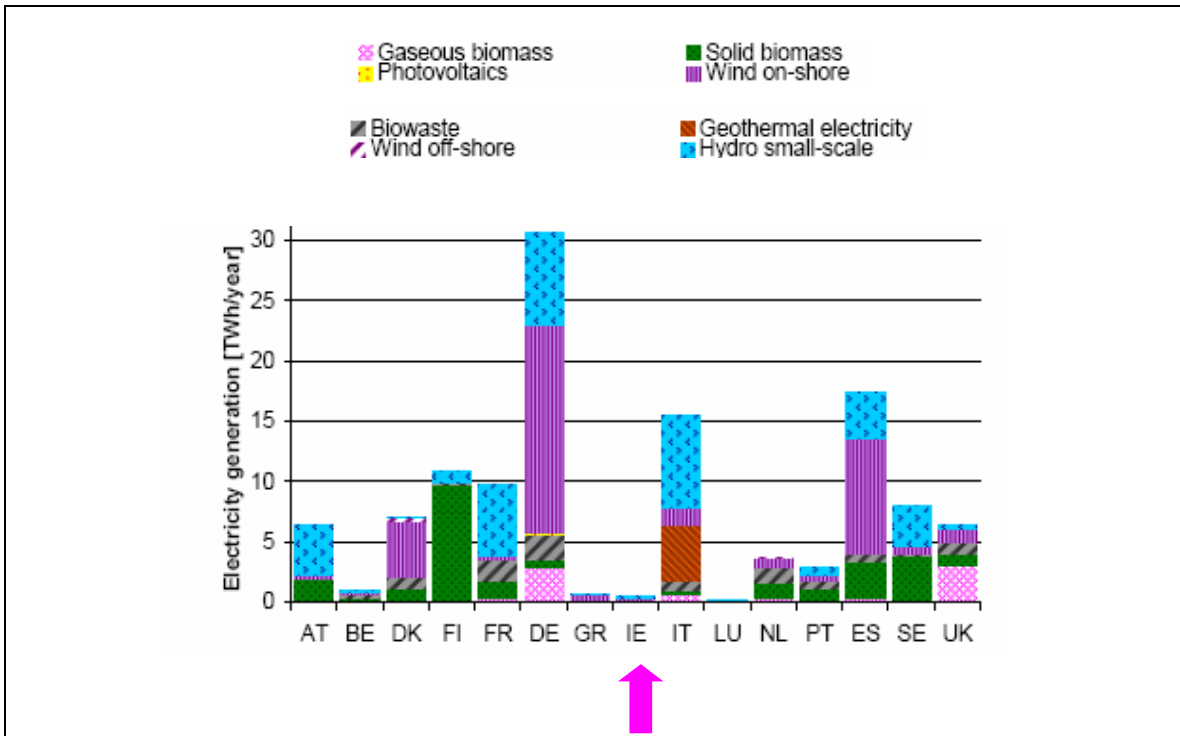


Figure 3.2: Increased electricity generation from renewables between 1990 and 2003

Renewable Potential in Ireland

A study was commissioned by the EU whereby a pan-European collection of energy experts analysed the potential evolution of renewable energy sources (RES) up to 2020⁶³.

Model calculations and analyses are based on two different scenarios; each with a different mix of promotion schemes and assumptions. The first scenario is the business-as-usual scenario (BAU). This scenario models the future development based on present policies with currently existing barriers and restrictions, e.g. administrative and regulative barriers. Future policies, which have already been decided on, but have not yet been implemented, will also be considered. The second scenario is the policy scenario (PS). This scenario models the future evolution based on the currently available best practice strategies of individual EU member states. Strategies that have proven to be most effective in the past for implementing a maximum share of RES have been assumed for all countries. Furthermore, the policy scenario assumes that a stable planning horizon is in place and that existing barriers will be overcome. Both scenarios include the effects of technology learning and economies of scale, which have a higher impact in the policy scenario.

Figure 3.3 shows a summary of the potential RES share of primary energy demand in the EU – 15 by the year 2020.

⁶² Ragwitz, Mario et al. *FORRES 2020: Analysis of the renewable energy sources' evolution up to 2020* Fraunhofer Institute 2005

⁶³ *ibid.*

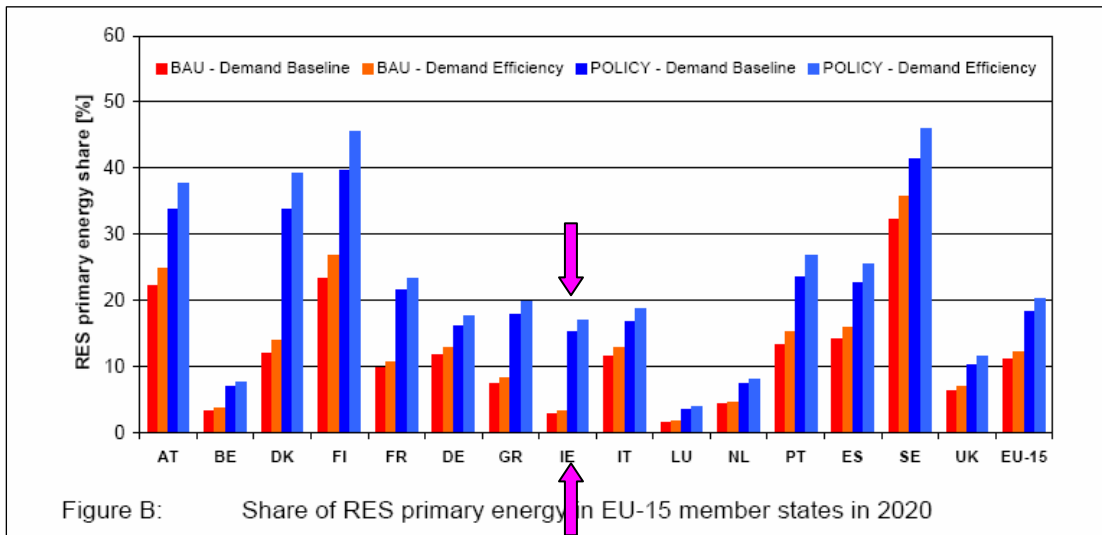


Figure 3.3: RES share of primary energy demand in the EU - 15 by 2020

3.5.3 Irish Initiatives

A number of Irish initiatives have been established (or are in the process of coming into effect) in the past few years. These are summarised as follows:

All Island energy market

Co-operation between Northern Ireland and the Republic of Ireland on energy matters is being advanced in the context of the development of an All-Island Energy Market. This takes place under the auspices of a Joint Steering Group (JSG) established in July 2003. In June 2004 a Draft All-Island Energy Market Development Framework paper was published. Following a period of consultation, the Development Framework was finalised in November 2004⁶⁴. The framework defines the All-Island Energy Market, lists the benefits against which progress should be measured and details the short to medium term priorities. These include increasing the electricity and gas infrastructure, establishing a single wholesale electricity market, addressing market dominance and increasing the penetration of sustainable energy. In addition *Renewable Electricity – A ‘2020’ Vision* was published and outlines the contribution that renewable energy could and/or should make to electricity supply on the island of Ireland by 2020, through addressing the economic, technical and regulatory facets of RES-E implementation.

Renewable Energy Feed in Tariff

The Minister for Communications, Marine and Natural Resources in September 2005 announced a new target to increase the installed capacity of renewable energy based electricity generation to at least 1,450 MWs by 2010 (current renewables capacity is 624 MW)⁶⁵. This figure is in line with our international commitment for 13.2% of electricity consumption to be sourced from renewable technologies by 2010.

⁶⁴ Available from <http://www.dcmnr.gov.ie/Energy/North-South+Cooperation+in+the+Energy+Sector>

⁶⁵ DCMNR *All Island Energy Market: Renewable Electricity – A ‘2020’ Vision*, <http://www.dcmnr.gov.ie/NR/rdonlyres/6F292506-1DAF-4A57-95863A42CEE6C63A/0/RenewableElectricity2020final.pdf>

In addition, the Minister has introduced a new market mechanism to encourage deployment of renewable energy technologies, following a period of consultation with the renewable energy industry. The new Renewable Energy Feed in Tariff (ReFIT) programme replaces the Government's previous support mechanism, the Alternative Energy Requirement (AER) programme which has been in place since 1993 and provided financial support of €119m to renewable energy projects over a fifteen year period.

The scheme will support the construction of at least 400 MWs of new electricity generating plant powered by renewable sources. Most of the new capacity is expected to come from onshore wind projects but there is also support for biomass, landfill gas, anaerobic digestion plants and hydro projects.

The proposed feed in tariff levels are as follows:

- Large-scale wind energy (over 5 MW's) @ 5.7 cent per kilowatt hour,
- Small-scale wind energy (under 5 MW's) @ 5.9 cent per kilowatt hour,
- Biomass (landfill gas) @ 7.0 cent per kilowatt hour,
- Hydro and other biomass technologies @ 7.2 cent per kilowatt hour.

This is a change in light of the relatively poor success rate of the later AER schemes (AER I success rate: 153%; AER III: 42%; AER V: 18%; AER: 41%)⁶⁶. With regard to wind energy, which has been the fastest grower in Ireland, the success of different policy systems are highlighted in Figure 3.2⁶⁷.

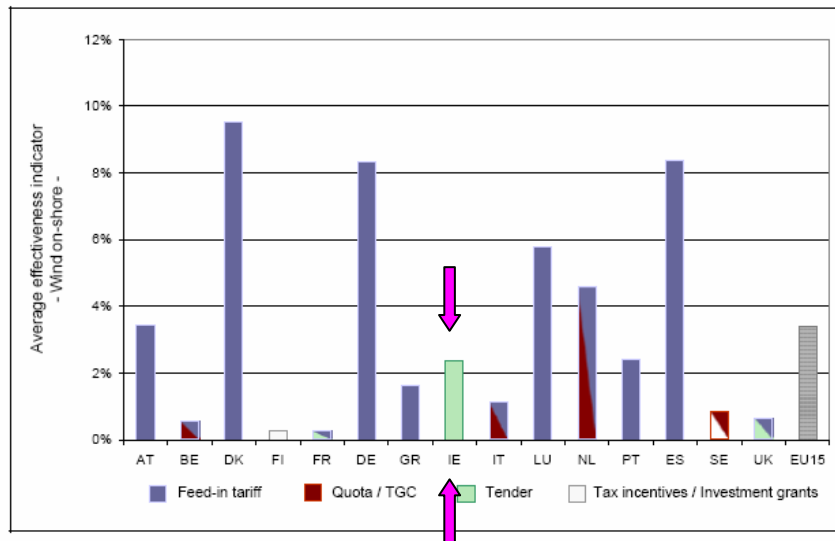


Figure 3.2: Effectiveness indicators of wind on shore energy

Renewable Energy Grants / Energy RTDI Programme

The Minister for Finance in December 2005 allocated up to €65 million to provide support for the implementation of several innovative grant schemes, relating to biofuels, combined heat and power, biomass commercial heaters and domestic renewable heat grants, during the period 2006 to 2010. There is also funding for a new Energy Research, Technological Development and Innovation (RTDI) Programme (Funding for 2006 of €4.17 million is allocated).

⁶⁶ *Moving from competitive tender to feed in tariff-Wind energy policy in Ireland*, O Gallachoir B. P., Bazilian M., McKeogh E.J., European Wind Energy Conference, Athens, 2006

⁶⁷ http://europa.eu.int/comm/energy/res/biomass_action_plan/doc/2005_12_07_comm_biomass_electricity_en.pdf

The Greener Homes Grant (introduced in March 2006) provides financial assistance to houses that install a renewable energy source. A similar scheme is in operation in the UK that offers up to 30% funding for projects up to £4,000.

4. Transport

4.1 Introduction

The transportation sector is a major user of non-renewable energy resources. It accounts for a quarter of the world's energy, and some 25% of total CO₂ emissions, 80% of which can be attributed to road transport. In the EU, the transport sector is responsible for 32% of energy consumption. Ireland is 100% reliant on imported fuels for the transport sector.

Due to its potentially detrimental impact on the environment and public health the transport sector poses one of the greatest policy challenges for sustainable development within the EU. The environmental impacts of transport activity include:

- emissions of greenhouse gases that are widely perceived as the main cause of global warming;
- emissions of compounds that make thin the ozone layer thinner and thereby cause damaging infiltration of ultraviolet radiation;
- production of persistent organic pollutants that damage biological systems;
- Transport activity usually contributes more than half of all local and regional air pollution;
- Noise, particularly from road transport, is the major source of external acoustic nuisance in urban areas.

Most of the above mentioned environmental problems are related to road transport - which is the dominant mode of transport in the EU with respect to both freight and passenger transport.

In light of these concerns the EU produced the White Paper on Transport Policy⁶⁸ in 2001, which highlighted 60 measures to improve the sustainability of transport. Many of these measures are related to greenhouse gas emissions and are in the process of being implemented. Road transport has been identified as the major contributor to the growth of greenhouse gas emissions in the EU and various measures focus specifically on road transport. The three main measures of the EU Commission strategy to reduce CO₂ emissions from passenger cars are

- 1) Agreements committing the automobile manufacturers to reduce CO₂ emissions from passenger cars by 25% between 1995 and 2008, mainly by means of improved vehicle technology.
- 2) Market-orientated measures to influence motorists' choice towards more fuel-efficient cars
- 3) Improvements of consumer information on the fuel-economy of cars

The first and third of these measures have been implemented while the second has progressed in some countries. In a more recent report⁶⁹ by the European Environment Agency addressing the dilemmas of transportation and its impacts on the environment 10 areas of concern emerged:

1. freight transport volumes grow with no clear signs of decoupling from GDP
2. passenger transport volumes have paralleled economic growth
3. greenhouse gas emissions from transport are growing
4. harmful emissions decline but air problems require continued attention
5. road freight continues to gain market share
6. air passenger transport grows while the share of road and rail remain constant
7. developments in fuels can contribute to emissions reductions
8. car occupancy and lorry load factors decline
9. new technology can cut emissions and fuel consumption but more needs to be done to achieve CO₂ targets

⁶⁸CEC. *White Paper: European transport policy for 2010: time to decide*. CEC, 2001.

http://europa.eu.int/comm/energy_transport/library/lb_texte_complet_en.pdf

⁶⁹European Environment Agency *Transport and environment: facing a dilemma*. EEA, 2006

10. pricing structures are increasingly aligned but do not reflect the true external costs associated with transportation

4.2 Alternative Options

The OECD has classified the alternative options available to the transport sector under three general headings⁷⁰:

- Alternative fuels and technologies
- Improvements in fuel efficiency
- Traffic demand management

4.2.1 Alternative Fuels

Alternative fuels generally refer to any fuel that powers an existing internal combustion engine that isn't derived from petroleum. They are often referred to as biofuels as they can be derived from biomass. No greenhouse gas emissions are attributed to the combustion of biofuels, according to IPCC reporting guidelines; however there are life cycle emissions associated with their cultivation, production and distribution. Biodiesel and vegetable oil produced from rapeseed oil and bioethanol produced from wheat and sugar beet represent the most likely biofuel options for the short-term in Ireland. The EU Biofuels Directive has recommended substitution targets of 2% and 5.75% of transport fuels in 2005 and 2010 respectively. Natural gas and liquid petroleum gas are also regarded as transitional fuels until hydrogen technology is mature. In the long term, hydrogen and synthetic fuels are likely to become mainstream and could represent the bulk of fuels used in transport, which will generate very few CO₂ emissions (of the order of approximately 10% of conventional fossil fuel CO₂ emissions).

The main categories of alternative fuels are summarised in the Table 4.1:

Table 4.1: Alternative Fuels

Biofuel	Description
Biodiesel	Cleaner-burning diesel replacement fuel made from natural, renewable sources such as vegetable oils. Just like petroleum diesel, biodiesel operates in combustion-ignition engines. Essentially no engine modifications are required. The consequences of fuel leaks or spillages from biodiesel are also much less severe than with diesel, as 98% is broken down within 21 days.
Bioalcohols	Alcohols such as methanol and ethanol can be produced from cereal crops such as corn, wheat, grasses and sugar beet. Modified petrol engines can run on this fuel. It is most often used as a blend with petrol, E85, which is a mixture of 15% (by volume) petrol and 85% ethanol (M85 – methanol mix). The alcohols which are also made from petroleum and natural gas can be converted into ethers and blended with petrol to enhance octane and create oxygenated petrol.
Synthetic fuels	Produced from synthesis gas obtained from natural gas, coal or biomass. The synthetic gas is transformed into the liquid fuel via a process called the Fischer-Tropsch synthesis. The most interesting developments are Gas-to-Liquids (GtL), Coal-to-Liquids (CtL) and Biomass-to-Liquids (BtL). These new fuels produce less sulphur emissions and unlike LPG (liquid petroleum gas) and CNG (compressed natural gas), they do not need any change of engines or fuelling infrastructure.
P Series	These fuels are blends of ethanol, methyltetrahydrofuran (MTHF), and pentanes, with butane added for blends that would be used in severe cold-weather conditions to meet cold start requirements. It is anticipated that both the ethanol and the MTHF will be derived from renewable resources, such as waste cellulosic biomass that can be derived from waste

⁷⁰ OECD *Guidelines towards Environmentally sustainable transport*, OECD, 2002

	paper, agricultural waste and urban/industrial wood waste.
Natural gas and Liquefied petroleum gas (LPG)	The interest in natural gas as an alternative fuel stems mainly from its clean burning qualities, its domestic resource base, and its commercial availability to end-users. Because of the gaseous nature of this fuel, it must be stored onboard a vehicle in either a compressed gaseous state (CNG) or in a liquefied state (LNG). (LPG) consists mainly of propane, propylene, butane, and butylene in various mixtures (though the mixture is mainly propane). It is produced as a by-product of natural gas processing and petroleum refining. The components of LPG are gases at normal temperatures and pressures.

Internationally, two biofuels, biodiesel and ethanol (and ETBE made from biologically derived ethanol), account for more than 90% of total usage. Biofuels are most commonly used in low concentration blends with petroleum products. While growing in market share, ethanol and biodiesel remain minor contributors to the overall fuel mix at under 1% of the total road energy use⁷¹. France is a major producer of biofuel⁷².

Biofuels in France

France is the largest producer of biofuels in Europe, accounting for 40% of total European production and increased their use by 250 ktoe between 1993 and 1999. They are also one of the few worldwide countries to have placed a high priority on development of biofuels, mainly through support of research and development and the agricultural sector. Oil companies are allowed substitute biodiesel for normal fossil fuels up to a level of 5% for use in private cars, while commercial fleets can replace up to 30%. In France, 55 cities have fleets of buses running on biofuel. In Germany and Austria biodiesel is mainly used in undiluted form. Production capacity in Germany alone in 2003 is estimated to reach 940,000t with 550,000t sold in Germany in 2002. There are now 14 biodiesel plants in operation.

Europe produces almost all of the world's biodiesel. Biodiesel is over 75% of total European biofuel production, reflecting its agricultural outputs. Within the EU the increased use of biofuels as an alternative to conventional petrol is currently governed by the Biofuels-Directive 2003/30/EC. This legislation proposes to promote the use of biofuels for transportation through:

- Setting a minimum percentage of biofuels to replace diesel or gasoline for transport purposes in each Member State.
- Member States shall ensure by end of 2005 a 2% minimum proportion of biofuels of all gasoline and diesel fuels sold on their market – by end of 2010 a 5.75% minimum proportion.
- Biofuels can be made available as: pure blended in mineral oil derivatives liquids derived from biofuels such as ETBE

As can be observed in Figure 4.1, biodiesel has the largest share of biofuels production in the EU-15, reaching more than 1.2 Mtoe in 2003. During the last decade, biodiesel production increased by about a factor of ten. The growth in bioethanol production has been more modest at about a factor of five compared to 1993 values. Germany, France, Austria, Italy, Sweden and Spain have set the pace for the biofuel sector in recent years.

⁷¹ http://www.dpmc.gov.au/biofuels/report/report_full.pdf

⁷² http://www.erec-renewables.org/documents/RES_in_EUandCC/Policy_reviews/EU_15/France_policy_final.pdf

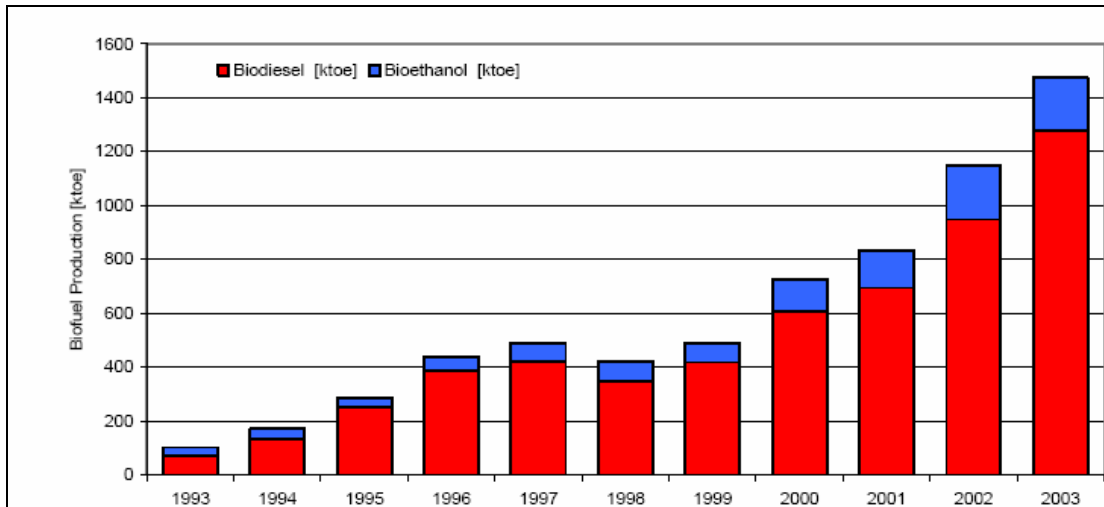


Figure 4.1: Production of Biofuels in the EU

Also, under Article 16 of the Energy Tax Directive 2003/96/EC Member States can continue or start to grant tax reductions/exemptions in favour of biofuels. Currently nine Member States have partly or completely detaxed biofuels: Austria, Czech Republic, France, Germany, Italy, Lithuania, Spain, Sweden and UK. Table 4.2 summarises some of the taxation policies in various countries⁷³.

Country	Biodiesel Tax reduction	Bioethanol Tax reduction	Comment
Austria	95% ~ 28 cent/litre		Blends exempted if up to 5% or 2% blended with gasoline or diesel respectively
France	84% 33 cent/litre	84% 50 cent/litre	
Italy	100% ~ 40 cent/litre	100% ~ 55 cent/litre	Only moderate growth due to high biofuel costs
Spain	100% ~29 cents/litre	100% ~42 cents/litre	
Sweden	100% ~29 cents/litre	100% ~29 cents/litre	For ethanol only in pilot projects
UK	42% ~29 cent/litre	42% ~29 cent/litre	Effective from 2005 – 2010

Table 4.2: Taxation policies on biofuels in some countries

4.2.2 Biofuels in Other Countries

In parts of North America, E10 is common and about 200 retail outlets sell E85 for 'flexible fuel vehicles'. In Brazil, petroleum contains ethanol within the range of 20–25%. In Europe, Sweden is the only country using direct blending extensively (at E5), but France and Spain produce ethanol

⁷³ Ragwitz, Mario et al. *FORRES 2020: Analysis of the renewable energy sources' evolution up to 2020* Fraunhofer Institute 2005

and convert it to ETBE. Spain and Germany are beginning to produce fuel ethanol. European fuel standards allow for blends of up to 5% of alternative fuels, including ethanol, without labelling.

Brazil through its extensive sugarcane crops, closely followed by the USA, dominates fuel ethanol production. Currently China, India and Thailand are emerging as significant fuel ethanol producers.

Sweden⁷⁴

Sweden is the first country to make a concerted drive towards an oil free economy within 15 years. Since the fuel crises of the 1970s the Swedes have been aware of the precarious nature of imported oil – initially due to the volatility of the Middle East and more recently due to the many reports highlighting the limited supplies of crude oil. In response to this they invested heavily in nuclear, hydro and renewables. Currently renewables provide 26% of their energy while oil (which is used almost exclusively for transport) accounts for 35%. In comparison Ireland's oil supplies account for 55% of our total energy demand while renewables account for 3%. The remainder is mainly gas, which comes from the European grid.

In Sweden 10% of all new cars are run on biofuels. The biofuels consist of methane, ethanol, biodiesel and DME. DME, which is a by product of the wood industry has been flagged for use in heavy machinery. There are numerous incentives promoting the uptake of these vehicles: E85 (85% ethanol, 15% petrol) is 40 cent cheaper than petrol; biofuel cars are exempt from congestion charges in the major cities and also receive free parking.

Environmental policy for vehicles used by the national authorities in Sweden

In order to increase the proportion of environmentally sound vehicles used by the authorities, in December 2004 the Government adopted Ordinance (2004:1364) on local authority purchases and leasing of environmentally sound vehicles, which stipulates that the equivalent of 25% of all vehicles owned by the national authorities purchased in 2005 must be environmentally sound. Vehicles which are fuelled, either wholly or in part, by biogas, ethanol or electricity are considered to be environmentally sound. This target has been increased to 35% for 2006.

Brazil

Brazil began to focus on its production of fuel ethanol in the 1970s as a reaction to the oil crisis. At that time Brazil was also facing severe economic difficulties, including the world's largest foreign debt and heavy dependence on imported oil.

The *Proálcool* programme, launched in the 1970s, remains the world's largest commercial application of biomass for energy production and use. The government adopted measures to develop new plantations, produce a fleet of ethanol-fuelled vehicles, extend the number of distilleries, establish new fuel-distribution systems, stimulate alcohol demand, and sought to identify common ground among the agricultural and industrial players. With the mandate for the quantity of ethanol in petrol in 1991, government succeeded in demonstrating the technical feasibility of large-scale production of ethanol as a transport fuel and its use in high level blends.

In recent years, Brazil offered government credit to the sugar industry to cover 60% of its storage costs in order to guarantee ethanol supplies, mandated their use in government fleet vehicles and pioneered flexible fuel vehicles that can operate on anything from straight petrol to E85. Brazil mandates the blend, each year, within the range of 20–25% ethanol in petrol. In 2003, government taxes on petrol containing 25% ethanol were about US\$0.30/L (A\$0.40/L) and approximately US\$0.17/L (A\$0.22/L) for hydrous alcohol (E85).

Brazil's ethanol exports are rising rapidly as costs continue to come down and world demand for biofuels increases. A highly regarded industry analyst has assessed the net cost of production,

⁷⁴ *World Report*, RTE Radio 1, Saturday 11th March 2006

including investment costs, in Brazil in 2003 in a plant with an annual capacity of 55 ML to be about US\$0.14/L (A\$0.19/L).⁷⁵

Brazil established the *National Programme for the Production and Use of Biodiesel Programme* in 2002 and legislation passed in 2004 year authorised B2 and B5 blends. A mandate will commence in 2008.

4.2.3 Alternative motorised transport

The current internal combustion engines (ICEs) in conjunction with three way catalysts, will remain the dominant automotive design for the near future⁷⁶. In recent times ICEs have undergone several changes resulting in more efficient and environmentally friendly transport. Some of these changes were a matter of technology developments and cost optimisation, but many were driven by government interventions such as emission legislation. Most manufacturers however still spend the majority of their efforts in improving conventional gasoline or diesel technology. Their main goal is to comply with future emission limits and to improve fuel economy. The European Commission's strategy to reduce greenhouse gases from passenger cars includes the voluntary agreement with manufacturers to reduce new fleet CO₂ emissions to 140g/km by 2008. This represents a 25% decrease since 1995 but it now appears that the targets may not be achieved in time.

These decreases are expected to be achieved with advances in the conventional vehicle technology. Some of the technological changes include altered injection systems, optimisation of the current systems, advanced cooling systems, lean burn control, variable valve control, engine downsizing, etc⁷⁷. While these improvements will continue to improve efficiencies (and this is of particular interest for biofuel driven vehicles) the need for a more sustainable transportation option, especially in the passenger car market, points towards a switch to electric, hybrid or fuel cell vehicles.

Hybrid

Many of the main automotive manufacturers have hybrid vehicles on the market or in the process of release (Toyota, Honda, Fiat, Ford, Audi, Saab, GM). Hybrid cars run using a conventional engine (petrol or diesel) in parallel with an electric motor. Though hybrid cars work well for both long and short distance trips their benefits for city driving are most pronounced because:

- The fuel supply to the engine can be turned off when no propulsion power is needed (for example, when coasting down a hill or when stopped at traffic lights) and the engine can be restarted instantly on demand.
- The engine size is decreased to improve efficiency, with electric power used to augment power demand when necessary.
- Regenerative braking can be used to recapture and re-use energy that otherwise would be lost to heat when braking. The alternator transforms this braking energy into electrical energy, which is stored in the battery for later use.
- Electric propulsion can be used with the engine off.

Some of the main issues with hybrid (and electric) vehicles that may affect their uptake as a viable sustainable option are:

- Weight
- Complexity
- Price
- Production cost

⁷⁵ FO Licht and Agra CES Consulting. *Ethanol production costs: a worldwide survey*. Agra CES Consulting, Kent, 2004, p.123.

⁷⁶ <http://www.irish-energy.ie/uploadedfiles/InfoCentre/GHGtransportFNLformattedcover04.pdf>

⁷⁷ <ftp://ftp.jrc.es/pub/EURdoc/eur20747en.pdf>

Current policy in Ireland allows for a 50% reduction in VRT for hybrid cars. Yet, even with this the costs of most hybrids are prohibitive.

Electric

Electric vehicles have been in development and discussion for decades without any great market penetration. Many studies on future sustainable transport strategies no longer include electric vehicles, as they are not seen to hold much potential unless combined with a combustion engine in a hybrid vehicle. Although the efficiency of electric vehicles is much higher than ICE vehicles with a 90 percent efficiency compared with an average of 25-30 percent for ICE's, the increased weight of electric vehicles due to the heavy batteries used in the past has not shown much improvement in total energy consumption. Battery technologies are critical to the success of electric vehicles and present large challenges technically and commercially. There has been no breakthrough of any one technology that demonstrates an economical combination of energy efficiency and density, power and life-cycle characteristics suitable for the mass production of vehicles.

Though battery technology has advanced in recent years all options remain prohibitively expensive. To date lead acid batteries have been mainly used in electric vehicles. They are the most inexpensive but have low specific power and poor performance in cold temperatures. Nickel-metal hydride and lithium-ion batteries are more advanced and offer significant improvements in terms of life cycle and specific energy. Pure electric vehicles are not viewed by the automobile industry as presenting an attractive option for sustainable mass transport in the future except for niche applications, for example where there is a need to solve local air quality problems. The focus has shifted to hybrid vehicles and alternative fuels, such as biofuels and natural gas for the short term, synthetic fuels for the medium term and hydrogen fuel cells in the long-term.

Electric Vehicles in California

The development of electric vehicles worldwide has been driven by the Zero-Emission-Vehicle (ZEV) legislation since 1998 in California. Californian automotive emissions legislation is the international trend setter and although the legislation has changed somewhat since its initial inception (due to litigation by manufacturers), vehicle manufacturers are still required to sell a certain percentage of their passenger vehicles as electric and advanced technology vehicles. Since most vehicle manufacturers sell vehicles in California, nearly all have been forced to develop some electric vehicles in order to comply. The legislation has also spurred on the development of other advanced technologies that qualify for partial credits under the ZEV-rule (CARB, 2003). There are now several electric vehicles available in California, which are competitive in terms of price and performance with conventional petrol cars. Electric vehicles in Europe have in recent years found more use as public service delivery vehicles in urban transport programmes such as CUTE (Clean Urban Transport for Europe).

Fuel cells

Though there has been much enthusiasm for the idea of hydrogen as the new fuel of the future that will solve greenhouse gas and energy supply problems, its more common suggested use is in fuel cells. As an alternative fuel, hydrogen has many technological issues that remain to be solved both in the vehicles utilisation of the fuel and its production, before its potential can be realised. Hydrogen can be burned in hydrogen combustion engines, with the advantage of zero CO₂ tank to wheel emissions and low emissions of other pollutants, except perhaps NO_x. Some vehicle manufacturers, such as Ford, have demonstrated concept models in recent years. This technology is also favoured by BMW and they have announced their intention to begin selling hydrogen vehicles in Europe in the near future. The real energy reduction is approximately 15% over a lean burn petrol engine producing the same power.

Fuel cells, the more common suggested use of hydrogen, are electrochemical systems that convert the energy of fuel directly into electric power with up to 65% efficiency and very low pollutant emissions. They have been used in other industries since the 1950's (aerospace and electric power) but a technological breakthrough in 1987 brought them to the notice of the automobile industry. The main difference between a fuel cell and a battery is that fuel and oxidants are not integral parts of the fuel cell, but instead are supplied as needed to provide power to an external load, while the waste products are continuously removed.

The main challenges to the use of fuel cells in the automotive industry are:

- The costs of producing the fuel cell stacks needs to be reduced
- Breakthroughs in storage technology would have a large impact in accelerating the acceptance and commercialisation of fuel cell vehicles
- The size and weight of all components of the fuel-cell power system have to be reduced in order to improve overall fuel efficiency
- Fuel cells need to be able to start faster and respond better to rapid changes in power requirements.
- Durability and reliability in extreme operating conditions must be increased.
- The processing systems that convert hydrocarbon fuels (such as gasoline) into hydrogen for the fuel cell need to be improved
- Experience needs to be gained of operating, fuelling, maintaining and repairing a sufficient fleet of buses operated over a sufficiently long period of time to allow thorough de-bugging of the drive-line technology and for setting standards and guidelines for updating its design
- Public awareness of and support for the new technology needs to be obtained
- Hydrogen-specific regulations must be introduced addressing safety
- Hydrogen infrastructure needs to be established.

Finally, the main advantages of the fuel-cell vehicle will have to be carefully assessed in comparison to the alternatives: other systems too, show significant improvements over conventional systems with regard to emission reductions. Regenerative hydrogen can also be used in internal combustion engines. Furthermore, it must be determined when, to what extent, and at which costs regenerative hydrogen can be made available for use in fuel cell vehicles. Fuel Cell bus trials have taken place in Australia⁷⁸.

Perth Fuel Cell Bus Trial

As part of the Western Australian Government's commitment to working towards sustainable transport energy solutions in Western Australia, a number of initiatives are being introduced to encourage the development of clean fuels.

Since September 2004, Perth has been participating in one of the first major trials of hydrogen fuel cell buses in the world. Three Daimler Chrysler hydrogen fuel cell buses will be trialled on normal Perth service routes for two years.

Participation in the trial brings Western Australians close to the global development of this exciting technology, and will allow us to fully evaluate the potential of hydrogen and fuel cells as one of the possible transport energy solutions of the future.

⁷⁸ <http://www.dpi.wa.gov.au/ecobus/1206.asp>

Hybrids around the world⁷⁹

- Robert Friedland, chairman of a large copper project in **Mongolia**, predicts that China will be the world's largest car manufacturer in less than 20 years. He says, "The Chinese Government is smart enough to realize that if they build 500,000 gas-guzzlers, they are going to have a huge environmental issue, as well as a balance of payment issue."
- Toyota announced the sale of the 50,000th Toyota Prius in **Europe** in November 2006. The 50,000th Prius was sold by a Dutch Toyota dealership, Dijkman in Haarlem, to a local family. **The Netherlands** accounts for 10% of Prius sales in Europe. The landmark comes as the demand for hybrid technology grows in Europe. As of the end of September, year-to-date sales topped 17,300 units, with 2006 sales accounting for over 34% of total European cumulative sales. September 2006 sales of 2,895 units was up 30% compared to September 2005, and marked the best ever sales month of Prius in Europe. As of the end of August 2006 more than 570,000 Prius models have been sold worldwide since its launch in Japan in 1997 – with total hybrid Toyota and Lexus cars sales now topping 750,000. Worldwide production of Toyota Prius has been stepped up to meet demand.
- **Israel's** finance ministry has decided to offer tax incentives on hybrid cars as part of a policy to encourage their use. The finance ministry has decided that the tax on hybrid models will be 45% instead of 95% on gasoline and diesel cars.
- **Thailand** will cut excise taxes on electric and hybrid cars by as much as 75% to promote the use of fuel-saving automobiles.
- Akio Toyoda, senior managing director at Toyota, told The Times of **India**: "Whatever technology is adopted – electric or fuel cell – hybrid will be the core. It's indispensable...India has great potential for growth."
- In June 2006, Toyota launched the Prius in **Costa Rica**, its first launch in a Latin American country, according to Agence France Presse.
- In **Singapore**, Borneo Motors stopped selling the classic Toyota Prius and has no plans to import the 2004 model. Honda distributor Kah Motors stopped selling the Insight, and is only accepting special orders for the Civic Hybrid. Distributors say high cost and poor sales sounded the death knell for hybrids.

The suitability of the various alternative fuels has been extensively examined and their applicability is summarised as follows⁸⁰:

- Biofuels represent a growing niche product as a replacement to fossil fuels. The EU Biofuels Directive has set a target for biofuels to achieve a 5.75 percent share of transport fuels by 2010.
- From the literature it is estimated that biofuels could reduce CO₂ emissions by between 0-80% compared with the energy-equivalent fossil fuel, depending on the biofuel, utilisation of co- and waste products, and how much societies and consumers are willing to pay.
- Natural gas and liquid petroleum gas are regarded as intermediate fuels until fuel cell technology has matured.
- Compressed natural gas can be used to produce synthetic liquid fuels for future combustion technologies.
- Pure electric vehicles are not viewed to be very relevant for the future mainstream fleet. They will remain useful as a local air quality solution.

⁷⁹ <http://www.hybridcars.com/newsletter/hybrid-cars-news-0006.html#world>

⁸⁰ <http://www.irish-energy.ie/uploadedfiles/InfoCentre/GHGtransportFNLformattedcover04.pdf>

- Hydrogen is regarded as the fuel of the future but only if the many technical challenges such as the energy intensity of its production and storage can be resolved. It will be used ideally with fuel cells but will probably not become widespread before 2015.

4.2.4 Modal Transport Shift

A shift away from road transport to other modes of transport was one of the outlining recommendations made in the White Paper on European Transport Policy⁸¹. In a recent study one of the key issues at a European level is the parallel growth between GDP⁶⁹ and passenger transport numbers and decoupling transport growth from economic growth is a central aim in the common transport policy. The white paper also noted that economic growth almost automatically generates greater mobility it must be ensured that this additional mobility is not automatically translated into road transport. A package of proposals to achieve the following is recommended in the white paper:

- Revitalising the railways;
- Improving the quality in the road sector;
- Striking a balance between growth in air transport and the environment;
- Turning intermodality into a reality;
- Adopting a policy on effective charging for road transport;
- Developing high quality urban transport;
- Putting R&D into clean, efficient transport;

Summarised below are some of the actions/incentives that have taken place across Europe in the drive towards more sustainable transport.

Taxation of Vehicles

One of the pillars of the EU Commission strategy to reduce CO₂ emissions from passenger car is a comprehensive strategy on their taxation. It recognises the need to harmonise taxes on passenger cars in the EU in order to 'remove tax obstacles and distortions to free movement of passenger cars within the internal market' and also in order to restructure 'existing vehicles taxes to put more emphasis on environmental objectives in line with Community policy and Kyoto Protocol'⁸². The Communication recommends abolishing registration taxes across the EU and relating vehicle taxes directly to their CO₂ emissions. More recently the European Commission presented a proposal for a Directive that would require Member States to re-structure their passenger car taxation systems⁸³. It would promote sustainability by restructuring the tax base of both registration taxes and annual circulation taxes so as to include elements directly related to carbon dioxide emissions of passenger cars. Under the draft, member states would be required to derive at least 25% of their total car tax revenues from CO₂ based elements by 31 December 2008. The figure will then rise to 50% by 2010. To date, it has not been possible to find a common position within the Community on this subject and there are 25 different tax regimes in existence in the EU for passenger cars. The UK is currently the only Member State with vehicle taxes differentiated according to CO₂ emissions.

Road Pricing

Road pricing is a generic term for charging for the use of roads using direct methods, charging the users of a specific section of the road network for its use. Examples include traditional methods using toll booths and toll roads, as well as more modern schemes employing electronic

⁸¹ CEC *European Transport policy for 2010: time to decide, White paper*. European Commission, 2001

⁸² http://europa.eu.int/comm/energy_transport/library/lb_texte_complet_en.pdf

⁸³ http://ec.europa.eu/environment/co2/pdf/taxation_com_2005_261.pdf

⁸³ http://europa.eu.int/comm/taxation_customs/taxation/other_taxes/passenger_car/index_en.htm

toll collection such as the (2003) London congestion charge⁸⁴, Singapore's Electronic road pricing, the Trondheim toll scheme, the Highway 407 bypass of Toronto and high occupancy toll lanes in the United states (e.g. SR-91 and Interstate 15 in California).

London Congestion Scheme

The London congestion charge, which commenced in 2003, is a fee for motorists entering the Central London area. London was not the first city to adopt congestion charges, but as of 2006 it is the largest city to do so. The aim of the scheme is to encourage travellers to use public transport, cleaner vehicles, bicycles, motorcycles or their own two feet instead of motor automobiles, thus reducing congestion and allowing for faster, less polluting and more predictable journeys. Much of the money raised in the scheme is invested in public transport.

A study into the impact of the scheme after 12 months gave the following results:

- Traffic delays inside the charging zone remain 30% lower than before charging was introduced
- Estimates of changes in traffic levels show a reduction of 18% in traffic entering the zone during charging hours
- There has been an increase of 29,000 bus passengers entering the zone during the morning peak period
- Congestion charging contributes £50m to London's economy, mainly through quicker and more reliable journeys for road and bus users
- There remains no evidence of any significant adverse traffic impacts from the charge
- The number of penalty charges issued average 165,000 per month
- There are about 110,000 charge-zone payments per day
- There are 65,000 fewer car trips into or through the charging zone each day
- Taxi, bus and coach movements have increased by 20%

In recent years some countries have implemented road charges for lorries, which have been differentiated according to environmental performance. These countries include Switzerland (2001), Austria (2004) and Germany (2005). Currently, the Czech Republic and the United Kingdom are also working on plans for road pricing for lorries. However, charge levels of existing schemes are still well below marginal infrastructure and external costs.

Other Pricing Structures

In aviation, price structures are adapted to environmental performance at some locations. Heathrow and Gatwick followed Sweden by introducing landing and take-off emission charges. However, these new charges are, unlike in Sweden, well below external cost levels. Excise duty on fuel for domestic flights has been introduced in the Netherlands, and other countries have expressed similar plans. Meanwhile, the Commission is working on plans for including the emissions from international aviation in the European Union emission trading scheme for greenhouse gases. This would constitute an alternative to fuel taxation, which is currently banned on international aviation by international agreements.

Cycling

A recent report by the European Conference of Ministers of Transport on National Policies to Promote Cycling⁸⁵ summarised findings from a study of 21 countries and seven municipalities on developing and implementing policies and measures to promote cycling as a means of travel. The report states that:

- While regional and local authorities bear the primary responsibility for detailed planning and implementation of cycling policies, national-level commitment is important in setting

⁸⁴ Transport for London *Central London Congestion Charging Scheme Impacts Monitoring*, TFL, 2005

⁸⁵ European Conference of Ministers of Transport *Implementing Sustainable Urban Travel Policies: Moving Ahead*. OECD, 2004.

the right legal, regulatory and financial framework so that successful implementation of cycling initiatives can take place.

- The report found that an increasing number of countries are developing national cycling strategies, plans and policies. Of the 21 countries studied, 14 cited the existence of a national plan in some form.
- The Netherlands provides an interesting example of what can be achieved through a national commitment to cycling. In the late 1960s and early 1970s, the Dutch Government became increasingly aware of the issues of congestion, oil dependence and pollution. As a result, since 1973 national transport policy in the Netherlands has focused on limiting the increase in travel demand and reducing car use. A national target to reduce growth in car use has been in place since 1980. In 1976 the Dutch Ministry of Transport established two contribution regulations whereby the national government would provide (a) 80% of construction costs for city bicycle facilities and (b) 50% of construction costs for bicycle facilities along secondary and minor roads. The Dutch Bicycle Master Plan was published by the Ministry of Transport, Public Works and Water Management in 1991. As a result of these and other initiatives, 28% of trips are now made by bicycle in the Netherlands.

In general, those countries with dedicated funding and an implementation plan have achieved the greatest changes for cycling.

In an effort to tackle the lack of policy for inclusion of cycling at a local level the Bicycle Policy Audit (BYPAD) group was developed by an international consortium of experts between 1999 and 2001 as part of an EU project⁸⁶. BYPAD is based on European best practice, which means that measures recommended in BYPAD have been successfully implemented in European cities. BYPAD stands for Bicycle Policy Audit and is based on the methods of quality management, which have already been used in the business world for many years. Cycling policy is considered as a dynamic process whose strengths and weaknesses are analysed. In this context, the focus is not only on the measures and results of cycling policy, but also, in particular, on the question of how this process is incorporated into political and administrative structures. This in turn enables problem areas to be analysed, new areas for activity and potentials for improvement to be identified, strategic partners to be found and sustainable solutions to be developed.

Danish Cycle City

From 1999 to 2002, the city of Odense, **Denmark** (population: 150,000) was the official National Cycle City of Denmark. The project developed 50 pro-cycling initiatives, which included physical improvements of bicycle infrastructure, changes in regulations and awareness campaigns. During the project period, the citizens of Odense made 35 million new cycle journeys (about 25,000 per day); half of which were previously made by car. The project shows that cycling policy can provide a rather cost-effective way to reducing car traffic in cities.

Call a bike

"Call a bike" is a German Railways bike rental service. This innovative bike hiring service offers a cost-effective, comfortable, easy and convenient alternative to the car in inner city areas. The new bicycle-hire scheme is mainly designed for one-way trips. Bicycles do not have to be returned to departure stations. They can be left at the nearest major crossing within the core area. People, who are registered as Call a Bike client, can use the bikes by calling the number on the bike they want to rent. The client receives a four digit code which he enters on a touch screen to release the lock. Each CallBike is protected by an electronic lock that can only be opened with a numerical code. The Call a Bike system has been highly appreciated by railway customers, but also by other city visitors. In Berlin and Munich more than 20,000 persons are currently registered as Call a Bike clients. More than 1,100 individual bike rides are recorded every day. Call a Bike shows how the combined use of bicycles and public transport in cities can be promoted successfully.

⁸⁶ http://www.bypad.org/cms_site.phtml?id=552&sprache=en

Public Transport

The switch away from passenger cars to public transport is one of the easiest ways to reduce GHGs, especially if that public transport is powered by alternative fuels (biofuels in buses, green electricity trams)⁸⁷. This switch is dependent on a quality public transport system. Austria for example has a low level of CO₂ emissions per capita and it has provided strong support for public transport systems – particularly rail. Currently the trends indicate that the occupancy rates of passenger cars have long been declining at a steady pace. No clear trends appear for public transport modes but train occupancies are generally 30% or less.

High-level public transport is possible — Curitiba, Brazil

Due to lack of funds to finance a proper metro system, the city of Curitiba in Brazil (about 1.5 million inhabitants) set out to construct a low-cost alternative 30 years ago. The system was centred around buses running on dedicated lanes, elevated covered platforms for loading and unloading, short intervals between buses etc. In short, these are all the attributes of a modern metro system. In spite of having a level of car ownership similar to many EU countries, around 70% of commuters use the bus system every day. This represents a high share for a city of relatively modest size. The success was helped by 30 years of political support in the form of land use planning that located people and businesses in such a way as to allow easy use of public transport.

Travel Smart

TravelSmart is a successful Western Australian community-based program that encourages people to use alternatives to travelling in their private car. TravelSmart is about encouraging a lot of people to make small changes in behaviour – which makes a big difference. They have already produced some spectacular results. They don't tell people what to do, rather give them information, advice and encouragement, and then leave the choices up to them. All levels of local communities are involved – government, business and community groups – in TravelSmart programs and let them drive the process of change. A great deal of effort is put into raising community awareness of travel issues, but success is measured by the changes people make in their travel behaviour. The Metropolitan Transport Strategy target is for a 35% reduction in car-as-driver trips over the next 30 years. TravelSmart is a vital part of this strategy.

Logistics

More goods are transported over longer distances and more frequently than ever before. As a result, freight transport volumes have grown 34% between 1991 and 2003⁶⁹. This has led to an increase in transport CO₂ emissions and slowed the decline in emissions of air pollutants. During the same period, the economy grew by only 26%, implying that freight transport intensities have increased. The rise of strategies such as supply chain management and just-in-time deliveries of freight loads has had an effect with smaller but more frequent loads now being delivered exactly when needed. Now, the use of transport logistics is being promoted as a method for reducing the emissions associated with this sector.

Various EU policies have been aimed at modal shift, such as the railway packages, initiatives on infrastructure charging and the Marco Polo programmes. The first phase of this programme ran from 2003 to 2006 with a budget of €100 million. The programmes objective is to reduce road congestion and to improve the environmental performance of the freight transport system within the Community and to enhance intermodality, thereby contributing to an efficient and sustainable transport system. To achieve this objective, the Programme supports actions in the freight transport, logistics and other relevant markets. These actions should contribute to maintain the distribution of freight between the various modes of transport at 1998 levels by helping to shift the expected aggregate increase in international road freight traffic of 12 billion tkm per year to short sea shipping, rail and inland waterways or to a combination of modes of transport in which road journeys are as short as possible.

⁸⁷ European Environment Agency *Transport and environment: facing a dilemma*, EEA, 2006

All segments of the international freight transport market are within the scope of the Programme. The second phase, Marco Polo II programme has the objective to shift at least the expected increase of international freight transport, 144 billion tonne-km in the period 2007–2013, off the road. With €106 million available per year, Marco Polo II ambitiously aims at a shift of nearly 200 tonne-km per euro.

Technology paves the way for lower freight transport volume - UK

The use of computerised vehicle routing packages offers a promising path to transport saving. Two types of computerised packages exist: journey planners and vehicle scheduling systems. Journey planners are typically used for single routes. Here, the user decides the calls to be allocated to each trip. Then, he or she determines the best route and call sequence by using the journey planner. Vehicle scheduling systems process information about customer locations, quantities and types of goods, and match this to available vehicle capacity to produce economic routes. Depending on the quality of the previous manual load planning, use of such packages can typically cut transport costs and distance travelled by between 5 and 10%. Occasionally, even greater benefits are realised. One such system, Paragon, has also been used to achieve more efficient routing and order volume smoothing through the week for the UK food wholesaler Cearn's & Brown. This has resulted in their national distribution fleet size being reduced by 13%. It has also reduced delivery kilometres per pack by 14%

Vehicle-kilometres can be saved without economic loss - the Netherlands

In order to stimulate transport efficiency, the Dutch Ministry of Transport has set up a subsidy programme and a website for promoting the saving of vehicle kilometres in goods transport. The website is a resource of ideas and concrete examples of transport savings. It offers many possible strategies, such as product design or packaging aimed at the reduction of occupied space; the removal of air or water from products before transport; the clustering of suppliers and consumers; and improvements to logistics. All these strategies can reduce the number of vehicle-kilometres while at the same time cutting expenses. One Dutch company processes 50 million kilograms of plastics waste annually. For this purpose, rubbish trucks cover 567,750 vehicle-km. If successful, a new innovative project will allow the company to compress the rubbish by 25% more than normal, allowing the containers to be optimally filled and reducing the transport requirements by the same percentage.

4.3 Transport in Ireland

In light of the Irish commitment to GHG emission limits under the Kyoto protocol, the increase of CO₂ emissions from the transport sector by 130% between 1990 and 2003 poses a serious problem⁸⁸. Energy use by the transport sector accounted for 26% of the energy related CO₂ emissions in 2002 with an annual growth rate of 7.5%⁹². The transport sector is currently almost completely dependant on oil. The amount of oil required by this sector has almost tripled since 1973⁸⁹. In the early 1990s Ireland used less oil per capita for transport than the average of the EU 25, however by 2002 Ireland had consumed at least 50% more oil per capita for transportation. Relative to other European countries Ireland is performing badly⁹⁰ as Figure 4.2 indicates.

⁸⁸ *ibid.*

⁸⁹ Forfás *A baseline assessment of Ireland's oil dependence*, Forfás, 2006

⁹⁰ European Environment Agency *Transport and environment: facing a dilemma TERM 2005: indicators tracking transport and environment in the European Union* EEA 2006

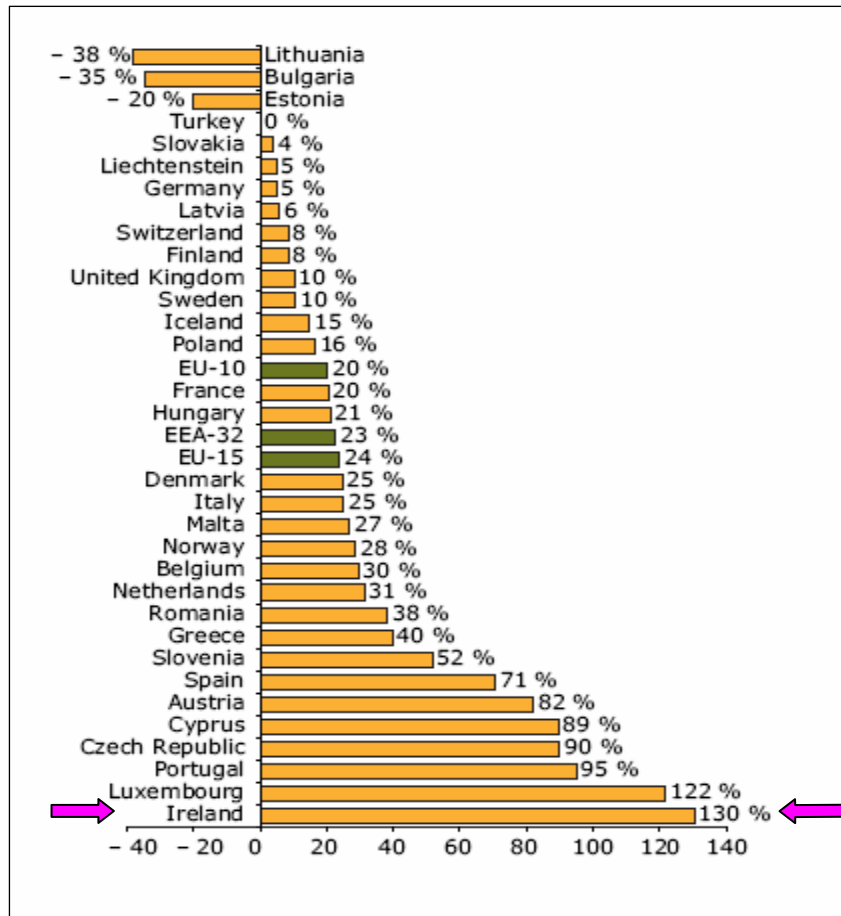


Figure 4.2: Increases in CO₂ emissions from transport between 1990 and 2003

A breakdown of the total transport energy use by mode for 2000 is given in Figure 4.3.

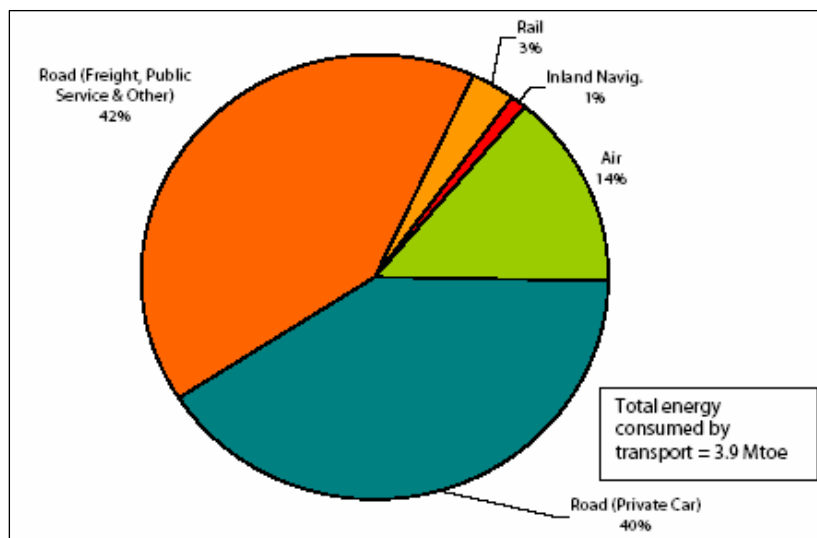


Figure 4.3: Transport energy use by mode

Ireland still has some way to go in terms of car ownership relative to the EU average. This suggests considerable room for further growth in car ownership and usage in the decades ahead. The anomaly of lower rates of car ownership but higher oil usage for transportation can be attributed to a number of factors.

- Firstly, it may be that Irish residents use the existing stock of cars more intensively than in other EU countries, due to more distributed settlement patterns, longer commuting distances and weaknesses in the public transportation infrastructure.
- Secondly, increased freight transport by road has contributed to the increasing consumption of oil in transportation in Ireland. Between 1995 and 2002, national road haulage volumes more than doubled, compared with an EU-15 growth of just 19%. Over the same period, rail haulage volumes fell by 28% in Ireland, while they increased by 6% in the EU-15 countries.
- Thirdly, the emergence of low cost air travel and the revolution in air travel availability from Ireland has also contributed to the increasing consumption of oil in transportation. Between 1990 and 2002, the number of passenger kilometers generated by Irish air travellers to other EU-15 countries more than doubled, while the volume of total EU traffic rose by 78% over the same period.

The growing popularity of larger cars and sports utility vehicles (SUVs) is now one of the single biggest contributors to increasing greenhouse gas emissions from transport in Ireland⁹¹. The purchase of heavier, less fuel-efficient cars with larger engine sizes has eroded the fuel efficiency developments made by car manufacturers in the last four years. Some SUVs produce more than three times the amount of greenhouse gases when compared with smaller cars. It is estimated that this trend will add an additional 300,000 tonnes of greenhouse gases into the atmosphere each year. While the number of private vehicles in Ireland had increased by 90% to 1.51 million, emissions from transport rose by 139%. Despite trends improving internationally, fuel efficiency in the Irish car fleet had remained virtually static and was getting slightly worse because people are buying larger cars. The average Irish car is now less fuel efficient than in 2004, burning on average seven litres of petrol for every 100 kilometres travelled. The number of large cars, or private vehicles with engine sizes of more than 1900cc, has increased threefold since 1990 to nearly 200,000. Car manufacturers are required under European law to provide figures on fuel efficiencies and greenhouse gas emissions. These show that some SUVs and sports cars produce more than three times the amount of greenhouse gases for every kilometre driven, compared with the most fuel efficient smaller cars.

4.3.1 Irish Transportation Policies

In Ireland, the main policy instruments available to mitigate greenhouse gas emissions from transport are fiscal and information instruments. These policy instruments have generally two objectives:

- Influence behaviour or the utilisation of public and private transport so that the energy intensity of transport activity is reduced
- Affect purchasing decisions in order to encourage increased market penetration of low carbon technologies (fuels and vehicles) and hence affect the fleet composition by lowering the energy intensity of transport.

A study by SEI in 2004⁹² extracted five main instruments by which transport sustainability may be achieved. These were:

- Alternative fuels incentives
- Taxes on vehicles and fuels
- Encouraging a modal shift

⁹¹ *Irish Times*, 3/4/2006

⁹² Sustainable Energy Ireland *Strategies to Reduce Greenhouse Gases from Irish Transportation*, SEI, 2004

- Consumer information
- Road charges and tolls

Many of these had previously been highlighted as essential in meeting our Kyoto commitments^{93,94}. Yet in Ireland private car ownership in Ireland jumped by 75% between 1990 and 2003 and has continued to increase since then. Nationally, the use of the private car for travelling to work has increased from 45% in 1986 to 62% in 2002. The public transport share has decreased from 10% to less than 9% over the same period. In addition, typical journey distances have also increased⁹⁵. Public spending on transport during our recent boom years has been predominantly on road infrastructure with public transport lagging well behind (80% spending on roads with 20% on public transport options).

More recently a Forfás publication⁹⁶ noted that there are a number of short term initiatives that can be undertaken to reduce the usage of oil in transportation, mainly relating to changes in commuting and working patterns, such as increases in teleworking, incentives for car pooling and greater use of existing public transport services. In the longer term, however, there are only two options in relation to reducing oil consumption for transportation purposes, namely:

- Bringing about the replacement over time of the existing stock of vehicles with more fuel-efficient vehicles, including hybrids and others that do not run on petroleum related fuels (e.g. biofuels, hydrogen fuel cells). Ireland already provides some tax relief in relation to hybrid cars. The budget of 2006 extended the hybrid tax relief to fuel-flexible cars. A more radical adoption of this approach could lead to a faster increase in hybrid usage (and therefore fuel efficiency benefits) than will otherwise be the case.
- The provision of alternative modes of transport, particularly public transport, that run on electricity rather than petroleum related fuels (e.g. electrified trams, trains and buses). The recent Transport 21 programme of capital spending on transport over the next 10 years can play a key part in preparing Ireland for the transition to a world of falling oil supplies - its strong emphasis on public transportation infrastructure (accounting for €16 billion of the total spend of €34 billion) will be central to this preparation. An opportunity exists to 'fast track' those elements of Transport 21 relating to public transportation that are currently envisaged as part of medium-term and long-term priorities rather than for immediate implementation.

Neither option is likely to yield significant benefits in the form of reduced oil demand for transportation in less than five years, with the main benefits arising after 5-10 years as older cars are replaced and new public transport infrastructure comes on stream.

Despite the call for greater innovation in the transportation sector a recent call on the Dublin Transportation Office (DTO) to trial a car pooling scheme was rejected. Despite a similar scheme being introduced in England the DTO refused to consider it at this time. The UK scheme, costing £2.5 million follows the announcement that a car sharing lane on Britain's oldest motorway, the M1, will open in 2008 following road widening⁹⁷.

4.3.2 Irish Initiatives

In spite of the positive suggestions within the *Transport 21 Strategy* many of them echo proposals that have been made before. For example, in Transport 21 it is proposed to engage with relevant sectors in order to explore the use of biofuels and other clean technologies. Much of the technologies alluded to are now well established in other countries and this has been stated in previous national publications. The needs for fiscal incentives to drive the biofuels industry as well

⁹³ Environmental Protection Agency *State of the Environment* 2004, EPA, 2004

⁹⁴ Department of Environment, Heritage and Local Government *National Climate Change Strategy*, DEHLG 2000.

[http://www.environ.ie/DOEI/doeipub.nsf/0/7d411c497cb4fbd80256f88003b0961/\\$FILE/pccexsuminside%5B1%5D.pdf](http://www.environ.ie/DOEI/doeipub.nsf/0/7d411c497cb4fbd80256f88003b0961/$FILE/pccexsuminside%5B1%5D.pdf)

⁹⁵ <http://www.transport.ie/upload/general/6855-0.pdf>

⁹⁶ Forfás *A baseline assessment of Ireland's oil dependence*, Forfás, 2006

⁹⁷ *Irish Times Motor Section*, 22 March, 2006

as government funding to purchase biofuel based public buses has also been previously highlighted. The success of France, Sweden, Germany and others in their application should preclude the need for further investigation.

Biofuels

Most EU countries currently choose excise duty exemption as the central policy instrument for the implementation of the Biofuel Directive. It is relatively easy to implement. Disadvantages to this instrument are the fact that it generally gives no long-term guarantee, which is a disincentive for investments and innovation. Another disadvantage is that the cost to the government is relatively high.

An alternative is an obligation in combination with a certificate system. The sellers of transport fuel are then obliged to redeem a certain amount of biofuel certificates at the end of the year. An advantage of this system is that one has the guarantee that the target will be obtained using the market mechanism as a driver. Furthermore, it is a flexible system, which could incorporate other elements, such as information about the sustainability of (imported) biofuels, in the longer term. Other interesting policy alternatives may be a levy/subsidy system or a tendering system.⁹⁸

In December 2005 the Minister for Finance, in presenting the 2006 Budget, expanded the excise relief scheme. The level of excise relief will start at €20 million in 2006 and will be increased to €35 million in 2007 and to €50 million in each of the following three years. This relief, when fully operational, is expected to support the use and production in Ireland of some 163 million litres of biofuels per year, representing 2% of transport fuels by 2008.

A significant quantity of research has been done in Ireland into the use of biofuels. In addition to the experimental research conducted by Teagasc at their research station in Oak Park, Co Carlow, the potential of the biofuels industry has also been extensively investigated by Sustainable Energy Ireland (SEI)^{99,100}. There is already a small amount of rapeseed oil produced here with increasing interest from farmers in the South East.

The ongoing research by Teagasc has shown that the best biofuels prospects are biodiesel from vegetable oil or animal fat and ethanol from sugar beet to replace the existing additive used in petrol. In light of the recent closures of the Irish sugar factories there appears to be an ideal opportunity to promote this new industry. According to Teagasc the main barrier to widespread adoption of this technology is cost. In 2004 Cork City Council, who run a portion of their fleet on vegetable oil, purchased rapeseed oil for €0.52/L. With VAT and excise duty added this resulted in an overall price of €1.12/L. At the time this was ~33% more expensive than diesel. In light of the rising costs of petrol and diesel the viability of biofuel is on the increase.

In 2004, the Department of Communications, Marine and Natural Resources secured an amendment to the Finance Act 1999, which provides for the introduction of a pilot scheme for mineral oil tax relief for biofuels which is designed either to produce biofuel or test the technical viability of biofuel for use as motor fuel.

A scheme under the Act was drawn up in 2004 and received State Aids clearance from the Commission in March 2005. Under the scheme, the mineral oil tax relief is proposed in the following categories:

- Six million litres per annum of pure plant oil produced from oil seed rape for use in modified diesel engines. The minimum project size in this category is 50,000 litres of biofuel per year.
- One million litres per annum of biodiesel or other biofuel blended with mineral diesel such that the blend complies with diesel standard EN 590. The minimum project size in this category is 100,000 litres of biofuel per year.
- One million litres of bioethanol, which is blended with petrol to a maximum of 5% (bioethanol), and used in standard petrol vehicle engines. This category also allows

⁹⁸ Sustainable Energy Ireland *Liquid Biofuels Strategy Study for Ireland*, SEI, 2005

⁹⁹ <http://82.195.132.38/uploadedfiles/RenewableEnergy/SEILiqBiofuelsBriefingNote20030912.pdf>

¹⁰⁰ http://www.senternovem.nl/mmfiles/149974_tcm24-124366.pdf

higher blends, up to 85%, for use in flexible fuel vehicles (FFV's). The minimum project size in this category is 100,000 litres of biofuel per year, except where the fuel is to be used in a flexible fuel vehicle application where smaller limits may be considered.

Providing excise relief for transport Biofuels has long been identified as a means to improve the economic viability of the biofuel industry. However, according to Teagasc, the proposed excise relief for 8 million litres of transport Biofuels will only achieve about ten percent of the European Commission's two percent substitution target¹⁰¹. Teagasc conclude that unlimited relief was required for an initial period to allow the industry to develop. Referring to the potential of the industry Teagasc noted that the best immediate Biofuels prospects are rape-seed oil for use in modified engines. The possibility of establishing a liquid biofuel plant based on the Biofine process in Ireland is under consideration.

"If we are to come near to meeting our initial transportation biofuel substitution targets, we need first to start using our oil/fat resource as engine fuel, either as biodiesel or in modified engines, with a target capacity of about 80,000 t/year. We also need an ethanol plant based on beet or cereals, hopefully with a similar capacity. If the Biofine project is successfully commercialized and the biofuel market is the most attractive for its produce, it will make a very useful contribution, but still short of our 2010 target".¹⁰²

Green Filling Station in Ireland

The first filling station in Ireland to sell a "green" fuel as an alternative to diesel opened in Cork in 2005. The pure plant oil (PPO) which is being sold from Great Gas's first outlet in Ballyhea, North Cork, is made from Irish-grown rapeseed oil and is nearly 20c per litre cheaper than diesel. However, diesel engines have to undergo a €1,600 upgrade to run on the new bio-fuel. Supplied by Eilish Oils in Wicklow, PPO was selling for 89.5c in Ballyhea yesterday - diesel was 108.9c. Some State agencies, including the parks and wildlife service of the Department of the Environment, and Cork city council, are running vehicles on bio-fuels on a pilot basis. It is hoped that 100 Great Gas service stations will be in place across the country by 2010. Great Gas has an alliance with www.ecocar.ie for PPO biofuel engine upgrades.

Source: Irish Examiner, 17/11/2005

Cycling

Though investment in cycling lanes is included in the plans for Dublin city, a national cycling strategy is required. Largely ignored in the European White Paper the importance of promoting cycling is finally being acknowledged¹⁰³ and promoted at a European level. Cycling, one of the oldest environmental technologies is embraced in many European cities to great effect.

Yet in Ireland the numbers of school children cycling to school dropped from 50,000 in 1985 to 11,000 in 2003. This can be closely linked to the increased quantities of vehicles and the associated lack of safety. However, the National Roads Authority makes no reference to cycling in any of their documents post 2001.

In Ireland, the cycling lanes that have been installed are often disjointed, begin and end at random and are too close to the traffic (cycling lanes as part of bus lanes puts the health of the cyclist in danger). The example of Cork City Centre's recent facelift without the inclusion of a single cycle lane points to a lack of worth being placed in cycling at a policy and planning level.

An Irish Cycling Campaign has been set up¹⁰⁴ and its main recommendations are:

1. The development of a National Cycling Strategy, such as exists for Northern Ireland.
2. The development of a National Transport Policy which would be integrated and sustainable, giving due weight to cycling as a mode of transport.

¹⁰¹ Rice, B. *Opportunities for Biomass as Fuel*. Teagasc, Carlow, 2005
<http://www.teagasc.ie/publications/2005/20050126/paper6.htm>

¹⁰² *ibid.*

¹⁰³ http://www.ecf.com/files/2/12/22/051220_EUtransportpolicyECFcontrtwhitepaper.pdf

¹⁰⁴ http://home.connect.ie/dcc/internal/icc_meeting.html

3. The need for changes to legislation and rules of the road. In particular there is a need for the removal of the legal requirement for the mandatory use of cycle lanes and for the lowering of speed limits. The impending change from imperial to metric speed limits could present a very good opportunity for the reduction of the limit in 30 m.p.h. zones to 30 km.p.h.
4. The need for more rigorous enforcement of traffic laws, particularly those prohibiting the use of mobile phones while driving, speeding and illegal parking.
5. The need for the NRA (National Roads Authority) to take account of the needs and safety of cyclists when designing roads
6. Representation for cyclists on the National Safety Council. At present there is a disproportionately large representation from the motor insurance industry on the council.
7. Promotion of cycling.
8. The need to shift the emphasis in transport policy away from creating road capacity for large numbers of vehicles to an emphasis on people and safety.
9. Changes in the education of road engineers to facilitate a shift to a more cycle friendly transport policy with respect to road design.
10. The new campaign should oversee a submission, made perhaps jointly by Dublin and Belfast, to host Velo City.
11. A media / public relations campaign.
12. Reducing the volume of HGVs in towns and cities.
13. The integration of cycling into public transport policy by the provision of abundant cycle parking facilities at bus and train stations, unrestricted carriage of bicycle on buses, trains and planes in so far as it is possible, and any other measures conducive to the use of public transport by cyclists.
14. The ownership of cycle routes: who is responsible for example for clearing broken glass from paths?
15. Long distance routes such as those promoted by Sustrans.
16. Improving the quality of cycle parts.
17. The need to counterbalance the disproportionate attention given to vehicular traffic in the media through, for example, the reports of AA Roadwatch, which is actually paid to disseminate its traffic news daily.
18. Contact with the European Cycling Federation.

5. Climate Change

5.1 Introduction

Climate change is one of the greatest environmental, social and economic threats facing the planet. Scientists have reported that temperatures across the globe rose an average of 1 degree over the past century, with the rate of change since 1976 at roughly three times that over the past 100 years. Over the past 100 years the global mean temperature has increased by 0.7 °C and in Europe by about 1.0 °C. The rate of change since 1976 is roughly three times that over the previous 100 years. The 1990s was the warmest decade over the past 150 years with 1998 being the warmest year followed by 2002, 2003 and 2004. Temperatures are projected to increase further by between 1.4 to 5.8°C by 2100, with larger increases in Eastern and Southern Europe¹⁰⁵. There is increased evidence that most of this warming can be attributed to the emission of greenhouse gases and aerosols by human activities.

Human activity, particularly in the industrialised or developed countries has resulted in an increase in the concentration of the three main greenhouse gases in the atmosphere, those being: Carbon dioxide (CO₂), nitrous oxide (N₂O) and methane (CH₄). Their liberation into the atmosphere has been directly linked to climate and weather pattern changes. Climate change has implications for a range of issues including economic activity, flooding, agriculture, marine, energy demand, etc. In addition other global, European and Irish climate change trends include¹⁰⁶:

- In the past 100 years the number of cold and frost days has decreased in most parts of Europe while the number of days with temperatures over 25°C increased.
- The annual growing season in Europe lengthened by about 10 days between 1962 and 1995
- In Ireland there has been an increase in winter max and min temperatures, a reduction in the number of frost days and an increase in the number of hot days
- Global sea surface temperatures have increased by 0.5 – 0.7°C since the late 19th century

In response to these issues the European Union committed to the Kyoto Protocol which aims to reduce emissions to 8% 1990 levels between 2008 – 2012. Under this agreement Ireland was allowed to increase emissions by 13% above its 1990 levels. By 2003 greenhouse gas emissions however were 24.9% higher than 1990 levels which leaves the country with an uphill task to fulfil our obligations.

A report by the Pew Centre for Global Climate change in 2004¹⁰⁷ noted the following themes from a combination of 6 major Climate Change investigation centres:

- While the climate challenge is ultimately one of mobilizing technology, it is in the first instance one of mustering political will, and some approaches to international action can better assist in that than others.
- Scientific and economic uncertainty is not a justification for inaction, but rather an additional rationale for acting now.
- While climate change is a common challenge, countries will engage in collective action only if they perceive it to be in their interest. A multilateral approach must therefore recognize domestic concerns such as development and competitiveness.
- Bridging diverse national interests requires new mitigation strategies and a flexible architecture that can accommodate different types of commitments for different countries.
- Engaging actors beyond the climate circle is essential, both to build domestic support for action and to extend the climate effort into non-climate forums such as trade and development.

¹⁰⁵ CEC. *Winning the Battle Against Global Climate Change*, EC, {SEC(2005) 180}, 2005

¹⁰⁶ Environmental Protection Agency, *Climate Change: Viewpoint*, EPA, 2005

¹⁰⁷ Pew Centre on Global Climate *Beyond Kyoto: Advancing the International Effort Against Global Climate Change*. PCGC, December 2003

5.2 European Policies on Climate Change

The European Union is at the forefront of international efforts to combat climate change and has played a key role in the development of the two major treaties addressing the issue, the United Nations Framework Convention on Climate Change and its Kyoto Protocol. The Kyoto Protocol entered into force on the 16th February 2005 following the ratification of 152 countries and regional economic integration organisations, representing 61.6% of the specified 1990 GHG emissions and almost 90% of the world's population. As part of its commitment to the Kyoto protocol it agreed to reduce its 2008 – 2012 greenhouse gases by 8% of its 1990 levels. As a result of the EU's and many of the individual Member States actions, the latest monitoring data indicates that the European Union has delivered on its long-standing Kyoto commitment to stabilise emissions of CO₂ levels. Equally the New Member States are determined to meet their individual targets under the Kyoto Protocol¹⁰⁸.

In 2005 EU published *Winning the battle against climate change* which gives an overview of various actions to be undertaken at European field for the coming years¹⁰⁹. It also tried to define the main axes of the EU strategy on climate change which are:

- building on key *Kyoto elements* - binding greenhouse gas emission targets, a global cap-and-trade system, and flexible mechanisms;
- undertaking *strong emissions reductions at home*, starting with 20-30% domestic reductions by 2020, using a combination of market incentives and regulation to stimulate investments in efficiency and/or carbon-free and low-carbon technologies;
- adopting a pro-active approach to engage other main actors, notably the US;
- developing a *strategic partnership* with countries like China, South Africa, Brazil and India to assist them in developing sustainable energy strategies and secure their participation in mitigation efforts;
- vigorously *promoting research and innovation* for sustainable energy technologies and removing 'perverse' incentives such as fossil fuel subsidies as well as internalising external costs, including those of climate change, into the price of energy production;
- using European and national legislation to stimulate *greater energy efficiency* and reduce the price of technology which reduces climate impact,
- encouraging much greater direct involvement in mitigation efforts at the level of the European citizen, a necessary prerequisite being the provision of detailed information about the carbon content of products and services and a future option being a system of personal tradable quotas.

MEPs also called on the European Institutions to set a positive example by limiting greenhouse gas emissions in their various activities, through enhanced energy efficiency in office buildings and for all equipment used, low carbon travel etc.; There was also support for "the introduction of ecotaxes at Community level" and a call "to put forward proposals and on the Member States to adopt the first European ecotax by 2009 at the latest".

Some of the other major points from the report that should be closely regarded include:

- Investing in energy efficiency is the most promising way to cut carbon emissions and the potential for cost-effective energy savings in the EU is substantial. It also has the effect of promoting sustainable and rapid economic growth,
- Climate impact can be reduced considerably by means of better community planning,
- Notes that with a systemic approach it would be possible for renewable energies to cover 25% of EU energy consumption by 2020,

¹⁰⁸ http://europa.eu.int/comm/environment/climat/home_en.htm

¹⁰⁹ <http://www.europarl.eu.int/omk/sipade3?PUBREF=-//EP//TEXT+TA+P6-TA-2005-0433+0+DOC+XML+V0//EN&L=EN&LEVEL=0&NAV=S&LSTDOC=Y&LSTDOC=N>

- Emphasises that many of the technologies needed to reduce GHG emissions already exist but that their market entry is hampered by numerous barriers, not least perverse incentives such as subsidies for fossil fuels; It therefore calls on the Commission to propose legislation to abolish all such subsidies and instead to put in place a positive incentive structure for the enhanced use of energy-efficient, low-carbon and carbon-free technologies, and calls for the pro-active use of public procurement within the EU to help bring down the costs for such technologies;
- Notes that investments in efficiency measures and renewable technologies are the main alternatives for climate change mitigation;
- Underlines that developments within the transport sector are critical as it contributes to roughly 30% of the Communities CO₂ equivalent emission, in which approximately 85% is the share of road transport;
- Notes that rail transport is much more energy efficient than road transport and regrets the fact that the automobile industry is unlikely to meet the target of 140 gm/km within the time-limit laid down under the current voluntary agreement; it therefore calls for a policy of strong measures to reduce emissions from transport, including mandatory limits for CO₂ emissions from new vehicles in the order of 80-100 gm/km in the medium term to be achieved through emission trading between car manufacturers; other measures are recommended such as EU-wide speed limits, traffic charges and tax incentives, together with a boost in rail and public transport in general; further urges the Commission to devise innovative ways of making apparent the CO₂ emissions caused by transport and to put forward proposals designed to stabilise or reduce traffic volumes in the EU between now and 2010;
- Reiterates the demand that emissions from international flights and shipping be incorporated into the emission reduction targets from 2012;
- Notes that aviation is responsible for between 4% and 9% of all GHG emissions worldwide and that emissions from aviation are increasing at an annual rate of 3%; it also emphasises the importance of severe reduction targets for the aviation sector; urges the Commission to take prompt action to reduce the climate impact from aviation, by creating a pilot emission trading scheme for aviation emissions for the period 2008-2012, covering all flights to and from any EU airport, and to ensure that instruments to tackle the full climate impact of aviation are introduced in parallel; calls for parallel efforts to address also emissions from shipping;
- Considers that the rapid development of the use of biomass and the encouragement of farm-related renewable energy production must be a top priority in shifting the focus of the Common Agricultural Policy, along with a balanced approach to food production; stresses that energy production from biomass must be organised in ways that are both effective in terms of energy conversion and ecologically sustainable;

Though these issues are not set policy as yet they indicate some of the major issues that will be tackled in the coming years at EU level. If Ireland is to comply with our Kyoto agreements in the near and long term then these are of utmost importance. The publication indicates that many feasible technologies are in existence but that a number of “push” and “pull” policies are required to simulate innovation.

5.2.1 Pulling Technology Change

According to the EU Commission, the more prices reflect external costs and the more demand reflects better consumer climate awareness, the more investments in climate friendly technology will increase. Currently the European Environment Agency estimate that annual energy subsidies in the EU-15 for solid fuel, oil and gas amount to more than €23.9 billion and for renewable energy €5.3billion. The establishment of a market in greenhouse gases, through either taxation or emissions trading will provide a financial incentive to curb energy demand (especially as the subsidies involved in fossil fuels diminish) and promote the use of alternative technologies and encourage further technological development.

Many technologies to reduce greenhouse gases exist and a recent study identified the 15 most promising for the EU¹¹⁰ (See Table 5.1). Market based incentives can encourage the adoption of new technologies and promote their early deployment. The European experience shows that active support policies have helped radically reduce unit costs of producing electricity from renewable sources (between 1980 – 1995, 65% Photovoltaics, 82% for wind, 85% for biomass). These efforts it is advised must continue at accelerated speed. In addition to the obvious environmental benefits there is the added prospect of generating significant numbers of new jobs and a more competitive industry consuming less energy.

Efficiency and conservation	Decarbonisation of Electricity and Fuels		Natural Sinks
Improved fuel economy of vehicles	Substituting natural gas for coal	Wind electricity	Forest management
Reduced reliance on cars	Storage of carbon captured in power plants	Photovoltaic electricity	Agricultural soils management
More efficient buildings	Storage of carbon captured in hydrogen plants	Renewable hydrogen	
Improved power plant efficiency	Storage of carbon captured in synthetic fuel plants	Biofuels	
	Nuclear fission		

Table 5.1: Technologies to reduce GHG emissions

5.2.2 Pushing Technological Change

Since the early 1980's Internal Energy Agency (IEA) members have halved their energy related research and technology development budgets. This trend needs to be reversed and more investment in research pertaining to climate, energy, transport and production/consumption is expected in the upcoming 7th framework programme. By doing so the EU can gain first mover advantage and create a competitive edge by focusing on resource efficient climate friendly technologies that other countries will need to adopt.

5.2.3 Emissions Trading Schemes (ETS)

Emissions trading is an administrative approach used to reduce the cost of pollution control by providing economic incentives for achieving reductions in the emissions of pollutants. In such a plan, a central authority, such as an air pollution control district or a government agency, whether on a regional or national level, sets limits or "caps" on each pollutant, recognising that clean air is a common pool resource. Groups that intend to exceed the limits may buy *emissions credits* from entities that are able to stay below their designated limits. The key advantage of emissions trading is that firms can flexibly choose to meet their target, rather than use predetermined technologies or standards. The EU emissions trading scheme was enacted as one of the main policy measures to enable the EU meet its Kyoto targets and came into operation on 1 January 2005. The EU Emissions Trading Scheme operates on such a "cap and trade" basis. EU Member State governments are required to set an emissions cap for each installation in the scheme. The number of allowances allocated to each installation must be set down in the National Allocation Plan (NAP) for the period in question, which must be approved by the European Commission.

¹¹⁰ Pacala S., Socolow R. 2005. Stabilization Wedges: Solving the Climate Problem for the Next 50 Years with Current Technologies. *Science* Vol. 305 Issue 5686, p968-972

The EU-ETS is a centrepiece of the EU's desire to be a global leader in climate change policy, and is viewed to some extent as industrial energy policy to develop new technologies. In addition to the European wide ETS scheme some countries have voluntary internal emission trading schemes already in place.

5.3 National Emissions Trading Schemes

5.3.1 UK ETS

The voluntary UK ETS scheme started in 2002. Some of its features include:

- Direct participants and climate change agreement participants
- Voluntary, incentivised scheme
- Includes basket of 6 greenhouse gases
- 31 organisations bid emissions reductions in return for share of incentive money

Direct Participants must submit annual verification opinions for sources

- Verifier must be provided with approved source list and baseline emissions data
- Changes of operation (e.g. divestment) / source list errors must be noted to verifier

The penalties involved are:

- Incentive payments can be withheld
- Penalties of £30 per tCO₂e can be imposed
- Following year allocation may be reduced

Other points include:

- Organisations can meet targets from purchasing allowances in UK ETS
- There is an 80% discount allowed on climate change levy when targets are met
- Over achievement of targets can be converted into allowances which can be sold

Some potential benefits to UK business include:

- Early experience of monitoring, reporting and verification
- Early experience in using the registry set up for allocation
- Board-level awareness of financial impact of emissions reductions

Benefits for the UK Government include:

- Experience in regulation of trading scheme
 - Operating the auction
 - Production of monitoring and reporting protocols
 - Monitoring performance and compliance
 - Verification
 - Registry development
- Stakeholder buy-in advantages for emissions trading

5.3.2 Japanese ETS¹¹¹

Three Methods to achieve cost-effective and real emissions reduction were identified in Japan:

- Subsidies for organisations for introducing the measures to reduce GHG emissions (cost-effectiveness of their plans will be the basis for selection)

¹¹¹ <http://www.inece.org/emissions/2005/shimada.pdf>

- Voluntary commitments for a certain amount of GHG emissions reduction (in case of non-compliance, companies need to return the subsidies – higher incentives for them to make serious commitment)
- Emissions Trading (Flexible mechanism that enables its participants to deal with the risks, such as the increase in GHG emissions. Also, in case of over-achievement, they can sell the excesses to others.)

Japan's Voluntary Domestic Emissions Trading Scheme (JVETS) was launched in May 2005. The main objectives of the scheme are:

- For businesses making efforts in reducing their GHG emissions voluntarily, the Japanese Department of Environment (MOEJ) provides further incentives, in the form of subsidies, to introduce additional measures to reduce GHG emissions.
- To learn “real” emissions trading with verification and compliance assessment
- To provide incentives for additional CO₂ reductions

The procedure involves the following:

- Private companies are invited to commit their CO₂ emissions reduction for receiving subsidy from MOEJ during 2005.
- Base-year emissions of each company will need to be verified by MOEJ-accredited verification entities before October 2005.
- MOE screens participants on the basis of “cost-efficiency” optimisation. Emission Allowances (EAs) will be allocated to each of the participants.
- Participants are required to demonstrate that they have allowances covering their verified CO₂ emissions in 2006. Participants can trade allowances (EAs) freely throughout 2006.
- In case of non-compliance, the subsidy must be returned to the MOEJ.

Emission trading for aviation to reduce climate impact¹¹²

In 2005, a European Commission policy paper started the discussion with other European institutions on internalising the environmental costs of aviation. The Commission regards the inclusion of aviation in the EU emission trading system (ETS) as the most promising way forward. Technical issues will be further considered by a working group installed under the European climate change programme. The Commission aims to put forward a legislative proposal by the end of 2006. A consultant study published by the Commission shows that the impact of inclusion of international aviation in the EU ETS depends on the scope of flights to be included; the treatment of the climate impact of non-CO₂ effects; and the way emission allowances are distributed. In all variants studied, emission reductions will foremost take place in other sectors due to the higher marginal abatement costs in the aviation sector. The impact crucially depends on the cap set for emission allowances distributed to the aviation sector. The study concludes that if a cap was set at the 2008 emission level, the impact on ticket prices in 2012 would be modest

5.4 Climate Change success stories

5.4.1 UK

The UK has one of the best records of any country in tackling greenhouse gas emissions. Their Climate Change Programme¹¹³ builds on the UK's position leading the world in promoting global action on climate change setting out policies and priorities for action in the UK and internationally.

¹¹² Source: CE Delft et al., *Giving wings to emissions trading – inclusion of aviation under EU ETS*, Oeko Institut, CATE, 2005

¹¹³ <http://www.defra.gov.uk/environment/climatechange/uk/ukccp/pdf/ukccp06-all.pdf>

The Programme is expected to reduce the UK's emissions of greenhouse gases to 23-25% below base year levels and reduce the UK's carbon dioxide emissions to 15-18% below 1990 levels by 2010. The new policies in the Programme will reduce carbon emissions by some 7-12Mt by 2010. This takes the Government close to its domestic target of a 20 per cent reduction by 2010. Higher than anticipated levels of economic growth and the recent rises in global energy prices which have altered the relative prices of coal and gas have led to increased emissions and made the target more challenging. In addition progress will be assessed more regularly and frequently. From next year, the Government will report annually to Parliament on progress at reducing greenhouse gas emissions and its future work programme. It will also build on this, and consider other aspects of recent proposals for the introduction of "carbon budgeting".

The measures to reduce emissions target every sector of the economy and include:

- A stricter emissions cap for industry;
- Measures to encourage the uptake of biofuels in petrol;
- Tighter building regulations;
- Measures to improve household energy efficiency;
- A renewed emphasis on encouraging and enabling the general public, businesses and public authorities to help achieve the Government's targets
- Increased levels of microgeneration

The draft National Allocation Plan (NAP) for the second phase of the EU Emissions Trading Scheme was released at the same time and the draft plan proposes savings between 3-8m tonnes of carbon in 2010 (11-29Mt CO₂), depending on the final figures for the total quantity of allowances.

Business measures

The Climate Change Levy (UK ETS) of companies will increase in line with inflation with effect from 1 April, 2007. The Carbon Trust's scheme for small and medium businesses will receive an additional STG£5million funding to allow for a significant expansion. This comes on top of the STG£15million of funding announced by the Chancellor in his 2005 Pre-Budget Report.

Household and personal actions

Over two years £20million has been allocated to a major new initiative to strengthen consumer demand for energy efficiency, working closely with energy suppliers, local authorities and others to promote and incentivise energy efficiency measures in households. These measures such as loft insulation, cavity wall insulation and condensing boilers will save an additional 0.3-0.6Mt of carbon in 2010 (1-2Mt CO₂).

Energy suppliers will carry out an extra 250,000 subsidised installations of home insulation over two years, saving 35,000 tonnes of carbon and reducing annual bills by around STG£20m. There will also be a pilot scheme for the use of "smart meters" to enable consumers to monitor their energy use and what measures are effective in reducing it, co-financed with energy companies. Working in partnership with major retailers and the Energy Saving Trust voluntary schemes will be introduced in the retail sector to encourage the purchase of more energy efficient consumer electronics. Better product design will also be encouraged to tackle problems such as excessive energy use during "stand by" mode in computers, televisions chargers, lighting and other products. These smaller appliances emit 1MtC a year when on standby, costing each household around £25 a year.

Building sector

A package of measures also being introduced in the building, household, public and local government sectors include:

- A new planning policy statement setting out how the Government expects participants in the planning process to work towards the reduction of carbon emissions in the location, siting and design of new developments.
- Updated Building Regulations came into force in April 2006 to further raise the energy standards of new and refurbished buildings and help to improve compliance. Taking into account the changes in 2002 and 2005, there will be a 40 per cent improvement in energy efficiency standards for new buildings and the opportunity for householders moving into new homes to see a similar cut in the size of their fuel bills, saving 0.4Mt carbon (1.3Mt CO₂).
- The introduction of a Code for Sustainable Homes which presents the opportunity to achieve higher standards for energy and water efficiency and will provide clear information and advice for house purchasers and tenants on the sustainability of the homes they are proposing to buy or rent.
- The introduction of Energy Performance Certificates for all buildings when they are constructed, sold or let to provide clear information on energy efficiency and advice on improvements.
- Consideration of how to ensure that the local government performance framework will include an appropriate focus on action on climate change, sufficient to incentivise more authorities to reach the levels of the best.
- Setting up a new revolving loan fund of £20m for the public sector, to invest in energy efficiency.
- A new £4m local government best practice support programme, to be launched in 2006-7, which will aim to proactively benchmark the performance of local authorities on climate change and sustainable energy and target those who need the most help to raise their performance.
- A review of measures to improve the sustainability of existing buildings to identify the role of possible further incentives, voluntary initiatives and regulations will be completed later this summer.
- Continued action to upgrade the energy efficiency of social and rented homes and those in fuel poverty through the Warm Front and Decent Homes programmes.
- New advice to stimulate the early replacement of inefficient boilers by those meeting tough standards contained in building regulations.

Transport

5% of transport fuel sold in the UK will have to come from renewable sources by 2010 and this will save 1.6Mt carbon (6Mt CO₂). Further changes to the Vehicle Excise Duty and Company Car Tax to give consumers and businesses an even stronger signal to buy low carbon cars have been introduced. From April 2006 a major cross-Government programme will offset all aviation emissions from official air travel, providing support for a range of overseas projects, developed through the Kyoto Protocol's Clean Development Mechanism. This will offset some 0.5Mt of carbon dioxide over the next three years.

Biomass

The Government will introduce a support scheme for biomass heat in the industrial, commercial and community sectors. The scheme will be worth between £10-15m in England over the next two years. It will save 0.1Mt carbon in 2010 (0.4Mt CO₂)

Awareness

A major television, radio and newspaper campaign has been established to educate the public on the threats posed by climate change and what the average citizen can do about it.

UK Climate Change Awareness Campaign

A three year campaign to raise awareness about the threat of climate change was launched by DEFRA in December 2005¹¹⁴. The campaign *Tomorrow's Climate, Today's Challenge* comprises a package of new communications materials which highlight the need for collective action to tackle the problems which climate change poses. In its first year, the initiative will use local channels to improve public understanding of the causes of climate change and its effects. The campaign will encourage groups and individuals to get involved in disseminating the message to people around them. A range of free communication resources are being provided to enable local communicators to tell the story of climate change and to help them change attitudes.

Because evidence has shown that people pay most attention to people they know, to social networks and to issues that are locally and regionally relevant, the initiative will equip local communicators to support local and regionally based activities. It will do this through a guidebook, a website, radio adverts, a short film and a climate change communications fund.

5.4.2 Germany

Germany has been another of the major success stories within the EU in reducing its Greenhouse gas emissions (GHGs). GHGs were brought down by as much as 18.5% by the year 2003 as against 1990 levels. However, reduction rates have drastically slowed down since the mid 1990s. Of particular note is the turnabout which took place in the traffic sector. Here emissions were brought down by 15 million tonnes between 1999 and 2003 (after a sustained period of growth from 1990 to 1999), which is in reverse to the trend within the European Union. The instruments by which this was achieved are amongst others the ecological tax reform and the strengthening of the public transport system (e. g. Law on the Regionalisation of Public Transport)¹¹⁵.

The Kyoto targets for the 2008-2012 period are laid down in the Emissions Trading Allocations Act (ZuG 2007) and are thus legally binding. Emissions trading guarantees that the targets in the energy and industry sectors will be met.

For the private households and transport sectors a joint reduction objective was set at 291 million tonnes per year. The Federal Ministry of Transport, Building and Housing was entrusted with dividing this figure between the two sectors and placed the rates at 120 million tonnes reduction per year for private households and 171 million tonnes per year for the transport sector. As for the other greenhouse gas emissions and the trade/business/service sector it is assumed that the 2008-2012 targets will basically be met without further intervention. Based on present forecasts it can be assumed that CO₂ emissions are likely to rise again in the private households and transport sectors if no additional measures are taken.

The Federal Ministry of Transport, Building and Housing (BMVBW) developed sets of measures for the private households and transport sectors and expects that they are sufficient to reach the joint reduction target of 291 million tonnes CO₂ per year for the 2008-2012 period as set out in the Emissions Trading Allocations Act. Table 5.2¹¹⁶ gives a summary of the measures planned for these two priority areas.

¹¹⁴ <http://www.defra.gov.uk/news/issues/2005/climate-1201.htm>

¹¹⁵ http://www.bmu.de/files/english/climate/downloads/application/pdf/klimaschutzprogramm_2005_en.pdf

¹¹⁶ *ibid.*

	CO ₂ Reduction Potential
Incentives to Reduce Transport Intensities and Increase Energy Efficiency in the Transport Sector	1.5
revenue -neutral tax reductions for low fuel consumption passenger cars taking into account activities of the EU Commission serving the same purpose	1
introduction of emissions-related landing fees at German airports	0.5
Technical Improvements in Vehicles and Fuels and Support for Alternative Fuels und Innovative Engines	8.5
Fuel Strategy of the Federal Government: substitution of traditional fuels by bio fuels	5
Substitution of F-gases in mobile air conditioning systems in accordance with the planned EU Directive on Air Conditioning in Vehicles	0.5 - 1
Public Information Campaigns on Low Emission Driving Habits	
stepping up the campaign "New Ways of Driving" (e. g. dena-campaign "efficient and on the move")	3
Total of Quantifiable Measures	10

Table 5.2: German measures for climate change in transport

In addition to the measures accounted for by quantifiable effects, decisions were taken on a whole range of additional measures in the transport sector which undoubtedly will bring about a tangible reduction in greenhouse gas emissions but the reduction effect of which cannot be reliably calculated at the moment:

- Upgrading of the toll system to set up a real "road pricing system " on the basis of different local and time-related toll rates
- Support given to international measures to promote energy efficiency in aviation
- Measures to eliminate distortions of competitive positions between different means of transport
- Refinement of the promise made by the car industry to reduce specific CO₂ emissions in new vehicles
- Introduction of new engine types and measures to increase engine efficiency
- Stepped-up fitting of fuel consumption indicators in new vehicles

Even on the basis of conservative estimates it can be assumed that the sum of these measures will be sufficient to meet the climate protection targets in the period 2008-2012.

5.5 Ireland and Climate Change

In October 2000 the government released the *National Climate Change Strategy* (NCCS) which set out the main strategies to be used in tackling our mounting problem with greenhouse gas emissions. It recognised that serious action needed to be taken in all sectors. Reductions of emissions were to have been achieved through an integrated approach, using the full range of instruments and policy options. These included in broad terms:

- the use of economic instruments (including taxation and emissions trading) with broad sectoral and/or cross sectoral application,
- a broad range of policies and measures tailored specifically to relevant sectors,
- a vigorous and appropriate pursuit of common and coordinated policies and measures implemented at EU and wider international levels, and,
- participation in international emissions trading.

Some of the more specific policy aims were:

- Taxation on the generation of greenhouse gases (GHGs) in any activity. It was proposed to phase these in so that sectors could adjust incrementally;

- A change in energy policies to support the phase out of coal use at Moneypoint towards less carbon rich fuels; a large switch towards the use of renewables; improved energy efficiency and an increased use of waste heat in district heating;
- A change in taxation to favour more fuel efficient cars; investment in public transport and general shift towards more sustainable national transport
- Improved building energy efficiency – both residential and commercial – through regulations, the introduction of energy labelling (energy efficiency certificates) and support for the introduction of renewable energy sources;
- A range of measures will be introduced to assist industry reduce their GHGs – emissions trading, tax benefits for emissions compliance and supports through SEI promoting energy efficiency and renewables.

However many of the commitments in this original document have either been abandoned (phasing in of CO₂ emission measures), shelved (rebalancing of VRT and motor tax to account for emissions) or seriously delayed (nitrates implementation).

5.5.1 Current Climate Change Status

By 2004 Irish CO₂ emissions were about 23% above 1990 levels, though there was virtually no change on 2003 levels, which were down from 24% in 2002. The largest increase occurred in the transport sector (up 130% in 2003¹¹⁷), while the energy sector, which accounts for 25% of national emissions, was up by 44%¹¹⁸. And while the residential sector was the only one to show a decrease (due to the switch from coal and peat to natural gas) the corresponding increase in renewable energy use has been poor with comparison with other European countries. This is evidenced by the fact that Ireland has one of the highest per capita GHG emission levels in the EU and is rated as one of the EU countries that is furthest from its national Kyoto target.

Over the 2008-2012 period, Ireland must restrict its emissions to 1990 levels plus 13%, which is equivalent to 63.032 million tonnes of carbon dioxide per annum. Recent estimates indicate that Ireland will be producing 7.174 million tonnes more than this level (about one third of total national emissions occur in the emissions trading sector) and that this will cost the Irish government between €500 million and €1 billion in fines under our Kyoto commitment (between 2008 - 2012). The Government has implemented a wide range of measures in areas such as strengthened building regulations, waste management facilities, support for renewable energy, fuel-efficient cars and biofuels. But it is clear from the increases in emissions that further initiatives are required.

Some of the main issues with Irish climate change actions that have been highlighted are summarised below¹¹⁹.

Carbon Tax

In 2002, the Government announced that “appropriate tax measures, prioritising carbon dioxide emissions, will be introduced on a phased basis across all sectors taking into account social and economic objectives”. This commitment was abandoned in September 2004, when the Government claimed the reductions in emissions it would achieve did not merit the measure, and that it would impact negatively on lower income people more reliant on peat and coal.

Automobile taxation

The Government also promised a “rebalancing of vehicle registration tax (VRT) and motor tax”, from being based on engine size to being based on the emissions. Again this promise remains unimplemented, with the exception of cars that run on bio-fuel. This is also a significant problem,

¹¹⁷ European Environment Agency *Transport and environment: facing a dilemma*, EEA, 2005

¹¹⁸ Environmental Protection Agency *State of the environment*, EPA, 2004

¹¹⁹ *Taxpayers will pay high price for broken promises on Kyoto*, Irish Times, 3/4/2006

as the fuel efficiencies of better designed cars have been eroded by Irish people buying larger cars like SUVs and luxury saloons.

Renewable alternatives

There has been some positive success in the expansion of renewable energy. Though this was very slow to begin with, amid complaints from industry operators that the previous Government grants system (AER) acted as a barrier to wind and renewable energies. The rising price of oil has now made wind more attractive, and the 13% target for renewables by 2010 looks like being achieved. Our climate change strategy also promised "negotiated agreements with industry". This system, working well in Britain and abroad, would see a climate change levy on smaller companies, which would be repaid if they introduced energy efficiencies. It has not yet been implemented, despite the advice of Sustainable Energy Ireland.

The Government will implement a €200 million bio-fuel investment programme over the next 10 years, to meet an EU requirement for 2% bio-fuel use by 2010. A €60 million plus grant system for industry and homes to switch to renewable energy sources is also now in place and uptake has been very high.

Agriculture

In terms of agriculture, the NCCS promised "a reduction in methane emissions from the national herd, equivalent to a 10 per cent reduction in livestock numbers". It has largely been achieved, but only through EU agricultural policy reform. The use of nitrogenous fertiliser was to be reduced by 10% by 2002 through the introduction of the Nitrates Directive. There was also to be a "review of the forestry programme" to increase the amount of trees, which reduce greenhouse gas emissions. Instead forestry grants were actually cut in 2002. Ireland currently has 9% – 10% forestation which is significantly less than the 30% European average.

Building

The NCCS promised more efficient new buildings by introducing new regulations requiring better insulation and building materials, to reduce the energy needed to heat them, from 2002. However, a transition period was introduced which meant that the new rules were not implemented until the end of January 2005. A decision was also taken to relax the rules, which meant that hollow block walls, banned in other countries but used widely in Ireland, could continue to be used. Since 2000, when the new regulations were signalled, nearly 300,000 new homes have been built, the vast majority to the older, less energy efficient standards. Sustainable Energy Ireland estimates that at present, Irish homes typically use 35% more energy than their European counterparts. An expert working in Ireland noted that the current building policy will leave Ireland "with a legacy of cold houses for coming generations because of their very poor standards of insulation and energy efficiency"¹²⁰.

5.5.2 Emissions Trading

The NCCS's most notable success has been in the commitment to introduce an Emissions Trading Scheme (ETS) to set a cap on the amount of emissions industry is allowed to produce, and which is being implemented in full (though it is a European Union initiative which the Government is legally obliged to follow under the European legislation).

The European Commission unconditionally approved a National Allocation Plan (NAP) for Ireland for the 2005-2007 trial trading period in July 2004. Under the EU Emissions Trading Scheme, 105 Irish installations have been given allowances to emit a certain amount of carbon dioxide; the reduction from previous levels varies from case to case depending on the circumstances of the industry. The Scheme only covers activities that give rise to emissions of carbon dioxide, subject to certain thresholds. These installations include all fossil fuel power generation facilities and

¹²⁰ *Government complacency over energy efficiency criticised*, Irish Times, 20/3/2006

large industrial energy users such as cement manufacture, paper and pulp manufacture and food processing. Collectively, these installations would account for an estimated 35% of forecast emissions for the Kyoto commitment period, had there not been an emissions trading scheme.

In Ireland a total of 22.32 million tonnes per year has been allocated to the emissions trading sector for the three-year period.

In preparation for the second phase of the EU Emissions Trading Scheme for the Kyoto Protocol Commitment Period (2008 - 2012), the Irish government recently announced that Ireland's projected 'distance to target' for Kyoto compliance in 2008-2012 has been reduced from 9.2 million tonnes per annum to 7.174 million tonnes¹²¹. The Government has agreed that the responsibility for bridging this gap will be shared between the Emissions Trading Sector (the 105 installations in the electricity and large industry sectors which have significant emissions) and the rest of the economy. The Trading Sector will meet about 3 million tonnes of the reduction, leaving about 4 million for the rest of the economy. The second phase is intended to involve tighter caps and may be expanded to other GHGs and additional sources and sectors.

¹²¹ Department of Environment, Heritage and Local Government *National Allocation Plan 2008-2012*. DEHLG, 2006

6. Air

6.1 EU Initiatives

6.1.1 Regulation and policy

The issue of air quality is now a major concern for many European citizens. It is also one of the areas in which the European Union has been most active. Since the early 1970s, the EU has been working to improve air quality by controlling emissions of harmful substances into the atmosphere, improving fuel quality, and by integrating environmental protection requirements into the transport and energy sectors.

The European Union (EU) has hence adopted a wide range of legislation and policies to combat air pollution and improve air quality. The primary Framework Directive in regard to ambient air quality is the Council Directive 96/62/EC of 27 September 1996 on ambient air quality assessment and management. In order to maintain and improve air quality within the Community, this Directive lays down the basic principles of a strategy for:

- establishing quality objectives for ambient air;
- drawing up common methods and criteria for assessing air quality;
- obtaining and disseminating information on air quality.

This Directive has a number of Daughter Directives, listed below, which are focused on emission limit values and alert thresholds of specific pollutants as shown in Table 6.1.

Act	Date	Pollutants
Directive 1999/30/EC [Official Journal L 163 of 29.06.1999]	22 April 1999	Sulphur dioxide Nitrogen dioxide Particulate matter Nitrogen oxides Lead
Directive 2000/69/EC [Official Journal L 313 of 13.12.2000]	16 November 2000	Benzene Carbon Monoxide
Directive 2002/3/EC [Official Journal L 67 of 09.03.2002]	12 February 2002	Oxone
Directive 2004/107/EC [Official Journal L 23 of 26.01.2005]	15 December 2004	Arsenic Mercury Cadmium Nickel Polycyclic aromatic hydrocarbons

Table 6.1: Daughter Directives of Air Framework Directive

It is also necessary for Member States, where limit values are exceeded by more than the margin of tolerance, to prepare air quality management plans to bring emissions within the limits by an attainment date. After the attainment dates short term action plans may be required on a contingency basis where there is a risk of breaches of the air quality standards. These plans must also be made available to the public.

Other specific legislation has been put in place and agreements have been developed on the following pollutants and topics:

- National emission ceilings for certain atmospheric pollutants.
- Substances that deplete the ozone layer
- Long-Range Transboundary Air Pollution
- Persistent organic pollutants (POPs)
- Reduction in the sulphur content of certain liquid fuels
- Control of volatile organic compound VOC emissions resulting from the storage of petrol and its distribution from terminals to service stations
- Limitation of emissions of certain pollutants into the air from large combustion plants
- Incineration of
- Limitation of emissions of volatile organic compounds due to the use of organic solvents in certain activities and installations

The Thematic Strategy (Communication of 21 September 2005 from the Commission to the Council and the European Parliament) supplements the current legislation. It establishes objectives for air pollution and proposes measures for achieving them by 2020: modernizing the existing legislation, placing the emphasis on the most harmful pollutants, and involving to a greater extent the sectors and policies that may have an impact on air pollution.

Compared with the situation in 2000, the Strategy sets specific long-term objectives (for 2020):

- 47% reduction in loss of life expectancy as a result of exposure to particulate matter;
- 10 % reduction in acute mortalities from exposure to ozone;
- reduction in excess acid deposition of 74% and 39% in forest areas and surface freshwater areas respectively;
- 43% reduction in areas or ecosystems exposed to eutrophication.

To achieve these objectives, SO₂ emissions will need to decrease by 82%, NO_x emissions by 60%, volatile organic compounds (VOCs) by 51%, ammonia by 27%, and primary PM_{2.5} (particles emitted directly into the air) by 59% compared with the year 2000. Specific problem areas such as transport and aviation are identified along with possible measures for improvement¹²²

Further tools employed by the European Union to assist Member States to improve their air quality are:

- entering into agreements with industry
- supporting scientific research and technological development
- assisting sectoral and spatial planning
- improving the quality and quantity of environmental data
- examining alternative fiscal measures to favour sustainable development
- supporting public information and educational campaigns
- promoting professional education and training
- providing financial support.

Examples of current EU actions being undertaken to improve air quality are as follows: ¹²³

- Introduction of an environmental impact assessment directive for land use planning.
- Adoption of a new framework directive on air quality and plans for so-called 'daughter directives'
- Tightening of legislation relating to vehicle emissions, fuel composition and noise control. Agreement with the oil and automobile industries on the 'auto-oil programme' to reduce noxious emissions.

¹²² <http://europa.eu.int/scadplus/leg/n/s15004.htm>

¹²³ http://europa.eu.int/comm/environment/eufocus/clean_air.pdf

- For example, the European Commission supports the Car Free Cities Network which currently comprises 60 members — including Amsterdam, Barcelona, Copenhagen and Palermo — and has working groups on commercial traffic, public transport, car sharing, road pricing, commuting, less polluting urban vehicles, and cycling and walking.
- The EC also supports ELTIS — the European local transport information service¹²⁴ — an on-line database of good practices.
- Evaluation and development of new technology, including road pricing and route guidance throughout the EU.
- Promotion of cycling as a mode of transport, for example through the Eurovo programme with its planned trans-European network of cycle paths.

6.1.2 Grant Aid/Economic

The EU has committed itself to the provision of grant aid for research into the improvement of air quality. Launched in 1992, LIFE (The Financial Instrument for the Environment) is one of the spearheads of the European Community environment policy.

The following are examples of some of the projects currently being undertaken in the area of air quality.

Reduction of solvents in the European newspaper printing industry

The increased use of the printing blanket in colour printing in newspapers requires a greater cleaning capacity. There are several conventional systems for cleaning printing blankets of which the majority are based on the use of solvents. Approximately 90%, or 17,540 tons, of the total solvents purchased by EU newspaper printing plants using the quadrichromy offset technique, are used to clean printing blankets.

Up to 70 days of continuous operation without manual cleaning has been demonstrated in the prototype model. The target of a reduction in solvent consumption of 90% per year, corresponding to 21,600 litres per press/year, has been met and even exceeded. Also the project has succeeded in identifying factors impacting on the application of the method – primarily water and temperature.

Clean Accessible Transport for Community Health¹²⁵

As road transport is a major source of local air pollutants, the cutting of road transport emissions is therefore a fundamental aspect of local air quality management plans. The “CATCH” project aimed to demonstrate the kinds of practical measures that can be implemented to meet these requirements and improve air quality in a large UK city (Liverpool). A strong focus was put on the city centre air quality management zone. The project fostered co-operation between transport planners, land-use planners and environmental health officers and established a new agency to promote widespread introduction of clean fuels, the implementation of green travel plans, and promotion of environmental objectives within regeneration plans.

6.1.3 Information/awareness raising

Raising awareness is an important measure in the promotion of better technologies. The internet is a primary source of information for all consumers with information in the form of publications, guidance notes and leaflets readily available.

The EU publishes a magazine entitled the *Environment for Europeans*. *Environment for Europeans* is published four times a year, plus a special supplement reporting on DG Environment’s *Green Week* events in June. It is available in seven languages: English, French, German, Italian, Spanish, Polish and Greek and is available to download from the homepage or can be accessed via subscription.

¹²⁴ <http://www.eltis.org>

¹²⁵ <http://www.cleanaccessibletransport.com/>

The EU is also aware of the importance of awareness of the current state of ambient air among the public. A fundamental principle of *Council Directive 96/62/EC on Ambient Air Quality Assessment and Management* is the necessity for all member states to report all information on air quality monitoring to the public through appropriate media such as the internet and teletext. More sensitive groups are provided with more specific information.

6.2 Air in Ireland

6.2.1 Regulations/policies

Long Range Transboundary Air Pollution and National emission ceilings for certain atmospheric pollutants

In 1998 Ireland ratified the UNECE ("Oslo") Protocol to the 1979 *Convention on Long-Range Transboundary Air Pollution (CLRTAP) on Further Reductions of Sulphur Emissions*. This required Ireland to limit sulphur emissions to 30% below 1980 levels by 2000. This target was achieved through the reduction of emissions from the power generation sector.

In December 1999, Ireland signed the UNECE ("Gothenburg") Protocol to the 1979 *CLRTAP to Abate Acidification, Eutrophication and Ground Level Ozone*. The objective of this Protocol is to control and reduce emissions of sulphur dioxide (SO₂), nitrogen oxides (NO_x), volatile organic compounds (VOCs) and ammonia (NH₃).

To achieve the targets Ireland will by 2010, have to meet national emission ceilings of 42kt for SO₂ (76% below 1990 levels), 65kt for NO_x (43% reduction), 55kt for VOCs (72% reduction) and 116kt for NH₃ (9% reduction), by 2010. These ceilings are set according to *EU Directive 2001/81/EC of the European Parliament and of the Council of 23 October 2001 on National Emission Ceilings for Certain Atmospheric Pollutants*.

The attainment of the targets will have implications for a broad range of sectors and detailed consultation will be required. A discussion paper outlining proposed reduction measures, as listed below, was prepared.

Measures Taken to Date in Ireland to Reduce Transport NO_x and VOC Emissions:

Reduction in the sulphur content of transport fuels facilitates the introduction of cleaner engine technologies such as de-NO_x catalysts, lean burn/direct injection etc., critical to the achievement of reductions in NO_x from vehicles. An efficient threeway catalytic converter typically reduces NO_x emissions from an individual petrol engine car by 75%. A UK Report states that NO_x emissions decrease by 2% over a 5 year period from the use of low sulphur and sulphur free diesel and petrol (both below 50ppm).

Technological Improvements:

Euro III standards for cars and light commercial vehicles apply from 2001, reducing NO_x and hydrocarbon levels from petrol cars by 70% below the Euro I standard, and diesel by 36%. Euro IV standards have already been agreed for passenger cars for 2005, halving emissions of NO_x and VOC from their 2000 levels and reducing them by 70% on 1992 levels. For HGVs, Euro IV and V for 2006 and 2008 are expected, resulting in an eventual reduction in NO_x emissions of over 85% and hydrocarbon emissions of over 70%.

Budgetary Measures:

- The scrappage scheme operated in 1996 and 1997 and in total some 60,000 cars were scrapped. There is evidence that the scheme skewed the market towards smaller cars for a time, accentuating the benefits of fleet replacement.
- In 1998 substantial reductions in motor tax were applied for categories of vehicle used as public transport vehicles. In 2001 provision was made for the VRT on hybrid engine cars to be refunded by 50% to incentivise the purchase of these lower NO_x emission vehicles.

- VRT has always been banded on the basis of engine size. The 1999 Budget further differentiated VRT to encourage consumers to purchase smaller cars, and Budget 2003 reduced the threshold for the top rate of VRT from 2,000cc to 1,900cc.

Sustainable Transport Strategy:

Several measures (removal of HGVs from major urban areas, traffic management schemes, air quality management plans, integrated public transport investment under the National Development Plan) are being implemented with the overall objectives of reducing the relative attraction of commuting by car, reducing congestion and making public transport more attractive.

For VOCs, controls have been in place since 1997 to reduce fugitive emissions from transport fuel depots, tankers and new petrol stations during loading, unloading and storage of the fuel. By 2005, these controls (i.e. Stage I VOC controls) were in operation at all petrol stations.

Measures Currently Envisaged to Reduce Transport SO₂ Emissions

Diesel for Other Mobile Sources Including Non-Road Mobile Machinery and Other Machinery:
The only fuel where reductions in sulphur content have not been applied is agricultural diesel, and a limit of 1,000ppm from January 2008 will apply to motive fuel as well as heating fuel.

Measures Currently Envisaged to Reduce Transport NO_x and VOC Emissions

- The measures to be implemented in the National Climate Change Strategy to reduce CO₂ emissions from the transport sector can help control NO_x emissions from the national vehicle fleet. A rebalancing of motor tax to favour vehicles with lower CO₂ emissions would have a beneficial result on NO_x emissions as less fuel is consumed in the transport sector.
- The National Climate Change Strategy states that “it is intended progressively to reduce the incentive for foreign purchase of fuel in the State by 2008 by setting excise duty on transport fuel at appropriate levels”. Achievement of this would reduce NO_x emissions in the national inventory from the sector by 8kt.
- Reductions in fuel used in the other mobile sources including non-road mobile sector from the current level of 2,000 ppm to the 50 ppm limit for road diesel would virtually eliminate the emissions of SO₂ from the sector, and would facilitate more advanced de-NO_x technologies in non-road mobile machinery.
- In identifying additional measures to tackle emissions from road and non-road vehicles, particularly NO_x where the sectors are the largest source, it is recognized that reducing transport emissions is likely to be most intractable. For this reason, it will be necessary to keep the full suite of reduction options under review until 2010. Where synergies can be incorporated into other policy areas addressing transport issues and involving problems associated with transport, it will be necessary to do so. It is recognised that Ireland is a technology taker in relation to vehicle standards, and the national focus will need to be on measures within the remit of national policy.
- Accelerated introduction of sulphur free fuels would facilitate early penetration of Euro IV petrol engines, and policy initiatives requiring or incentivising this could take the form of favourable taxation rates or VRT rebates. There would be added value in the reduction of NO_x emissions in heavily trafficked urban areas making it easier to meet challenging new ambient air quality standards from 2010.
- Another option is to incentivise a greater shift to LPG-fuelled vehicles, especially if structured to displace diesel. In 2000 only 0.05% used alternative fuels. Provision could be made for urban transport and captive fleets to be based on cleaner fuels, with NO_x efficiencies beyond those legally mandated under Euro III/IV.

The following section outlines progress and significant developments that have occurred, which need to be further considered in the national programme as it is implemented over the period to 2010.

National Emission Reduction Plan (NERP) under Directive 2001/80/EC:

Ireland has opted to develop a national emissions reduction plan (NERP) under Article 4 (6) of the Large Combustion Plants Directive (2001/80/EC)¹²⁶ to address emissions from 'existing plant' as defined in the directive. The NERP provides flexibility for plant operators to identify the most cost effective abatement options available, across a portfolio of plant, while still achieving the environmental objective of directive 2001/80/EC. The NERP developed by Ireland sets limits for emissions of SO₂ and NO_x from existing plant which are significantly more ambitious than the minimum requirements of directive 2001/80/EC. In the period from 2008 - 2016, the NERP is 27 % more ambitious for SO₂ and 46 % more ambitious for NO_x emissions.

Commissioning of New Power Plant:

Additional electricity generation capacity was delivered by two new state of the art gas fired plants, a 400 MW combined cycle gas turbine plant and a 150 MW CHP plant. The 400 MW plant is located in the west of the country which will help to address existing geographic network constraints and the CHP plant will largely replace the existing oil fired boilers at the largest industrial emitter of both SO₂ and NO_x in Ireland.

Sulphur free fuel excise differential:

The discussion paper indicated that consideration would be given to the incentivisation of sulphur free fuels for the full road transport market. To this end, on 1 December 2004 Ireland's Budget 2005 indicated that an excise duty differential would be introduced to incentivise sulphur free fuels. The excise duty differential will be introduced during 2005 and should result in a total market switch to sulphur free petrol and diesel within a matter of months.

Feasibility Study of Advanced NO_x Abatement in Cement Sector

The discussion paper indicated that consideration would be given to the application of advanced NO_x abatement techniques in the cement sector. The EPA in co-operation with plant operators in the cement industry is currently assessing the feasibility of selective non-catalytic reduction (SNCR) abatement techniques in the cement sector. Since 2001 NO_x emissions from this sector have increased by 59% and by 2003, the cement sector accounted for 57 % of total industry NO_x emissions and 7% of total national emissions.

Solid Fuel Trade Group Voluntary Agreement

The voluntary agreement to reduce the sulphur content in coal and petcoke was signed by the Minister for the Environment, Heritage and Local Government in 2002. To date the agreement has been working well with sulphur levels for coal in the 2003/4 heating season 0.48 %, below the 0.7 % required by the agreement. The sulphur levels in petcoke averaged 2.55 %, above the 2.0 % set out in the agreement. This resulted from a general shortage of petcoke on the world market. The agreement is scheduled for review during 2005 and any revision to increase the ambition level will need to be included in the update and revision of the national programme.

Ireland's National Programme, which was to be updated in 2006, indicates significant ongoing progress to date and is an important milestone with a view to a future National Emissions Reduction.

¹²⁶ Large Combustion Plants Directive (2001/80/EC) on the limitation of emissions of certain pollutants into the air.

Air Quality Framework Directive

In 1996 the European Commission published the Air Quality Framework Directive (96/62/EC) representing a new approach to ambient air quality monitoring, assessment and management. The Framework Directive set out the principles of the approach and was followed by four daughter directives which detailed the limit values for specific pollutants.

The Framework Directive was transposed into Irish law by the Environmental Protection Agency Act 1992 (Ambient Air Quality Assessment and Management) Regulations 1999 (S.I. No. 33 of 1999).

The first Daughter Directive (1999/30/EC) deals with sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead. The second Daughter Directive (2000/69/EC) deals with carbon monoxide and benzene. These two Daughter Directives were transposed into Irish law by the Air Quality Standards Regulations 2002 (S.I. No. 271 of 2002). These regulations came into force on 17th June 2002. A third Daughter Directive, Council Directive (2002/3/EC) relating to ozone was published in February 2002 and was transposed into Irish law by the Ozone in Ambient Air Regulations 2004 (S.I. No. 53 of 2004). The fourth Daughter Directive (2004/107/EC) was published in January 2005. It covers polyaromatic hydrocarbons, arsenic, nickel, cadmium and mercury in ambient air. It is due to be transposed into Irish law by 15th February 2007.

Regulations made in February 1999 designated the Environmental Protection Agency (EPA) the competent body for implementation of *Framework Directive 96/62/EC on Ambient Air Quality Assessment and Management*. The EPA also prepared a discussion paper on a national air quality monitoring programme (August, 2000) to meet monitoring requirements for the next ten years.

The opening of the Dublin Port Tunnel should help in the compliance of the Dublin monitoring stations with particulate emissions. Alert thresholds are set for SO₂ and NO₂, to be triggered where ambient levels reach concentrations that would present health risks across wide areas, especially for sensitive populations. These public announcements will detail the time and place of the exceedance, the reason for the occurrence and any appropriate precautions which the general public, particularly vulnerable sectors such as the young, old, asthmatics etc., should take. In addition, the regulations provide for advice by the Agency to local authorities about the need for air quality management plans where the limit values, plus additional margins of tolerance, will be or may be exceeded, and the preparation of such plans by local authorities. Provision is also made for air pollution action plans for short-term risks of exceedances of the limit values and alert thresholds.

IPPC Licensing

In accordance with the Environmental Protection Agency Act (1992), the EPA is responsible for the Integrated Pollution Prevention Control (IPPC) licensing of large or complex industries with significant polluting potential. The register of IPPC licences is available free of charge to the public. The EPA grants almost 98% of licences. A separate list of licences granted by local authorities is available from the Department of the Environment, Heritage and Local Government.

The EPA is responsible for monitoring emissions from large or complex industries with significant polluting potential to all media including air emissions and dealing with any infringements of the terms of the licence. Offences under the Environmental Protection Agency Act can result in companies being taken to court by the EPA. The court can impose fines and prison sentences and the EPA can revoke licences. The EPA will only grant a licence if it is sure that the licence holder will do its utmost to prevent or limit any emissions from the plant. All emissions from the plant must be within set limits and must not contravene any relevant air quality standard. IPPC licensing is discussed in more detail in the section on industry.

Persistent Organic Pollutants

Persistent Organic Pollutants (POPs) are toxic chemicals which are used primarily in pesticides and industrial chemicals. They are highly stable compounds, lasting for years or decades before breaking down. POPs circulate globally, and those released in one part of the world can, through

a repeated (and often seasonal) process of evaporation and deposit be transported through the atmosphere to regions far away from the original source.

Ireland is a signatory to the 1998 (Aarhus) protocol on Persistent Organic Pollutants to the UNECE Convention on Long-Range Transboundary Air Pollution. This protocol applies to the UN Economic Commission for Europe area and deals with 15 substances to be eliminated from production and use with restrictions on the use of a number of others.

On 23 May 2001, Ireland signed the UNEP Convention on POPs in Stockholm. The new treaty (dealing with 12 of the 15 POPs covered by the Aarhus Protocol) encompasses a far broader global geographical scale and with an added element dealing with assistance (financial, technology transfer, capacity building etc.) for the developing world. The Convention will enter into force when ratified by 50 signatories.

Irish policy on POPs reflects EU legislative requirements in the main. Those POPs which were manufactured for use as pesticides are already banned for such use in Ireland under EU law. In the case of printed circuit boards (PCBs), primarily in use in electrical equipment, the Waste Management (Hazardous Waste) Regulations, 1998 require the provision of certain information to the EPA in respect of all such equipment and the ultimate safe disposal of PCBs as hazardous waste.

The EPA's integrated pollution control and waste licensing systems already address any use of POPs for industrial processes and any relevant emissions from incineration and other relevant sources in a manner that is consistent with the requirements of the Stockholm Convention.

Volatile Organic Compounds

VOCs are air pollutants which can have detrimental effects on human health by contributing to respiratory illnesses, and some VOCs are mutagenic or toxic to reproduction and harmful to the unborn. They also have harmful environmental effects (crop, vegetation and materials damage, reduced visibility) when they chemically interact with oxides of nitrogen and sunlight to form ground-level ozone. Sources of VOCs include vehicle emissions, fuel combustion and domestic solvent usage. Other major sources of VOCs include commercial and industrial activities using organic solvents.

Regulations made in November 2002 entitled "Emissions of Volatile Organic Compounds from Organic Solvents Regulations 2002" (S.I. No. 543 of 2002) introduce controls on emissions of VOCs from various sectoral activities ranging from dry cleaning and vehicle respraying to pharmaceutical manufacture.

Car Fuel and CO₂ Emissions Consumer Guide

Regulations made in July 2001 require all new cars displayed or offered for sale or lease to bear a label detailing the vehicle's fuel efficiency and CO₂ emissions. Posters detailing this information for all new cars must be displayed in a prominent position at all points of sales. The regulations also require the Society of the Irish Motor Industry (SIMI) to publish an annual guide detailing the fuel efficiency and CO₂ emissions of all new car makes and models. The aim of the regulations is to allow consumers to include environmental and fuel-savings factors to inform their new car purchases. By choosing to purchase a more fuel-efficient car, a person can make significant savings in reduced fuel costs. The guide details the individual fuel efficiency of all new cars based on an urban test cycle, an extra-urban cycle and a combined fuel consumption figure, as well as each vehicle's specified CO₂ emissions.

Fuel Standards

The terms of the EU Auto Oil Programme which specifies stringent standards for a number of pollutants in petrol and diesel were fully transposed into Irish law during 1999 and 2000. The new standards mean that the permissible level of benzene has been reduced from 5% to 1% and aromatics from the industry norm of 48% to 42%; in the case of diesel, the sulphur content has

been reduced from 500 ppm to 350 ppm. In addition, the sale of leaded petrol has been prohibited since 1 January, 2000.

Regulations made in January, 2001 set, for the first time, a statutory EU and national sulphur content for heavy fuel oil (1% max) which will apply from 1 January 2003. Heavy fuel oil is used in power generation and in some industries. The regulations also strengthen the controls on the sulphur content of gas oil (home heating oil, agricultural gas oil and for the first time aviation kerosene and marine gas oil). It has been prohibited to sell gas oil with more than 0.2% sulphur content since 1994; the regulations ban its use above this limit. The regulations further require the sulphur limit to be halved to 0.1% from 1 January 2008.

Bituminous Coal Ban

A ban on the marketing, sale and distribution of bituminous coal applies in sixteen towns and cities around the country (Dublin from 1990, Cork 1995, Arklow, Drogheda, Dundalk, Limerick and Wexford 1998, Celbridge, Galway, Leixlip, Naas and Waterford 2000, Bray, Kilkenny, Sligo and Tralee 2003).

The origins of the coal bans date from the start of the 1990s when the main air quality problem facing Ireland was the occurrence of "winter smog" (smoke and sulphur dioxide emissions) resulting from widespread use of bituminous coal in major urban areas, notably Dublin, leading to serious health effects for people. In the mid to late 1980's levels of smoke and sulphur dioxide were as much as seven times the EU and national limit values. To deal with the problem, regulations were made in 1990 to ban the marketing, sale and distribution of bituminous coal in the Dublin area. Smoke and sulphur dioxide (SO₂) levels showed considerable improvement once the ban was introduced and it was decided in subsequent years to extend the ban further in order to achieve and preserve good air quality in the selected areas.

In 2002, the Department and the Solid Fuel Trade Group signed a negotiated agreement to reduce the sulphur content of all bituminous coal and petcoke and also provided for the extension of the ban on the marketing, sale and distribution of solid fuels. The agreement was the culmination of a consultation process commenced in 2001 on foot of the Public Consultation Paper "Potential National Ban on Bituminous Coal and Petcoke".

In April 2006, the Department and the Solid Fuel Trade Group signed a new negotiated agreement concerning further reductions in the sulphur emissions of bituminous coal and petcoke and the maintenance of existing limitations through smokeless zones on the marketing, sale and distribution of solid fuels. The new Agreement, which runs until the end of the fuel season in April 2008, locks in place significant environmental gains achieved by the first agreement through ambitious limits on sulphur levels in bituminous coal and petcoke.

6.2.2 Research

The EPA has spent in the region of €2 million on a number of projects on air quality. Several research projects are based in the area of emissions reductions and emissions monitoring improvements so as to more accurately identify those areas on which future environmental policies must be targeted. Emissions from road traffic are now the primary threat to the quality of air therefore a number of these projects are focused on the emissions from this sector. The details of a selection of these projects are as follows:

Evaluation of options for reducing Irish diesel particulate emissions utilising measurement and modeling methods:

This project aims to refine and use a novel measurement device to collect real world particulate emissions data from a variety of used vehicles, with a view to identifying and targeting heavy polluters. The data gathered will then be used, in combination with localised pollution dispersion modeling techniques, to determine the peak doses of particulate matter that city pedestrians might typically be exposed to. This and other data will be used subsequently in cost-benefit

analyses - to evaluate alternative policy options aimed at reducing emissions and improving Irish urban air quality.

Validation of air pollution dispersion modeling for the road transport sector under Irish conditions:

Air dispersion modeling is used in Environmental Impact Assessments of road projects. The accuracy of modeling predictions is dependent not only on data quality, but also on both model and user methodologies. The models in common usage in Ireland were developed and validated abroad. The main aims of the project are to carry out a validation study of models currently in use in Ireland, to critically assess their use in air quality prediction and to establish the minimum monitoring of air quality, traffic and meteorological conditions, required for air quality modeling.

Air Quality: Transport Impacts and Monitoring Networks - Nature and Origin of PM10 and Smaller Particulate Matter In Air:

The dramatic increase in the volume of traffic, resulting in regular congestion and gridlock on our city streets is an increasing cause of frustration as well as air pollution. There are other air pollutants however, and although traffic is an important source, its contribution to air pollution levels is not yet quantified for Irish cities. This major three-year project will investigate the impact of various factors, including transport on air quality. The main objective of the research will be to determine the principal sources of particulate matter (PM) emitted to urban air, by obtaining the chemical composition of the air pollution particles. Primary sources such as road traffic and industry, and secondary sources resulting from chemical reaction of vehicle exhaust gases, will be identified. Urban pollution can also come from rural sources. Air pollution knows no boundaries, so it is important to obtain the contribution of trans-boundary air pollution to urban levels. It is hoped to identify areas vulnerable to exceedances of PM limits and to understand the causes of these exceedances and their potential impact on air quality and health-related issues.

Life cycle analysis of emissions management for Irish livestock production systems:

This project will use Life Cycle Analysis (LCA) to establish whether proposed methods of reducing emissions from livestock production will have a net reduction impact or merely transfer the emission to another part of Ireland's 'emissions basket'. This project will define Irish livestock production in terms of a system, create an inventory of inputs and outputs and then assess the impact of changes to the system in terms of emissions from livestock production.

The **Cleaner Greener Production Programme (CGPP)**¹²⁷ is another funding programme operated by the EPA in Ireland. Cleaner greener production is the application of integrated preventive environmental strategies to processes, products and services in order to increase overall efficiency and reduce risks to humans and the environment. A number of projects have been undertaken which aim to improve air quality by means of reducing emissions. Other projects which do not have direct environmental impacts inadvertently have benefits for air quality through reduced energy and input usage.

New printing technology

Alert Packaging Ltd is an independent company that prints, laminates and converts flexible packaging, principally for the food market. The company prints solvent based inks on a variety of plastic materials, such as polyethylene, polypropylene, polyester, nylon, etc.

The aims of this CGPP project were to reduce solvent usage and associated VOC emissions, and to reduce waste plastic material sent to landfill.

¹²⁷ See www.cleanerproduction.ie

Solvent emissions were reduced through enclosing solvent delivery to the printing presses, by changing pumping systems, and through operational improvements. A reduction in solvent usage and emissions of approximately 30% when related to production throughput has been achieved. The alterations to the printing presses involved a change in design, eliminating the need for the previously used open tray and associated fugitive emissions. The main solvents are now delivered in sealed 200 litre drums on a trolley using a fuel gun. The smaller use solvents are delivered in sealed containers, with small sealed nozzles.

8.2.3 Awareness Raising

A primary objective of the Air Quality Framework Directive is the publication of air monitoring results via suitable methods. This is essential in order to raise awareness of the current quality of air. The EPA monitors and publishes air quality data on an ongoing basis and the public can see the current quality of local air quality from the EPA website¹²⁸.

Other initiatives operated in Ireland include:

Backyard Burning Prevention

Backyard burning has been found to be a significant issue in relation to illegal waste management. It is of primary interest to air pollution as it is a major source of harmful dioxin emissions. It was found that backyard burning contributes over 50% of all dioxin emissions in Ireland and is more prevalent in rural areas.

Local Authorities have increased their enforcement of this issue through on the spot fines and mobile air monitoring. However the aspects of this practice in regard to the rural context and difficulties in obtaining proof for enforcement means that prosecutions are uncommon.

Increased public awareness campaigns through local authority websites, Waste Management Initiative websites and the media have been undertaken to inform the public of the environmental and health effects of the practice.

European Mobility Week/In Town Without My Car Day

Since 2000, Ireland has been an enthusiastic supporter and participant in European Car Free Day. Since 2002, the European Car Free Day concept has grown and developed into European Mobility Week (16th-22nd September), of which Car Free Day (22nd September), or *In Town Without My Car Day* as it is also known, remains an integral part. European Mobility Week takes a much broader approach than the traditional car free day idea and since its inception the event has been based around a specific theme, from Public Transport, Cycling and Living Streets/Greenways in 2002, to Accessibility and Safe Streets for Children in 2003 and 2004.

Initiatives which were undertaken in the 2005 event include:

- setting up of a temporary public transport information centre in Dublin city centre, car-pooling competitions and free park and ride facilities.
- Bus Éireann provided free off-peak services in a number of towns.

6.3 Situation in other Countries

6.3.1 Canada

Canada has committed itself to a 10 year programme called The Clean Air Agenda in response to growing scientific evidence demonstrating that more and quicker action was necessary to protect the health of Canadians. This program focuses primarily on smog but recognizes linkages to other air issues, such as acid rain, climate change, persistent organic pollutants (POPs), hazardous air pollutants (HAPs) and stratospheric ozone depletion.

¹²⁸ <http://www.epa.ie/OurEnvironment/Air/>

Over the last five years, the government has announced significant investments in this program totalling CAN\$210 million to deliver on key elements of the Clean Air Agenda¹²⁹.

A number of regulations aimed primarily at the Transport sector have also been implemented and these include:

- On-Road Vehicle and Engine Emission Regulations introduce more stringent national emission standards for on-road vehicles and engines and a new regulatory framework under the Canadian Environmental Protection Act, 1999. These stringent new standards are now being phased in, and will reduce allowable emission levels from new on-road vehicles by up to 95 per cent. When fully operational in 2009, the Regulations will subject all cars and light-duty trucks to the same set of stringent emission standards.
- Off-Road Small Spark-Ignition Engine Emission Regulations. These Regulations establish emissions standards for engines rated up to 25 horsepower (19 kilowatts). These are, typically, gasoline engines used in lawn and garden machines, light-duty industrial machines and light-duty logging machines. The new Regulations are expected to reduce smog-forming emissions (combined hydrocarbons (HC) and nitrogen oxides (NOx)) from this category of engines more than 40 per cent as of 2025.
- Sulphur in Diesel Fuel Regulations (2002) ensure that the level of sulphur in diesel fuel used in on-road vehicles in Canada will not impede the effective operation of advanced emission control technologies planned to be introduced on 2007 and later model year vehicles (i.e., in mid-2006) to comply with stringent new exhaust emission standards. This is accomplished by reducing the maximum allowable limit for sulphur in on-road diesel fuel to 15 milligrams per kilogram of the fuel, which is equivalent to 15 parts per million (p.p.m.), commencing June 1, 2006.
- *Gasoline and Gasoline Blend Dispensing Flow Rate Regulations* (Feb. 1, 2001) reduce refuelling vapour emissions of benzene and other VOCs by 95% and to perform effectively with fuel dispensing flow rates up to 38 litres per minute.

A number of initiatives to engage the public and raise awareness are operated by the Canadian Government and include the following:

- Environment Week (June 5 - 11, 2005) was created to promote and to celebrate activities that care and nurture the Canadian environmental legacy.
- Clean Air Day was proclaimed by the Government of Canada to increase public awareness and action on two key environmental priorities: clean air and climate change.
- The Commuter Challenge and a nation wide sustainable transportation campaign coordinated by the Canadian Urban Transit Association (CUTA), takes place in 65 communities. The Commuter Challenge engaged more than 48,000 Canadians from more than 43 communities in a friendly competition to reduce air pollution levels and greenhouse gas emission through sustainable transportation choices.

The creation of the National Office of Pollution Prevention (NOPP) is another commitment made by the Canadian Government. This is Environment Canada's focal point for the management of toxic substances, implementation of federal pollution prevention policy and legislation, and the development of new concepts and policy instruments that facilitate the transition to pollution prevention in Canada¹³⁰

6.3.2 United Kingdom

The Beacon Scheme, which was introduced by DEFRA in 1999, is intended to recognise excellence amongst local authorities and facilitate the spread of best practice and in turn drive up local authorities' performance. Round 8 of the Beacon Scheme, *Delivering Cleaner Air*, was launched in March 2006.

¹²⁹ http://www.ec.gc.ca/cleanair-airpur/Clean_Air_Agenda-WS51062DA3-1_En.htm

¹³⁰ <http://www.ec.gc.ca/NOPP/EN/index.cfm>

Under this theme, Beacons will have to demonstrate full appreciation of their air quality duties under Part IV of the Environment Act 1995 and make appropriate links with their other duties under Local Air Pollution Prevention Control and Local Integrated Pollution Prevention Control, and local enforcement of the Clean Air Act 1993, and dealing with statutory nuisances under Section 79 of Environmental Protection Act 1990.

Beacons (those who participate in the programme) will have to show evidence that they promote air quality beyond statutory duties and work in partnership to minimise impacts of air pollution and deliver improvements to local air quality. Beacons will also have developed innovative ways of raising awareness of air quality issues and engaging other local government departments and also involving the local community in the local air quality management process.

Consultation with the public and interested parties has also begun in relation to the review of the Government's Air Quality Strategy. The primary aim is to seek comments on and hence improve the Strategy's current objectives for air pollutants and an option for a new policy framework and a new provisional objective for controlling particulate matter.

Public information leaflets are published on the website in areas of concern. These include booklets and leaflets on ammonia emissions, the health effect of air pollution, winter and summer smog and sulphur limits in liquid fuels. Within these leaflets recommended methods for the reduction of emissions in different practices are listed, with the example of transport listed below

On the road booklet in the UK

Road vehicles are a major source of air pollution in urban areas - they are responsible for over half the nitrogen dioxide emissions and over 75% of the carbon monoxide emissions in the UK. Some tips from the booklet include:

- Avoid using your car for short journeys - 2.5km or less
- If possible, don't use your car at all during periods of high pollution
- Start your engine only once you are ready to move off
- Don't rev the engine unnecessarily
- Drive smoothly. Heavy braking and rapid acceleration means you use more fuel and increase pollution
- Keep to the speed limit
- Maintain your car. Keep the engine properly tuned and the tyres at the right pressure
- Use public transport whenever you can

6.3.3 Australia

The key strategies implemented to improve air quality include the *National Environment Protection Measure on Ambient Air Quality*, and the development of national fuel quality standards.

Fuel quality standards are in place for petrol, diesel, biodiesel and LPG. A further standard is in place to ensure consumers are informed when they purchase ethanol blended fuel. The Australian Government has an ongoing compliance and enforcement program to ensure that fuels supplied in Australia meet the fuel standards.

Australia continues to phase out and manage ozone depleting substances. The Government supervises the orderly phase-out of these substances in accordance with Australia's commitments under the Montreal Protocol on Substances that Deplete the Ozone Layer. For example, the National Halon Bank collects and safely disposes of surplus halon, formerly widely used in fire extinguishers, while maintaining a reserve of halon until the year 2030 for essential uses¹³¹.

¹³¹ <http://www.deh.gov.au/atmosphere/index.html>

A number of financial incentives have been put in place by the Australian government for research and the application of pollution controls. A number of research projects have been funded which are aimed primarily at the area of air pollution. The Clean Air Research Programme is a \$1.4 million multi-year research programme (2005-2008), funded through the Sustainable Cities initiative that supports research into Australia's most critical air quality issues. A number of these are detailed below:

- Sources of ozone precursors and atmospheric chemistry in a typical Australian city *CSIRO Marine and Atmospheric Research*
- New assessments of vehicle air pollution emissions and health effects using advanced on-road remote sensing technology. *NIWA Australia*
- Measurement of real-world PM₁₀ emission factors from wood heaters by in-situ source monitoring and atmospheric inversion methods. *CSIRO Marine and Atmospheric Research*

The Launceston Clean Air Industry Programme is aimed at providing grant aid to assist eligible companies to reduce emissions of particles from their facilities through changes to technology or processes (for example, replacement of wood-fired boilers with gas boilers) or through the installation of pollution control equipment.

The Australian Government is funding the installation of secure bicycle parking at public transport nodes. *Cycle Connect*, a \$2.4 million initiative, is part of the Australian Government's "Sustainable Cities" urban environment program. *Cycle Connect* is a two-year grant initiative to provide secure parking, principally in the form of bike lockers, at suburban bus and train stations

The National Pollutant Inventory (NPI) provides Australians with free access to information on the types and amounts of pollutants being emitted in their community. The public can access information on the emissions from sectors and individual companies. A number of countries operate industry licensing such as IPC licenses in Ireland and make information on emissions available to the public at a regional EPA offices around the country. The Australian model of internet access allows easier access by the public in any location in the country.

6.3.4 Germany

A number of initiatives have been undertaken by the German government in relation to air pollution control. It is a policy of the government to create economic incentives rather than introducing bans to tackle air pollution.

This can be seen in the success of the reduction of the sulphur content of fuel. Since 1 January 2003 the mineral oil tax rate for sulphur-free fuels that contain a maximum 10 milligrams of sulphur per kilogram of fuel is 1.5 cent less than the higher sulphur content equivalent.

The German government also promotes alternative fuels. The mineral oil tax rate for natural gas has been considerably lowered until 2020. In Berlin, various organisations, including the Federal Environment Ministry, have set the goal of promoting and using 1000 natural gas-powered eco-taxis; these can now be found all over the city.

7. Water

7.1 EU Initiatives

7.1.1 Regulatory and Policies

The primary current piece of legislation in the European Union regarding water is Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000, establishing a framework for Community action in the field of water policy - also known as *The Water Framework Directive*. The establishment of this Directive will result in a number of earlier Directives being repealed.¹³²

The objective of *The Water Framework Directive* (WFD) is to establish a Community framework for the protection of inland surface waters, transitional waters, coastal waters and groundwater, in order to prevent and reduce pollution, promote sustainable water use, protect the aquatic environment, improve the status of aquatic ecosystems and mitigate the effects of floods and droughts

Under this Directive, member states must identify all the river basins lying within their national territory and assign them to individual river basin districts. A competent authority must be assigned to each of the districts. A management plan and programme of measures for each river basin district is necessary

The objectives of the directive have to be achieved within fifteen years after the date of entry into force of the Directive, but this deadline may be extended or relaxed, albeit under the conditions laid down by the Directive.

Other pieces of European Legislation for the protection of water include the following:

- Nitrates Directive
- Council Directive on Quality of Water intended for human consumption
- Council Directive concerning the quality of bathing water
- Council Directive concerning urban waste water treatment
- Council Directive on the quality of fresh waters needing protection or improvement in order to support fish life
- Regulation on the prohibition of organotin compounds on ships
- Council Decision authorising the Member States to sign, ratify or accede to the International Convention on Civil Liability for Bunker Oil Pollution Damage,
- Decision setting up a Community framework for cooperation in the field of accidental or deliberate marine pollution.
- Proposal for a regulation of the European Parliament and of the Council on the establishment of a fund for the compensation of oil pollution damage in European waters and related measures
- Proposal for a Directive of the European Parliament and of the Council on ship-source pollution and on the introduction of sanctions, including criminal sanctions, for pollution
- Regulation on detergents
- Proposal for a Directive of the European Parliament and of the Council on the protection of groundwater against pollution

¹³² Council Directive 75/440/EEC of 16 June 1975 concerning the quality required of surface water intended for the abstraction of drinking water in the Member States; Council Decision 77/795/EEC of 12 December 1977 establishing a common procedure for the exchange of information on the quality of surface fresh water in the community; Council Directive 79/869/EEC of 9 October 1979 concerning the methods of measurement and frequencies of sampling and analysis of surface water intended for the abstraction of drinking water in the Member States

- Council Directive on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community

Thematic Strategy on the Protection and Conservation of the Marine Environment

This aims to achieve good environmental status of the EU's marine waters by 2021 and to protect the resource base upon which marine-related economic and social activities depend. The Marine Strategy will constitute the environmental pillar of the future maritime policy the European Commission is working on, designed to achieve the full economic potential of oceans and seas in harmony with the marine environment.

A *Marine Strategy Directive* will establish European Marine Regions on the basis of geographical and environmental criteria. Each Member State, in close cooperation with other relevant Member States and third countries within a Marine Region, will be required to develop Marine Strategies for its marine waters. The Marine Strategies will contain a detailed assessment of the state of the environment, a definition of "good environmental status" at regional level and the establishment of clear environmental targets and monitoring programmes. Each Member State will draw up a programme of cost-effective measures. Impact assessments, including detailed cost-benefit analysis of the measures proposed, will be required prior to the introduction of any new measure.

Where it would be impossible for a Member State to achieve the level of ambition of the environmental targets set, special areas and situations will be identified in order to devise specific measures tailored to their particular contexts. The Marine Strategy is consistent with the Water Framework Directive which requires that surface freshwater and ground water bodies (lakes, streams, rivers, estuaries, coastal waters etc.) achieve a good ecological status by 2015 and that the first review of the River Basin Management Plan should take place in 2021.

OSPAR Convention¹³³

The aim of OSPAR is to prevent and eliminate pollution and to protect the maritime area against the adverse effects of human activities.

The European Community is a Contracting Party to the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR), which was signed in Paris on 22 September 1992.

The Parties to the Convention undertake to take all possible steps to prevent and eliminate pollution and the necessary measures to protect the maritime area against the adverse effects of human activities so as to safeguard human health and to conserve maritime ecosystems and, when practicable, restore marine areas which have been adversely affected. To this end, the Parties will:

- individually and jointly, adopt programmes and measures;
- harmonise their policies and strategies.

To meet their obligations, the Parties to the Convention must observe two principles:

- the **precautionary principle**, by virtue of which preventive measures are to be taken when there are reasonable grounds for concern that substances or energy introduced, directly or indirectly, into the marine environment may bring about hazards to human health, harm living resources and marine ecosystems, damage amenities or interfere with other legitimate uses of the sea, even when there is no conclusive evidence of a causal relationship between the inputs and the effects;
- the **polluter pays principle**, by virtue of which the costs of pollution prevention, control and reduction measures are to be borne by the polluter.

A commission is set up, consisting of representatives of the Contracting Parties. Its duties are:

- to supervise the implementation of the Convention;
- to review the condition of the maritime area;

¹³³ www.ospar.org

- to check the effectiveness of the measures being adopted;
- to draw up programmes and measures for the prevention and elimination of maritime pollution;
- to establish its programme of work;
- to create the instruments necessary to execute that programme.

7.1.2 Economic Instruments

A number of projects aimed at the improvement of Water Quality have been funded by the EU through a number of programmes.

LIFE, the Financial Instrument for the Environment, introduced in 1992, is one of the spearheads of the European Union's environmental policy. It co-finances projects in three areas: LIFE Nature, LIFE Environment, LIFE-Third Countries. LIFE is open to all EU countries, some candidate countries (currently Romania) and some third countries bordering the Mediterranean and the Baltic Sea.

The following are a number of projects financed by LIFE aimed at the improvement in the quality of water.

Odense Pilot River Basin – Agricultural Programme of Measures

This WFD - related LIFE project will focus on agricultural nutrient pressure and its impact on achieving the WFD objectives. Its main aim is to demonstrate the development of a cost-effective programme of measures to reduce levels of nitrogen and phosphorous originating from agricultural activities in the Odense river basin. Further goals are to prepare a Pilot River Basin management plan, to elaborate input for the EU Strategic Steering Group, as well as to demonstrate and make available the project's results to other environmental and rural development authorities and stakeholders within the EU.

Integrated Multi-Objective System for optimal management of urban drainage

The project uses real time multi-sensors (rain gauges, flowmeters, turbidity monitors, low cost meteorological radar), modelling activities (rain field forecasts and network modelling) and upgrades to infrastructure (sluice gates, pumping stations, volume rehabilitation, new SCADA system), to achieve the integrated multi-objective management of the drainage system in the urban environment of Genoa. Forecast results were:

- Under ordinary conditions, an increased capability for treating first flush flows, controlling the pollution load to treatment plants and, consequently, safeguarding water bodies receiving wastewater;
- In emergencies, the now-casting of critical flows and their control (attenuation of flow peaks), through by-passes and temporary storage by water volumes.

Another financial measure to be implemented by the EU is the pricing of water. The misuse of water results in large volumes being unnecessarily sent to waste water treatment facilities. A reduction in this unnecessary water usage will result in less strain on current systems, reducing the need for upgrades with the result of money being available to finance other areas such as research projects. In fact water conservation is a major part of environmental policy in other countries.

As part of the Water Framework Directive Member States must ensure that water pricing policies provide adequate incentives for users to use water resources efficiently and that the various economic sectors contribute to the recovery of the costs of water services including those relating to the environment and resources. This measure is to be achieved by 2010.

7.2 Other Countries

7.2.1 United Kingdom

The Water Services Regulation Authority (Ofwat)¹³⁴, the UK regulator of water and sewerage companies, regularly reviews the prices that these companies can charge taking into account environmental improvements that are to be paid for between 2005 and 2010. The Environment Agency advises on these improvements and aims that the following are achieved:

- the existing and new infrastructure works well, environmentally;
- European and national targets for the environment are met;
- companies have good plans to provide enough water for their customers, taking account of the environment.

7.2.2 Canada

Canada has a number of legislative measures in place to maintain or improve the quality of water. These include the following:

- **Canada Water Act:**
An Act to provide for the management of the water resources of Canada, including research and the planning and implementation of programs relating to the conservation, development and utilization of water resources.
- **Dominion Water Power Act:**
An Act respecting Dominion water-powers (includes any force or energy of whatever form or nature contained in or capable of being produced or generated from any flowing or falling water in such quantity as to make it of commercial value.)
- **Environmental Effects Monitoring on Metal Mining:**
Metal Mining Effluent Regulations including requirements for metal mines in Canada to conduct Environmental Effects Monitoring.
- **Fisheries Act:**
An Act respecting fisheries in the fishing zones of Canada, all waters in the territorial sea of Canada and all internal waters of Canada.
- **Regulation and support for Aquaculture in Canada:**
Outlines the various regulations and support measures for the aquaculture industry from different government departments

The promotion and application of water conservation measures are a major part of Canada's approach to ensuring water quality. A number of initiatives have been undertaken and can be classified mainly under four categories: 1) Structural 2) Operational 3) Economic and 4) Socio-political.

Water Pricing in Canada

Water pricing initiatives in selected areas where the bill to the consumer rises uniformly with the volume used or where successively higher prices are charged where larger volumes are used. Roughly 45% of the population is subject to these pricing schemes. Public awareness campaigns are utilized to inform the consumer of the measures.

¹³⁴ www.ofwat.gov.uk

Public Education Scheme in Canada

In 1995, all federal Ministers signed the *Guide to Green Government* committing their departments to "green" their operations, policies and programs and be prepared for the Commissioner of Environment and Sustainable Development to audit their performance. The Guide outlines recommended best practices for "greening" operations in priority areas, including water use, and promotes environmental management systems (EMS) as a method of ensuring that environmental objectives are properly considered and implemented.

One initiative which has been found to have been particularly successful is the ARET (Accelerated Reduction/Elimination of Toxics) program. The concept of ARET was developed in the early 1990's by a group of senior industry representatives and key Environmental Non-Government Organizations (ENGOS) known as the New Directions Group (NDG). By the year 2000 ARET succeeded in attracting participation from 8 major industry sectors, 171 companies and government organizations, and 318 individual facilities. Collectively these participants achieved a total reduction in releases to the environment of almost 28,000 tonnes of toxic substances, when releases in the last year of the program are compared to the base year levels of those releases. Over the entire course of the program, more than 70,000 tonnes of ARET substances were prevented from being released into the Canadian environment¹³⁵.

A number of community involvement schemes have been developed by the Canadian Authorities to reduce water pollution. These include:

The Yellow Fish Road Project

This began in Alberta and has spread to cities across Canada, raises awareness of urban water pollution by painting yellow fish symbols on storm drains.

The Clean Annapolis River Project, one of 13 Atlantic Coastal Action Program organizations, undertakes water quality monitoring in Nova Scotia on a volunteer basis. These programs demonstrate a commitment to improve water quality and to preserve and enhance freshwater ecosystems.

The Watershed Stewardship Training Program trains students in stream restoration techniques. Students learn how to replant streambanks, survey and map streams, test water quality, restore stream habitat, and plan and conduct public education projects. To date, 110 students have been trained and 96 have gone on to participate in local stream enhancement projects in various parts of Western Canada.

High water use and point source pollution in Collingwood, Ontario

A comprehensive water conservation program was established to serve as pollution management at source. Economic incentives, including a water-metering system and increasing the unit cost of water, were combined with an educational program to promote water conservation and pollution prevention. Water use dropped 33%. Reduction of wastewater meant reduced energy, chemical requirements, and phosphorus loading to the harbour and improved water quality. Collingwood Harbour is no longer an "Area of Concern" under the Great Lakes Water Quality Agreement.

The Agricultural Environmental Stewardship Initiative (AESI) is a three-year (2000-2003) \$10 million program provided for by the Canadian Adaptation and Rural Development (CARD) fund which was renewed in 1999. The AESI emphasizes projects that address the regional impacts of agricultural practices on water, soil, and air quality, biodiversity and greenhouse gas emissions. This initiative addresses these issues through education and awareness, technology transfer, and stewardship tools including environmental clubs, environmental management systems, and land use planning. It will not support infrastructure such as manure storage facilities. Water quality is the priority environmental issue challenging the agriculture and agri-food sector in all regions. To protect water quality, the primary focus of the initiative will be on soil and manure/nutrient management, as well as the management of pests and food processing waste.

¹³⁵ <http://www.ec.gc.ca/nopp/aret/en/index.cfm>

A number of research projects have been undertaken at Environment Canada's National Water Research Institute (NWRI) to develop practices that reduce and minimize damage to water quality.

Researchers are investigating the pathways agricultural chemicals take as they move through and over soil. The idea is to help develop practices that reduce contaminant migration and minimize damage to prairie water quality. These include agriculture based studies such as soil studies and manure management. A number of studies have also been undertaken in regard to management of polluted aquifers and well systems.

7.2.3 Australia

Water Efficiency Labelling and Standards (WELS) Scheme

To help to reduce urban water consumption on a national scale, the Australian Government, in collaboration with State and Territory governments, has introduced a Water Efficiency Labelling and Standards (WELS) Scheme, which applies national mandatory water efficiency labelling and minimum performance standards to household water-using products.

The WELS Scheme will help to address the issue of high domestic water consumption by providing nationally consistent water efficiency information to consumers at point of purchase and by encouraging manufacturers to design more water-efficient products. The aim of the WELS Scheme is to encourage the uptake of water-efficient products and appliances in domestic and commercial areas while maintaining individual choice and accounting for regional variations in water supply in urban Australia. From 1 July 2006, mandatory registration and labelling will apply to all of these products apart from flow controllers, for which this will be optional¹³⁶. A number of information seminars are currently being provided for the general public so as to understand the requirements of the legislation.

The National Water Quality Management Strategy (NWQMS) was introduced in 1992 as a response to growing community concern about the condition of the Australia's water bodies and the need to manage them in an environmentally sustainable manner. The policy objective for the Strategy is "to achieve sustainable use of the nation's water resources by protecting and enhancing their quality while maintaining economic and social development."

Water Reform Framework

In February 1994, the Council of Australian Governments (COAG) consisting of the Prime Minister, Premiers, Chief Ministers and the President of the Australian Local Government Association agreed to implement a "strategic framework to achieve an efficient and sustainable water industry."

Critical environmental water issues are identified in the Water Reform Framework and include:

- allocation of water for the environment;
- ecological sustainability of new developments;
- institutional reform;
- the incorporation of environmental costs in water pricing;
- ecologically sustainable water trading;
- protection of groundwater; and
- implementation of the National Water Quality Management Strategy.

In April 1995, COAG endorsed the National Competition Policy for Australia. Under this policy, payments are made available for States and Territories that successfully implement a range of important reforms — including the COAG Water Reform Framework. A separate body, the National Competition Council, is responsible for annually assessing the progress of jurisdictions in implementing reforms until 2005. As a result of this process, implementation and continued

¹³⁶ <http://www.waterrating.gov.au/about/index.html>

observance of the COAG water reforms is now a requirement for States and Territories to receive their full share of the payments under the National Competition Policy.

In June 1999 an assessment of the progress of jurisdictions in implementing COAG water reforms was undertaken and payment of over \$1 billion was released to States and Territories in annual payments over the two year period to June 2001.

7.2.4 United States

The establishment of an Office of Ground Water and Drinking Water (OGWDW) is an indication of the United States commitment to raising awareness among the public of the importance of the prevention of water pollution. The OGWDW published a pocket guide titled "Consider The Source: A Pocket Guide to Protecting Your Drinking Water: Drinking Water Pocket Guide #3" to heighten public awareness of the importance of protecting source waters. This guide lists some of the work of the office and lists Best Management practices by the public for source water protection. The guide can be downloaded or ordered on the Safe Drinking Water hotline.

National Pollutant Discharge Elimination System (NPDES) Permit Program

This program controls water pollution by regulating point sources that discharge pollutants into waters of the United States. Sectors covered under this program include agriculture, industrial and commercial facilities and waste water treatment plants (WWTP). Under NPDES, all facilities which discharge pollutants from any point source into waters of the United States are required to obtain a permit. The permit provides two levels of control: technology-based limits (based on the ability of dischargers in the same industrial category to treat wastewater) and water quality-based limits (if technology-based limits are not sufficient to provide protection of the water body).

Public involvement in this program is also encouraged as a means of raising awareness of the measures necessary to protect water. The public is encouraged to provide opinions during the initial State NPDES authorization process through submission of public comments and participation at public hearings, and may occur during any substantial program revision. Citizens may also participate in the Federal rulemaking process where NPDES program requirements are established. Citizen participation helps to ensure the NPDES permit program is working effectively in every community.

Remediation

The restoration and remediation of polluted groundwater sources is an area where the USEPA provides funding. The Ground Water and Ecosystems Restoration Research Division undertakes research and technical assistance to provide the scientific basis to support the development of strategies and technologies to protect and restore ground water, surface water, and ecosystems impacted by man-made and natural processes.

7.3 Ireland

7.3.1 Initiatives

Water Framework Directive

On the 22 December 2003, the Water Policy Regulations (S.I. No. 722 of 2003) were enacted, which transpose the Water Framework Directive (2000/60/EC) in to national law. In summary the Regulations provide for

- the protection of the status of all waters (i.e. no deterioration to be allowed) and the achievement of at least "good status" by 22 December 2015 for all waters
- the establishment of "river basin districts" (RBDs) as the administrative areas for implementation of the Directive (including international RBDs in relation to cross-border river basins)

- the co-ordination of actions by all relevant public authorities for water quality management in an RBD including cross-border RBDs
- the characterisation of each RBD
- the establishment of environmental objectives for each RBD
- the development of a programme of measures to achieve those objectives and subsequently its review / updating every six years
- the development and adoption in each RBD of a river basin management plan (RBMP) and subsequently its review / updating every six years.

The regulations assign responsibilities to the EPA, local authorities and other public authorities for implementation of the Water Framework Directive and lay down deadlines for the delivery of the main tasks of required by the Directive.

Eight RBDs have been established in Ireland, north and south (including three crossborder RBDs). The European Communities (Water Policy) Regulations, 2003, (S.I. No. 722 of 2003) identify seven RBDs which are wholly or partly within the state. The Regulations require local authorities, acting jointly in relation to each RBD, to establish environmental objectives and programmes of measures to achieve those objectives, to make river basin management plans and to establish river basin district advisory councils (which should include relevant interested parties). The EPA is responsible for a number of technical aspects relating to implementation of the Directive, including the formulation of monitoring programmes (which must be operational by the end of 2006). In addition, the Regulations identify other public bodies that are required to assist in the implementation process.

Approximately €50 million has been provided by central government to the local authorities to assist with initial implementation of the Directive.

The Water Services Investment Programme

The Programme over the years contains 869 individual water and sewerage schemes, at various stages of development. At the end of June 2005, a total of 321 water and wastewater schemes had been provided since the start of 2000. These completions included many very large wastewater treatment plants. For example, Ringsend (completed in 2003) is the biggest completed wastewater treatment plant anywhere in the EU and will produce the single greatest improvement ever in the quality of Irish coastal waters. As a result of the improvements achieved through the installment of this wastewater treatment facility Dollymount Beach was included among the Blue Flag awards scheme in 2005. Ireland is only one of five countries which have a Blue Flag Beach in its capital city¹³⁷.

A number of other large urban areas have also had new wastewater treatment facilities provided. WWTPs incorporating phosphorus removal have been installed in a number of locations including in the Shannon, Boyne, Liffey, Suir and Lough Leane catchments in the late 1990s due to particular eutrophication problems in these areas. At present roughly 17% of wastewater treatment facilities have nutrient reduction facilities however with increased upgrading of facilities this is expected to increase in coming years¹³⁸. Significant new water supply schemes have also been provided at many locations around the country during this time. Substantial increases in water and wastewater treatment capacity are being achieved as a result of increasing spending on water and sewerage

The objectives of the Water Services Investment Programme are being achieved through sustained State investment over the period of the National Development Plan (NDP) in capital works managed by the Department of the Environment Heritage and Local Government.

Capital expenditure on the Programme is expected to amount to €3.7 billion over the NDP period. EU financial assistance is being made available over the NDP period of 2000 to 2006 - €285

¹³⁷ http://www.dublincity.ie/gaeilge/press_news/press_releases/pr_blue_flag_for_dollymount.asp

¹³⁸ Clenaghan, Conor et alia. *Phosphorus Regulations National Implementation Report*, EPA 2005

million under the Cohesion Fund and €71 million under the European Regional Development Fund¹³⁹.

Limerick County Council Rural Towns and Villages Initiative

This aims to promote development in existing settlements and to reduce pressure on river water quality. Under this initiative the Council will contribute towards the cost of a sewage treatment plant which is provided by a private developer and which meets the needs of the existing town or village, the needs of the proposed development and some additional reserved capacity for future developments. The aim of the Council's contribution will be to ensure that the provision of this facility is viable from the developer's viewpoint. The Council's contribution would be conditional on there being sufficient effluent dilution available in the receiving watercourse; an acceptable treatment system proposed to the Council; and, upon satisfactory completion and commissioning, transfer of the plant ownership to the Council who will be responsible for its maintenance and operation. The initiative is mainly aimed at towns and villages where the existing scheme may not be otherwise upgraded for some time and where there is significant development pressure. To date the Council has received expressions of interest in respect of twelve towns. In all cases phosphorus reduction will be stipulated, in some cases down to 0.1 mg/l Total Phosphorus.

Rural Water Programme

In 2002, the European Court of Justice found that Ireland was obliged to ensure that privately sourced group schemes met the water quality standards prescribed in the EU Drinking Water Directive. The Rural Water Programme, a scheme administered by local authorities is comprised of a number of measures to address deficiencies in group water schemes, small public water and sewerage schemes in rural villages and private and individual water supplies. A budget of €644 million has been committed under the NDP 2000-2006. A number of schemes and subsidies are available to the different schemes mentioned above to bring water supplies up to a satisfactory standard.

National Water Conservation Programme

In May 2003, the Minister announced the allocation of over €276 million for the first round of a new nation-wide water conservation programme. This new investment builds on the 15 initial fact-finding water conservation schemes, carried out by selected local authorities in the period since 1996. The programme is designed to identify and substantially reduce the levels of unaccounted for water in Ireland's water supply network. A very significant amount of water is lost into the ground every day. This represents an unsustainable and unacceptable drain on the resources of local authorities and the State and on the environment itself.

The new investment package provides for –

- €194 million to allow those 14 City and County Councils that have already completed the study phase to carry out the necessary major network rehabilitation, water conservation and leakage reduction schemes identified in those studies.
- €82.5 million to allow the remaining 17 City and County Councils to commence studies to map out their water supply networks, and to establish the level and sources of unaccounted for water. As part of the study phase, authorities will also undertake pilot water conservation and leakage reduction projects and identify measures to be incorporated in longer-term strategies.

Results from the first 15 schemes show that “unaccounted for” water rates have reduced significantly. For example, in Dublin they were reduced from 42.5% to 28.7%; in Donegal from 59% to 39%; in Meath from 47% to 34%; and in Kilkenny from 45% to 29%.

¹³⁹ <http://www.environ.ie/DOE/DOEIPol.nsf/wvNavView/wwdWaterServices?OpenDocument&Lang=en>

Local Government (Water Pollution) Act, 1977 (Water Quality Standards for Phosphorus) Regulations, 1998 (S.I. 258 of 1998)

The Water Pollution Acts enable local authorities to:

- prosecute for water pollution offences;
- attach appropriate pollution control conditions in the licensing of effluent discharges from industry, etc., made to waters or to sewers;
- issue notices ("section 12 notices") to farmers, etc., specifying measures to be taken within a prescribed period to prevent water pollution. (Note: Local authorities issued a total of 1346 section 12 notices in 1996, including 1203 in respect of the agricultural sector);
- issue notices requiring a person to cease the pollution of waters and requiring the mitigation or remedying of any effects of the pollution in the manner and within the period specified in such notices;
- seek court orders, including High Court injunctions, to prevent, terminate, mitigate or remedy pollution/its effects;
- prepare water quality management plans for any waters in or adjoining their functional areas;
- make bye-laws regulating certain agricultural activities where the local authority considers this to be necessary so as to prevent or eliminate pollution of waters,
- issue notices requiring farmers to prepare nutrient management plans with the aim of ensuring that nutrients applied to land from chemical fertilisers and organic farm wastes, e.g. slurries, take account of nutrients already available in the soil and are consistent with recommended application rates, crop requirement and the need to avoid water pollution.

Regional Fisheries Boards, as part of their fisheries management function, are also in a position to take prosecutions for water pollution offences. However, the Boards do not have the range of powers which is available to local authorities to prevent pollution.

Catchment Based Strategy Against Eutrophication

In 1997, the Government published a strategy document *Managing Ireland's Rivers and Lakes – A Catchment Based Strategy Against Eutrophication* which set out Ireland's pollution reduction programme in respect of phosphorus.

The Strategy identified a long-term target of improving all unsatisfactory waters in rivers and lakes to a level consistent with the beneficial uses of the water. Interim quality standards were also identified, which are to be achieved generally over a ten-year time frame. In order to give effect to these interim quality standards and to meet, in part, the requirements of the Dangerous Substances Directive, the Local Government (Water Pollution) Act, 1977 (Water Quality Standards for Phosphorus) Regulations, 1998, were introduced. These Regulations were unique in Europe in their inclusion of direct ecological assessment of the impact of eutrophication. This ecological approach foreshadowed the introduction of the EU Water Framework Directive, which strongly emphasises ecological assessment and sets a target of good ecological quality for all of the Community's surface waters, to be met by 2015.

The Phosphorus Regulations, 1998, is a legislative measure aimed at reducing eutrophication in rivers and lakes. The targets set by the Phosphorus Regulations are designed to prevent deterioration of waters of good quality and to improve waters of unsatisfactory quality to a specified standard.

The Regulations require that each local authority must submit an Implementation Report to the EPA every two years detailing measures it is taking to meet the specified standards.

The Phosphorus Regulations require that water quality be maintained or improved by reference to the baseline biological quality rating (rivers) or trophic status (lakes) assigned by the Agency in the 1995-97 review period or at the first occasion thereafter. Water quality targets set in the

Regulations must be met by 2007 at the latest for waters surveyed by the EPA in the 1995-97 period and within a maximum of ten years for waters first surveyed after 1997¹⁴⁰.

A number of measures are available to local authorities to tackle water pollution and these include:

- the implementation of agricultural bye-laws and farm surveys
- the review of discharge licences
- upgrading/constructing of wastewater treatment plants and collection systems
- carrying out misconnection surveys.

The presence of agriculture as one of the main causes of pollution mainly through eutrophication has been identified by a number local authorities. Increased monitoring and enforcement has been undertaken by a number of local authorities with a number of local authorities developing specific teams to tackle this sector.

The majority of local authorities have indicated that they will make greater use of powers under the Water Pollution Acts in issuing, enforcing and reviewing section 4 and section 16 discharge licences, and in issuing and enforcing section notices to prevent pollution.

The success of the measures put in place already for this program can be seen by the increase of 3.4% in compliance from the baseline (generally 1995-1997) period. Marked increases (>30%) in compliance between the baseline and 2001-03 periods are apparent in Dublin City, Kildare, Fingal, Westmeath, South Dublin and Meath. A significant decline (>20%) in compliance with the Regulations is apparent in Donegal and Wicklow. Of the 496 lakes with updated trophic status information available, 401 currently comply with the targets set in the Regulations and the remaining 95 do not comply¹⁴¹.

Commitments made to environmental issues by Local Authorities

In Clare County Council an Assistant Scientist post has been created for the issue of Section 16 licences for the county, with particular reference to the Shannon Industrial Estate. In addition, the Council are requiring activities with significant unlicensed commercial discharges to apply for Section 4 discharge licences. Phosphate free detergents are specified in licence conditions where relevant.

Offaly County Council have engaged a technician full-time in the licensing of premises under the Water Pollution Acts and, following a survey of manufacturing/commercial activities in the county, has issued 22 new discharge licences.

Cork County Council require new licensees, where relevant, to have in place and available for inspection, operating procedures and training requirements for staff involved in effluent control. It is an offence under the Shannon Navigation Bye-laws to discharge sewage from a boat directly to the River Shannon or Shannon/Erne Waterway. Leitrim County Council proposes improved liaison with Waterways Ireland in regard to the improved implementation of this bye-law. Leitrim County Council also proposes improved environmental control of marinas including the provision of pump-out facilities.

Waterford County Council is currently processing a Section 4 discharge licence for one quarry site, which will be used as a template for the control of other sites in the county. In this case the Council has reported that diffuse run-off generated from the quarry site during rainfall events far outweighed any point source discharges, in terms of quantity and quality (suspended solids).

Urban Waste Water Treatment Regulations 2001 (S.I. No 254 of 2001)

These Regulations revoke and generally re-enact in consolidated form the Environmental Protection Agency Act 1992 (Urban Waste Water Treatment Regulations, 1994, as amended, and prescribe a further 30 water bodies as sensitive areas. The Regulations:

¹⁴⁰ Clenaghan, Conor et alia. *Phosphorus Regulations National Implementation Report*, EPA 2005

¹⁴¹ *ibid*

- prescribe requirements in relation to the provision of collection systems and treatment standards and other requirements for urban waste water treatment plants, generally and in sensitive areas
- provide for monitoring procedures in relation to treatment plants and make provision for pre-treatment requirements in relation to industrial waste water entering collection systems and urban waste water treatment plants,
- and give effect to provisions of Council Directive 91/271/EEC of 21 May 1991, as amended, concerning urban waste water treatment, and Directive 2000/60/EC of 23 October 2000 - the Water Framework Directive.

Article 14 of the Urban Waste Water Treatment Directive (UWWTD) states that "Sludge arising from waste water treatment shall be re-used whenever appropriate. Disposal routes shall minimise the adverse effects on the environment." There has been substantial progress in sludge management over the last five years and Ireland is systematically moving towards effective management of sewage sludge. Standards have been developed in excess of those set by the EU and which utilise best international practice.

To guide the development of policy and practice in relation to the treatment and re-use of sewage sludge, the Department commissioned a *Strategy Study on Options for Treatment and Disposal of Sewage Sludge in Ireland* in 1993. A key finding of the study was that in the period to 2013 the quantity of sewage sludge arising from waste water treatment plants would increase to 130,000 Tonnes Dry Solids (TDS) as a consequence of higher treatment levels occurring under the Urban Waste Water Treatment Directive.

In 2003 42,298 TDS were produced at agglomerates with a population equivalent in excess of 500. Some 63% of this sludge is re-used on agricultural land and 35% is disposed to landfill.

The 1999 EU Landfill Directive sets mandatory targets for the reduction of biodegradable waste to landfill. Already EPA landfill licenses are reflecting these requirements and attaching conditions that limit or preclude the disposal of sludge to landfill. A number of regulations exist in regard to the proper use of WWTP sludge on agricultural lands¹⁴².

Local Authority Initiatives

Up to 1999 sludge was disposed of to the sea mainly from the Ringsend Treatment Plant¹. However this practice has since terminated. Sewage sludge previously disposed of at sea is now treated by thermal drying at the Ringsend Treatment Plant and used in accordance with the Code of Good Practice and reused as an agriculture fertiliser.

Offaly County Council has adopted a sludge management plan. In the context of recommendations in the plan relating to landspreading and increased sludge production.

Over the coming years, management procedures will be introduced to effectively limit phosphorus inputs to surface water bodies and to ensure disposal of sludge in a sustainable manner. Sludge holding facilities are being constructed at Edenderry, Co. Offaly, to serve as a hub centre for the surrounding villages in the area. Sludge treatment facilities utilising mechanical dewatering have been set up at Clonaslee Water Treatment Plant. A Scientific Officer has been employed to carry out research into alternative sludge disposal methods.

The Planning and Development Act 2000

The incorporation of environmental concerns and planning is now a common part of planning application appraisals by local authorities. A number of local authorities refer planning applications to the Environment Department for consideration at the planning stage, prior to the requirement for a water discharge licence under the Water Pollution Act.

¹⁴² *Waste Management (Use of Sewage Sludge in Agriculture) Regulations 1998 (S.I. No. 148 of 1998)*
Waste Management (Use of Sewage Sludge in Agriculture) (Amendment) Regulations 2002 (S.I. No. 267 of 2001)

Planning Initiative in Cork

The Planning Department in Cork County Council refers planning applications for housing estate developments to the Environment Department for consideration at the planning stage, prior to the requirement for a water discharge licence under the Water Pollution Act. This allows the application to be reviewed more fully in terms of the Phosphorus Regulations particularly in relation to housing density, treatment facility requirements and the capacity of the receiving waters. The Environment Department is working with the Forward Planning section of the Planning Department in the future development of ten Local Area Plans for the county, as required under the Planning and Development Act, 2000. This will be with particular reference to 200 key towns and villages in the county, the receiving waters for projected effluent discharges from identified zoned land, and the requirements of the Phosphorus Regulations.

Cork County Council notes that agricultural planning applications have substantially increased from 100 applications in 2000 to 350 in 2003, mainly driven by the availability of grant aid for agricultural developments and the increasing uptake of the Rural Environment Protection Scheme (REPS). Cork County Council applies restrictions to landspreading of farm slurries or other organic manures which are in line with BATNEEC guidance in the appraisal of all agricultural planning applications. Cork County Council is carrying out a survey of pig production units ongoing in the county to establish operative status and location of spreadlands.

Ground Water Protection Schemes

The interdependency between groundwater and surface waters means that even relatively low levels of phosphorus in groundwater may lead to a significant problem in surface water if there is large groundwater base flow to a river. The Geological Survey of Ireland (GSI) has completed, or is nearing the completion of, a number of groundwater protection schemes for various local authorities and is planning to have developed such schemes for much of the country by 2010.

Groundwater protection schemes provide guidelines for the planning and licensing of activities that could pose a risk to groundwater resources. The schemes provide a land surface zoning map which outlines areas in which groundwater is vulnerable to pollution and areas that have a good groundwater potential. These maps can be used to assess the acceptability of a particular activity with regard to potential hazard and groundwater source protection. The schemes are also a guide to identifying works that should be carried out to protect groundwater sources. Regard should be had to these schemes in the preparation of County Development Plans. The WFD and the setting up of RBM Projects require vulnerability assessment to be undertaken as well as the delineation of resource and source protection zones. The groundwater protection responses for landfills, landspreading of organic wastes and for wastewater treatment systems for single houses put measures in place to reduce the risk of phosphorus and other pollutants entering groundwater.

Drinking Water Regulations

Drinking Water Regulations introduced in December 2000 brought all group schemes serving 50 persons or more within the remit of the Drinking Water Directive and set a compliance date of end December 2003. The Regulations impose more severe penalties than was previously the case for non-compliance.

The European Directive on the quality of water intended for human consumption (98/83/EC) was transposed into Irish law on the 18th December 2000 and took effect on the 1st January 2004. The 2000 Regulations are substantially different from the previous Regulations (the European Communities (Quality of Water Intended for Human Consumption) Regulations, 1988). In summary, the 2000 Regulations:

- set standards in relation to the quality of water intended for drinking water, cooking, food preparation, other domestic purposes and food production (other than natural mineral waters, bottled water, certain medicinal products and exempted supplies);
- provide for temporary departures from the standard where there is no threat to human health; and

- require that information is made available to consumers in relation to various matters including water quality, exempted supplies, departures granted, precautionary measures and remedial action in case of non-compliant supplies.

The primary requirement on the sanitary authority is to investigate each exceedance of the parametric value that is reported. Where the failure is with the microbiological or chemical parametric standard, the sanitary authority is required to prepare an action programme within 60 days of receipt of the initial result. The measures proposed in the action programme must be in place within one year in relation to failures that present a risk to public health and within two years for those exceedances that do not present a risk to public health.

Where a microbiological or chemical failure occurs in a private water supply, such as a group water scheme, the sanitary authority is required to serve a notice on the person responsible for the supply within 14 days of receipt of the results. The notice must require the persons responsible to prepare an action programme within 60 days of receipt of the notice. The action programme must ensure that the supply is brought back into compliance with the Regulations within one year in relation to failures that present a risk to public health and within two years for those exceedances that do not present a risk to public health.

Where a failure to meet the indicator parametric values occurs the sanitary authority is first required to determine whether the non-compliance poses a risk to human health. If such a risk exists then the sanitary authority is required to follow the corrective action procedures outlined in the previous two paragraphs.

Sanitary authorities should develop an enforcement plan for dealing with non-compliances within the group water scheme sector. The sanitary authority should ensure that the enforcement of the standards is carried out in accordance with Article 9 of the Regulations and that powers of prosecution available under Article 14 are used where necessary.

Failure to comply with the notice is an offence and that person shall be liable on summary conviction to a fine not exceeding €1,905 or to a term of imprisonment not exceeding 6 months.

Waste Management Act, 1996

Local authorities have powers under the Waste Management Act, 1996 to require a farmer to prepare a nutrient management plan where this is considered necessary to prevent, eliminate or minimise nutrient losses to waters. Guidelines for local authorities on the implementation of these measures were published in August, 1998.

Dangerous Substances Regulations

The Dangerous Substances Regulations, 2001, prescribe water quality standards in respect of 14 dangerous substances in surface waters, e.g., rivers, lakes and tidal waters.

Water quality targets set in the Regulations must be met by 2010 and, where the existing condition of waters does not meet a particular standard, there must be no disimprovement in water quality in the meantime. The local authorities are required to submit two-yearly reports to the EPA, outlining the measures they aim to take to prevent water pollution from dangerous substances so as to meet the standards set by the Regulations.

Quality of Bathing Waters Regulations, 1992

In Ireland the primary legislation governing the quality of bathing waters is set out in the Quality of Bathing Waters Regulations, 1992 (S.I 155 of 1992) and amendments which transposed the EU Directive 76/160/EC concerning the quality of bathing water. These Regulations transposed the requirements of the EC Directive concerning the quality of bathing waters (76/160/EEC), the purpose of which is to ensure that bathing water quality is maintained and if necessary improved so that it complies with specified standards designed to protect public health and the environment. The Regulations set more stringent limits for some parameters than in the EU Directive and all parameters specified are used by the EPA in assessing compliance with the

Regulations in contrast to the European Commission which use a sub set of parameters in assessing compliance with the Directive.

Although the overall quality of bathing waters remains very good, there was a 2% reduction in compliance with the National standards in 2004 as compared with 2003.

Local authorities are required to sample (or arrange for the sampling of) waters at the bathing areas for which they are responsible. These samples must be taken at specified locations, at a required frequency and as far as possible, analysed using specified methodologies. Local authorities are also responsible for conducting periodic investigations of conditions which may affect the quality of bathing waters for the purpose of determining the volume, nature and effect of all potentially polluting discharges at the bathing areas.

Where bathing waters do not comply with the specified standards, local authorities are required to give public notice of this fact and to undertake the necessary measures to ensure compliance with standards. However, deviations of water quality standards caused by floods, other natural disasters or abnormal weather conditions should not be taken into consideration in determining compliance with the standards.

The Nitrates Directive:

The Nitrates Directive (91/676/EEC) – *Council Directive of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources* – was adopted in 1991 and has the objective of reducing water pollution caused or induced by nitrates from agricultural sources and preventing further such pollution, with the primary emphasis being on the management of livestock manures and other fertilisers.

The Directive requires Member States to implement one of the following two options:

1. To apply agricultural *Action Programme measures* throughout their whole territory or;
2. To apply Action Programme measures within discrete *Nitrate Vulnerable Zones (NVZs)*

Ireland's revised action programme was submitted to the European commission in July 2005 and appropriate Irish legislation is currently being prepared. Though Ireland only submitted its action plan in 2005 it must be noted that a number of initiatives are already in place in Ireland since 1991 in relation to improving compliance with the Nitrates Directive. These include:

- monitoring waters
- development and dissemination of a Code of Good Agricultural Practice to Protect Waters Against Pollution by Nitrates (1996)
- promoting good agricultural practice in numerous ways e.g. grants for farmyard waste facilities
- The establishment by the local authorities of agricultural bye-laws in relation to agricultural activities
- Appropriate conditions applied in planning permission
- Issuing of Integrated pollution prevention control (IPPC) licences by the EPA for intensive pig-rearing and poultry rearing units
- The rules of Good Farming Practice applicable to farmers claiming aid under direct payments and other national schemes operated by the Department of Agriculture and Food
- The issuing of "section 12 notices" and related farm inspections by local authorities under the Local Government (Water Pollution) Acts. This Act also enables the application of compulsory Nutrient Management Plans for farms where deemed appropriate by the local authority

In the interests of both the environment and interested parties Ireland is to apply its Agricultural Action programme throughout the whole national territory rather than designated Nitrate Vulnerable Zones. The national territory will then be sub-divided into three zones based mainly on soil type, rainfall and length of growing season.

Ireland's adoption of the whole territory approach, (under regulations SI 213 of 2003) is in line with six (of the old 15) other Member States (Austria, Denmark, Finland, Germany, Luxemburg and the Netherlands) who have adopted a whole territory approach. The legislation which enacts the national territory approach is the European Communities (Protection of Waters Against Pollution from Agricultural Sources) Regulations, 2003 (S.I. No. 213 of 2003). The application of the national territory shows a commitment to the reduction in nitrate pollution of water in Ireland.

The primary aim of Irelands Nitrates Action Programme as detailed in the Action Programme is to: *"Reduce water pollution/eutrophication caused or induced by Nitrates and Phosphates from agricultural sources and to prevent further such pollution/eutrophication. In addition specific objective is to increase the efficiency of nitrogen use in agriculture using 2006 as a base year"*.

The measures outlined in the Action Programme include:

- The listing of periods during which the application to land of certain types of fertilizer will be prohibited.
- Minimum storage capacities for manure in the different zones
- Preventative measures applicable for the stockpiling of farmyard and mushroom manure. These include minimum distances from water bodies and limestone features
- Limits on the amount of fertilizers to be applied
- Requirements to the manner of application of fertilizers
- Requirements for ploughing of land

It must be noted that farmers involved in the REPS scheme run by the Department of Agriculture are already subject to stringent nutrient management plans and are required to meet the nitrogen limits as applied in the Nitrates Directive. Ireland has applied for a derogation in accordance with the paragraph 2(b) of Annex III of the Directive, for approval of a limit of 250 kg nitrogen per hectare per annum.

The detergents industry has virtually ceased to market phosphate-based domestic laundry detergents in pursuance of a voluntary agreement made by the Industry with the DEHLG in 1999.

7.3.2 Research

The EPA water quality research program is focused in two main areas of research: eutrophication from agriculture and forestry; and water quality. The former topic has four main aspects, sources and pathways of nutrient losses, seasonal variation of phosphorus losses from soil and field management and nitrate leaching from soils. The forestry water projects are being funded in partnership with the Council for Forest Research and Development (COFORD). These projects focus on determining the best practice for forestry plantation and management, particularly with regard to fertiliser application and minimising the threat from acidification. In addition to these large-scale projects there a number of medium scale projects on topics such as ecological assessment of lakes, endocrine disruption in fish and impacts on groundwater¹⁴³.

A selection of projects is listed below:

- Identification and initial assessment of phytases suitable for inclusion in animal feed for the purposes of phosphate pollution abatement
- Eutrophication from Agriculture Sources - Phosphorus and Nitrogen
- Eutrophication from Agriculture Sources (Phosphorus and Nitrogen) - Soil and Phosphorus
- Wastewater treatment Efficiency of Subsoil and Stratified Sand Filters

In addition, the ERTDI Programme 2000 – 2006 has funded a suite of projects specifically to address the research requirements for the Water Framework Directive in Ireland. The total funding awarded was of the order of €2 million.

¹⁴³ <http://www.epa.ie/EnvironmentalResearch/ProjectSearch/WaterQuality/>

A programme of new and innovative technologies funded by the Marine Institute and the EPA is to provide instant alerts on pollution incidents, falling water quality levels and poisonous plankton blooms in bays, rivers and lakes directly to computer screens in the country. New approaches to monitoring are being developed at a number of research institutes across the country. These include advanced remote sensor and monitoring technology that can be applied to the EU Water Framework Directive. Since these technologies can be applied not only in Ireland, but also across the world, this offers an opportunity for Irish researchers and businesses to play a significant role in what could be a highly lucrative market, estimated to be worth some €550 million in Western Europe alone.

The three projects being funded under the first phase of this strategic programme are:

SmartCoast: aimed at developing novel sensors to continuously provide water quality data via wireless links to a web-enabled interface, thereby enhancing the ability of monitoring and regulatory bodies to achieve compliance with the WFD. This project involves collaboration between two leading research institutes (the National Centre for Sensor Research at DCU and The Tyndall National Institute at UCC), two companies (MAC in Limerick and Marine Informatics in Killaloe), the South West Regional Authority and the Marine Institute's catchment research facility at Newport, Co. Mayo;

The **Cytometry** project aims to develop a miniaturised multi-channel system capable of detecting and counting bacteria and viruses in water. At present, this technique is limited to laboratory use. The new system will use cell counting coupled with suitable immunological (antibody) markers and fluorescence markers. The project partners are Tyndall National Institute and Dept of Zoology, Ecology and Plant Science, at UCC;

The **Optical Sensing** project aims to deliver a new highly efficient and innovative monitoring system based on optical oxygen sensing (and respirometry). The new biosensor method will provide primary screening of marine samples thus allowing identification of contaminated, suspicious and life-threatening samples. The project consortium includes the Biochemistry Department of UCC, Luxcel Biosciences Ltd. (Co. Kildare) and the Environmental Research Institute at UCC.

7.3.3 Information/awareness raising

A number of initiatives are undertaken by the Department of the Environment, the EPA and local authorities, in order to ensure that members of the public and those people employed in sectors involving water, including government employees

Training

The DEHLG has launched a Performance Management System (PMS) for WWTPs in 2002, which was developed by the Water Services National Training Group. This is a management tool for local authorities to manage the Operation and Management phase of Design Build Operate contracts. It is also recommended as a management tool for local authorities in their own operation of treatment plants. This PMS should contribute to improved environmental and performance management of WWTPs.

On a related note, consultants have developed a FÁS training programme for the introduction of Environmental Management Systems (EMS) in local authorities. The development of the training programme was supported by a committee chaired by South Tipperary County Council, with representation from the DEHLG, FÁS, EPA, Cork County Council and SIPTU. It has been designed to assist local authorities in implementing the EU EMAS (Environmental Management and Audit Scheme) Regulation. South Tipperary County Council was used as the pilot local authority for the development of this programme. The Council has put in place the EMS in its Planning, Environment and Waste Management Sections. Implementation of the EMS should lead to more efficient use of resources and better overall performance with regard to the environmental obligations of the Council. This programme is being carried out in conjunction with the Water Services National Training Group.

Awareness Raising

The cooperation of the government authorities with representative public groups such as farmers, fisheries and residents groups is essential in order to ensure the awareness of the general public.

A National Rural Water Monitoring Committee (NRWMC), which is representative of the local authorities, the Federation of Group Water Schemes and the rural organisations, is now in place to advise on policy and oversee the implementation, by local authorities, of the annual Rural Water Programme. The NRWMC published a Guidance Document for the preparation by local authorities of a Rural Water Strategic Plan. These plans set out an agreed strategy for supplying all rural areas within Counties with a satisfactory water supply. The plans are based on sound economic and engineering principles and are being used by local authorities and the group sector in developing and implementing proposals for bringing quality deficient group water schemes into compliance with the requirements of the Drinking Water Regulations.

Local authorities do have the necessary powers to force consumers to conserve water - there are provisions for fines and ultimate disconnection. Such powers are important but the main focus at this stage is on public education to promote responsible water usage. Therefore, local authorities will be allowed to use a portion of the new allocations for information and awareness campaigns designed to highlight what individual consumers can themselves do to reduce water usage and demand on water resources. Education schemes are also important to raise awareness among the young generations.

There is a very specific requirement that the public be consulted in the implementation of the directive, in particular the preparation of the management plans. To this end, the RBD must make relevant information available to the public in a timely manner, thereby facilitating commentary and consultation. The Commission must also be kept informed of the implementation of the directive and must, in particular, receive copies of the management plans and monitoring programmes as well as summaries of the reports on characterisation.

The availability of information on the quality of bathing water is an essential part of public awareness. Each local authority involved in sampling of water at the designated bathing areas must establish and maintain a register of sampling results which should be made available for inspection by any person during office hours. During the bathing season, the results of sampling should be displayed at or near the bathing area or alternative arrangements should be made for their availability to the public at the area concerned. The results displayed should be updated regularly, at least every four weeks and the location of the sampling point(s) should be indicated on a map displayed at or near the bathing area.

In regard to the Nitrates Directive Teagasc, the national agri-environmental advisory service will be utilized to inform farmers of the requirements and implications of the directive. Nation-wide public awareness campaigns aimed at farmers are also to be used. These include a national conference involving the main stakeholders including farming groups. Awareness meetings at county and sub-county are also to be utilized.

Blue Flag Awards

The Blue Flag is a well-recognised, well respected eco-label, awarded to beaches and marinas with excellent environmental management and the system currently operates in twenty four countries. *An Taisce* is the responsible body in Ireland for the administration of the Blue Flag scheme.

To gain a Blue Flag, a beach has to meet 26 criteria and a marina 16 criteria covering water quality, beach/marina management, safety, services and facilities, environmental education and information. In Ireland, in 2004 the European jury awarded Blue Flags to 73 beaches (75 in 2002) and 5 marinas (4 in 2002) from a total of 88 beach and 5 marina applications. The Blue Flag for beaches is only valid during the blue flag season which coincides with the bathing season (June to August). In addition to compliance with the requirements corresponding to those of the EU Bathing Water Directive there must be compliance with the standards and requirements for sewage treatment and effluent quality such as are contained in the EU Urban Waste Water Directive. There must be no industrial or sewage related discharges affecting the beach area.

8. Products

8.1 Introduction

Throughout the ongoing quest for sustainable development new ideas and methodologies have evolved. Governments, businesses and consumers began turning more attention to the environmental aspects of products during the 1990s. The trend has been encouraged by a growing awareness of responsibility for the environment. Ecodesign emerged out of the end-of-pipe solution as a popular policy for environmental protection. The first stage of waste prevention resulted in the attempt to avoid waste and toxic substances in the production stage (Cleaner Production). Next, minimising the environmental impact of a product was promoted. This applied to the entire ecological life cycle of a product (i.e. the product life cycle), namely from raw material extraction to the ultimate disposal of a product. Now it is the aim to optimise the entire socio-economic system of the product as well as that of its use to meet the criteria of sustainable development for the future¹⁴⁴. Thus the focus has shifted from environmental management in the form of 'end-of-pipe-technology' to cleaner production followed by improving the design of the product itself.

8.2 EU policy on sustainable product design/ Integrated Product Policy (IPP)

In the area of managing natural resources more responsibly the European Council agreed, "that the EU Integrated Product Policy aimed at reducing resource use and the environmental impact of waste should be implemented in co-operation with business"¹⁴⁵. The Commission has developed the EU Integrated Product Policy (IPP) in cooperation with stakeholders and with the aid of numerous studies¹⁴⁶. IPP was first discussed with stakeholders in 1998. The following year, IPP was considered at the Weimar Informal Meeting of Environment Ministers. The conclusions from the meeting welcomed the Commission's intention to adopt a Green Paper and emphasised that improving the market conditions for greener products on the European market would also help to strengthen the competitiveness of European industries. The Commission adopted the Green Paper in February 2001 and launched a stakeholder consultation exercise on its contents. These consultations showed that IPP clearly has a role to play in contributing to sustainable development. A subsequent communication re-iterated the need for a product dimension to environmental policy, explained the IPP approach and outlined the guiding principles of the EU's IPP strategy¹⁴⁷.

IPP required a rethinking of policies relating to the environmental impacts of products. All products and services have an environmental impact, whether during their production, use or disposal. The exact nature of this impact is complex and difficult to quantify but the potential magnitude of the problem is clear. At the same time continued economic growth and prosperity is significantly influenced by the production and use of products. The challenge is to combine improving life styles and well-being – which are often directly influenced by products - with environmental protection. In other words, win-win situations need to be found where environmental improvements and better product performance go hand in hand and where environmental improvements support long-term industrial competitiveness. This is what IPP seeks to achieve.

¹⁴⁴ Austrian Eco-design Information point, Institute for Engineering Design, Vienna University of Technology.
<http://www.ecodesign.at/english/index.htm>

¹⁴⁵ *Decision 1600/2002/EC of the European Parliament and of the Council laying down the Sixth Community Environment Action Programme*, OJ L 242, 10.9.2002, p. 1-15

¹⁴⁶ <http://europa.eu.int/comm/environment/ipp/ippsum.pdf>

¹⁴⁷ *Integrated Product Policy: building on environmental life cycle thinking*, EC, Brussels, 18.6.2003 COM(2003) 302 final

Quantifying the effects of a product can be difficult and onerous: For example, one product, the car, is responsible for roughly 80 % of the European Union's CO₂ emissions from the transport sector, the sector from which emissions have been rising fastest. At the same time the number of cars per inhabitant is also increasing – by 14 % between 1990 and 1999 – using up more resources in their manufacture, more space for parking and roads, and creating more waste disposal problems. All this is despite significant reductions in the emissions per car and considerable efforts by the industry concerned, such as the voluntary agreement to reduce CO₂ emissions by 25 % by 2008. Moreover, for other pollutants there have been extremely significant reductions over recent decades.

Up to now, product-related environmental policies have tended to focus on large point sources of pollution, such as industrial emissions or waste management issues.

Often these have been successful. Now, however, it is becoming clear that they need to be complemented by a policy that looks at the whole of a product's lifecycle, including the use phase. This should ensure that environmental impacts throughout the life-cycle are addressed in an integrated way – and so are not just shifted from one part of the life-cycle to another. It should also mean that environmental impacts are addressed at the point in the life-cycle where they will best and most cost-effectively reduce the overall environmental impacts and resource use. To be successful, the IPP must consider the following:

- The overall number of products is increasing – greater disposable incomes, smaller house sizes, etc has lead to a more diffuse spread of products. Any product policy should therefore aim to reduce the environmental impacts of increased quantities of products.
- The variety of products and services is increasing. Basic products now come in many different versions. Any product policy has therefore to be flexible in order to address many different product variations simultaneously.
- Innovation constantly creates new types of products and the innovation cycles for components can often be even shorter. The rapid development of more powerful computer processors is testament to this. A product policy has to use this creativity for the benefit of the environment as well as the economy.
- Products are traded globally. A product policy has to take account of the global nature of trade and be in compliance with relevant international agreements, such as World Trade Organisation rules.
- Products are becoming more complex. For this reason any product policy needs to ensure that producers and designers become more responsible for ensuring that their products fulfil agreed criteria on health, safety and the environment.
- The product can be designed perfectly, but inappropriate use and disposal will cause significant environmental impacts. Although products can be designed to cause as little environmental impact as possible, consumers may still use them in an environmentally unfriendly way.
- Products now involve a greater variety of actors throughout their lifecycle. Product policy needs to be capable of addressing many different actors. It also has to take account of the fact that a product may be assembled, marketed or used many miles apart under different sets of societal values. It is therefore difficult for an actor at one stage in the product's life-cycle to have a clear idea of what potential problems there are in others. The conditions under which our products are produced may be unknown. Therefore policy should contribute to improving information flows along the supply-chain.

Member States of the EU are increasingly applying different environmental product policy measures which come under the banner of Extended Producer Responsibility (EPR). This endeavours to extend the manufacturers responsibility from managing the environmental issues of the production process to the entire lifecycle of the product – from raw materials, production, distribution, consumption to end-of-life. The EC *Sixth Environmental Action Programme Environment 2010: Our Future, Our Choice*, which is a 10-year vision for European environmental

policy, emphasises the importance of product policy¹⁴⁸. The IPP approach emphasises EPR and is designed to make the producer responsible for product take-back at end of life, disposal and treatment. These are seen as motivational factors that encourage the producer to eliminate or minimise environmental impacts e.g. waste and hazardous substances when designing the product, thereby minimising the impacts to be dealt with at end-of-life¹⁴⁹.

The *EU Packaging Directive*, the *EU End-of-Life Vehicles (ELV) Directive*, the *EU Waste from Electrical and Electronic Equipment (WEEE) Directive*, the *EU eco-labeling scheme*, and the funding schemes under the EU 5th Action Framework programme (e.g., “Competitive and Sustainable Growth” scheme) can be regarded as examples of the vertical elements of an IPP at the EU level. Some EU Member States have already developed national Environmental Product Policy frameworks.

8.3 EU Incentives for IPP

Continual environmental improvement requires incentives for producers to make new product generations greener than their predecessors on the basis of life-cycle thinking and taking into account the parameters set by the market. It also requires incentives for consumers to buy these. An effective IPP requires the economic and legal framework to be conducive to greening products and to their purchase, ideally with minimum government intervention. The following are some of the incentives suggested for promoting IPP¹⁴⁷:

- **Taxes and subsidies** - Price signals give incentives for the continuous environmental improvement of products throughout the life-cycle. They facilitate and reinforce measures, such as greener public procurement and product design obligations, by improving the economic rewards for green design and production.
- **Voluntary Agreements and Standardisation** - To green products effectively, non-legislative solutions, such as environmental agreements and the standardisation process, need to be considered in addition to legislation.
- **Public Procurement Legislation** – Public procurement constitutes around 16 % of EU wide GDP. Detailed Community rules exist setting down the procedures to be followed in public procurement within the internal market. The Commission’s Interpretative Communication on Public Procurement and the Environment explains the legal situation¹⁵⁰ and shows that there are ample possibilities for taking into account environmental considerations in the tendering of contracts covered by these rules. The real tasks for greener public procurement are to ensure that existing possibilities are used by public purchasers.
- **Other Legislation** – Community legislation for any product-related measure may be necessary to resolve environmental problems particularly if market failures are not corrected or if the Single Market could be affected without Community action (e.g. Restriction of Hazardous Substances in Electrical and Electronic Equipment directive). It is also the case for the forthcoming Commission proposal for a Directive establishing a framework for the eco-design of energy using products (EuP), which will, in addition, enshrine the IPP principles, such as life-cycle thinking, stakeholder involvement and continuous improvement in a legislative framework. Legislation is also necessary where extended producer responsibility measures or deposit schemes are considered to be the most effective way to reduce the life-cycle environmental impacts. Such initiatives also have a particular value at the European Community level where individual Member States have developed, or are in the process of developing, their own initiatives in this area. The Commission has developed these points further in its *Thematic Strategy on the Recycling and Prevention of Waste*.

¹⁴⁸ <http://europa.eu.int/comm/environment/newprg/index.htm>

¹⁴⁹ Charter, M. and Belmane, I. Integrated Product Policy (IPP) and eco-product development (EPD). *The Journal of Sustainable Product Design*, July 2002.

¹⁵⁰ http://europa.eu.int/eur-lex/lex/LexUriServ/site/en/com/2001/com2001_0274en01.pdf

Labelling of cars

The energy and efficiency labelling of cars is a start in this process. While taxation in most countries is still based on engine size changes have been suggested to change this to emission based. The UK is one of the first countries to introduce CO₂ based taxation for automobiles.

In the United States tax credits are available for many types of home improvements including adding insulation, replacement windows, and certain high efficiency heating and cooling equipment.

Sweden is to appoint a committee to evaluate the possible introduction of new taxes on raw materials as a step to reducing environmental impact in connection with resource extraction.

*Reducing CO₂ emissions from light-duty vehicles*¹⁵¹

Negotiated self-commitments are an important element of the EUs strategy to reduce CO₂ emissions from passenger cars and improve fuel economy. Commitments have been concluded with the European (European Automobile Manufacturers' Association - ACEA), the Japanese (Japan Automobile Manufacturers' Association - JAMA) and Korean (Korean Automobile Manufacturers' Association - KAMA) automobile industries.

All three Commitments are equivalent having the following main features:

- The CO₂ emission objective: The three Commitments contain the same quantified CO₂ emission objective for the average of new passenger cars sold in the European Union, i.e. 140 g CO₂/km (to be achieved by 2009 by JAMA and KAMA and by 2008 by ACEA). In other words the fleet of new passenger cars put on the market in 2008/2009 will consume on average about 5.8 l petrol/100 km or 5.25 l diesel/100 km.
- Means of achievement: ACEA, JAMA and KAMA have to achieve the CO₂ target 'mainly' by technological developments and market changes linked to these developments.

8.4 Promoting IPP

For IPP to be effective, life-cycle thinking needs to become second-nature for all those who come into contact with products. Educational and awareness-raising measures are best undertaken closest to the citizen, i.e. on a national and regional level. Below are some of the actions that have been taken at different levels in various countries.

8.4.1 EU Level - IPP Pilot Projects

This exercise aims to demonstrate how IPP can work in practice by establishing two pilot projects: on mobile phones and on a teak garden chair. The Commission selected these based on 22 suggestions from stakeholders. The importance of the environmental impact of these products did not play a role in the selection process. The successful proposals came from Nokia and from Carrefour. The projects began in mid-June 2004 and will end in 2006. The projects have the following stages:

1. Analysis of the environmental impacts of the products throughout their life-cycle based on available information;
2. Identification of options to improve the environmental impact of the products;
3. Analysis of the potential social and economic effects of the improvement options identified;
4. Selection of the viable options for improvement and ideally different participants making commitments to implement some of the solutions identified;
5. Monitoring of commitments on an annual basis.

¹⁵¹ Source: http://europa.eu.int/comm/environment/co2/co2_agreements.htm

8.4.2 Sweden Environmental Product Declarations (EPD)

There is an increasing demand on the market for LCA-based, quantified information about environmental performance of products and services, so-called Type III environmental declarations. The EPD system is a system for science-based, verified and comparable environmental information open for all products and services to support continuous improvements based on flexible in-company product development processes. Such information is needed in several market places, e.g. in the raw material supply-chain, within the framework of an environmental management system and for green purchasing and procurement.

Swedish industry has initiated and established an official Type III environmental declaration programme called the EPD system based on ISO TR 14025 - a pre-standard in the ISO 14000 series. The EPD system is applicable worldwide for all interested companies and organisations. Currently companies and organisations in seven countries have joined the EPD system in various stages (Canada, Japan, South Korea, Norway, Germany, Denmark and Italy)¹⁵².

Also in Sweden the Environmental Code Committee is to look into how to clarify National legislation to emphasise that all operators or all those taking action have an obligation to limit the environmental impact of products and services throughout their entire lifecycle.

8.4.3 UK

Environment Direct

DEFRA are developing this new information service to give consumers information and advice about how to reduce their environmental impacts and exercise more sustainable choices in purchasing and consumption. The Advisory Committee on Consumer Products and the Environment (ACCPE) provides advice to the Government on policies to reduce the environmental impacts of products and services.

The UK Performance Standards Information Base (PSIB)

Increasingly, there is a demand to assess and measure the environmental performance of products sold in the UK. Published Performance Standards offer benchmarks with which to compare the environmental performance of a range of products and help inform the decision making process of policy makers, manufacturers and consumers when promoting, manufacturing or purchasing products. The PSIB, drawn up by DEFRA's Market Transformation Programme (MTP), mainly aims to provide information on benchmarks for the environmental performance of household appliances and traded goods.

8.5 Promoting Ecodesign

A number of countries have established ecodesign centres to promote collaboration between research houses and industry. Listed below are some of these.

8.5.1 Design Wales

Established in 1994, Design Wales is funded by the Welsh Assembly Government (WAG) to provide free and independent advice on all aspects of design to Welsh industry and to offer strategic design advice to the WAG. Practical support is provided by a team of eight advisors via one-to-one advice and a programme of seminars and workshops to help companies realize and achieve their design related objectives. In 2004 Design Wales were commissioned by the WAG and the Welsh Development Agency (WDA) to develop a detailed proposal for a Welsh ecodesign initiative. Design Wales believe that ecodesign is essentially just 'good' design.

The Centre for Advanced and Renewable Materials (CARM) is a consortium of four research centres within North Wales. CARM offers a wealth of expertise and facilities in the fields of materials and materials chemistry, which are readily available to industry. The major objective of

¹⁵² <http://www.environdec.com/international/programs.asp>

the centre is to help support industry through collaborative research and technology transfer projects.

8.5.2 UK Programmes

The UK's Market Transformation Programme is supporting the development of an approach for water using products similar to the EU energy labeling of products, with a view to introducing a UK voluntary agreement to label the water consumption of products such as WCs and baths.

Also in the UK, Envirowise has developed 'DesignTrack', a free and confidential service focusing on reducing the environmental impact of a product over its entire lifecycle. As part of the service a design advisor spends a day visiting a site looking at the product and processes. These visits are focused on reducing the whole life environmental impact of a specific product.

B&W Loudspeakers

B&W Loudspeakers pride themselves on their design and innovation, investing heavily in design and technology. The product range is continually revitalised through R&D, investing up to 10% of product sales for product research and development. The recommendations of the Envirowise DesignTrack were:

- Replace disposable transit packaging with returnable crates, reducing costs and cutting down part rejects
- Redesign secondary packaging to minimise raw materials used
- Redesign for lead free and cadmium free product
- Redesign to incorporate Eco materials
- Adopt proactive approach to WEEE and RoHS directive, resulting in B&W becoming founder member of REPIC (Recycling Electrical and Electronic Producer Industry Consortium)
- Make environment a core part of all design briefs for new products

Benefits include:

- Compliant with forthcoming WEEE and RoHS directives
- Reduced toxicity of product components
- Informing legislation. Board member of REPIC
- Material substitution (biosphere) factor 10 embodied energy reduction
- Packaging volume reduced by 50%, costs reduced by 30%
- New dimension to 'innovation culture' - environment mindset
- New design rules
- Supplier educations - presentation to design agencies

The result is an annual saving of STG£150,000 through reduction in packaging costs.

8.5.3 Australia

The Sustainable Products Program undertakes research, consulting and training activities on EcoDesign and Product Stewardship. The Centre for Design, which is part of the Royal Melbourne Institute of Technology, is recognised internationally as a leader in the development of design methods and tools that support sustainable product design. Their programmes focus on sustainability and eco-efficiency as a source of innovation and responsible business development.

The Axis Kettle

The Axis kettle was designed by Australian company MEC-Kambrook Pty Ltd as part of an EcoReDesign project. On the basis of an LCA on the original product, a number of environmental impacts were established. The most significant of these was the energy consumption during use, followed by the diversity of materials used, which hampered the potential for recycling. The redesign of the Axis kettle resulted in a number of environmental enhancements:

- Up to 25% less electricity used during heating
- Approximately 50% reduction in the number of materials
- One single material now constitutes 66% of the kettles weight
- 40% reduction in the number of components
- Total weight has been reduced by 16%

8.5.3 Finland

Finland's National Programme to Promote Sustainable Consumption and Production launched in 2003 outlines a wide range of aims including:

- Examination of the harmful effects of advertising and collaboration with advertisers to improve responsibility
- Dialogue between industry, researchers and administration on targets and solutions for energy and material efficiency
- Long-term political goals for ecological tax reform
- Differentiation of vehicle taxation according to carbon dioxide

8.6 Green procurement

Green procurement is defined as the use of environmental criteria in public authority purchasing. Money spent by public authorities across the EU accounts for 16% of EU wide GDP. The results of a 2003 Commission study¹⁵³ examining the percentage of administrations that include environmental criteria for >50% of purchases found:

The top 2 countries were Denmark at 40% and Sweden at 50%, the EU average was 19% and the rate in Ireland was estimated at 5%.

A 2006¹⁵⁴ study indicates the "Green-7" in terms of public procurement are Austria, Denmark, Finland, Germany, Netherlands, Sweden and UK. These 7 consistently have more tenders with green criteria than the other EU member states. These Green-7 exhibit some or all of the following traits:

- Strong political drivers and/or national guidelines.
- National green procurement programmes for a number of years.
- Websites and information resources (often containing product related criteria and specifications).
- Innovative procurement tools:
 - life cycle thinking.
 - functional specifications - ask for a function or outcome instead of providing detailed technical specifications of a product (for example transport instead of cars).

¹⁵³ ICLEI European Secretariat, *Eco-Procurement Programme Survey on the state of play of green public procurement in the EU - Final Report* Freiburg, July 2003.

¹⁵⁴ Virage et alia *Green Public Procurement in Europe 2006 Conclusions and recommendations (Take 5 Report)* EU 2006

- contract variants - suppliers are asked to submit greener variants for the same product.
- Environmental management systems which address green procurement.

The EU has established a European Green Procurement Database¹⁵⁵ which aims to provide public purchasers with objective and scientifically accurate information on potential environmental criteria for their calls for tender. This database informs users about existing Eco-labels for the product groups they are interested in, the main environmental issues and potential questions they can ask suppliers. The current database covers about 100 product or service groups of most relevance to corporate and public purchasers. Product and service groups are arranged in categories and a few themes or areas of interest.

Green Procurement in Industry

Apart from national green procurement, companies are also involved. Canon, Sony, NEC and numerous other Japanese based companies have created lists of approved products that were developed based upon each product's environmental attributes. Before making a purchase the purchasing department must first consult the list of approved products to determine if the supplying company has established a product of a suitable standard and environmental character.

Pearl Pressman Liberty (PPL) green procurement policy

As part of an in-house initiative to buy green, Pearl Pressman Liberty (PPL), a commercial print facility in Philadelphia, joined the EPA's Green Lights program (a daughter program of EPA's Energy Star program) to learn how buying efficient lighting could help them cut costs. In just 1 month, PPL completed energy-efficient lighting upgrades that are now producing savings of more than \$21,000 a year - the energy reductions from these upgrades are equivalent to removing 28 cars from U.S. highways, or planting 56 acres of trees in US forests. In addition to these obvious cost reduction, maintenance costs have also been reduced as lighting fixtures do not need to be changed on as regular a basis.

8.6.1 Green Procurement Policies in Other Countries¹⁵⁶

Similar initiatives and measures as those described for the European Member States have been developed in North America and Japan.

In 1993, the United States EPA established the Environmentally Preferable Purchasing Program. In 1999, this Program created an online Database on Environmental Information for Products and Services. In 2000, the Greening the Government through Leadership in Environmental Management programme required federal agencies to incorporate environmental management systems into agency day-to-day decision-making and long term planning processes.

Supported by the Government of Canada, the Canadian Environmental Operations for Governments association was created to green government operations as was the development and implementation of an Environmental Management System (EMS). Guidelines for several product groups have been elaborated, in addition to the national eco-label scheme called the Environmental Choice Programme (ECP), established in 1988.

In Japan, the Government adopted an 'Action Plan for the Greening of Government Organisations' in 1995, which requires all Ministries and governmental agencies to adopt their own policy. The Japanese Green Purchasing Network was established in 1996 to promote green purchasing among consumers, companies and governmental organisations. The activities covered by the Action Plan were made legally binding by the Japanese green procurement law adopted in April 2001. This law also obliged all national departments to monitor their policy by reporting on their purchasing share of a specific list of green products. Local authorities and companies were called upon to undertake similar action. One of the distinctive features of green

¹⁵⁵ http://europa.eu.int/comm/environment/green_purchasing/html/general/index_en.cfm

¹⁵⁶ http://europa.eu.int/comm/environment/green_purchasing/html/general/gppoliciesoe_en.cfm

purchasing in Japan is the high level of take up of corporate green purchasing. A number of large companies have joined the green purchasing network and use their significant purchasing power to encourage environmental improvements from their suppliers.

NU-Spaarpas - the sustainable incentive card scheme in the Netherlands¹⁵⁷

The project, which finished in 2004, piloted a savings card for sustainable purchasing behaviour by consumers. People used their NU smart card to get points for separating waste and for buying sustainable products. Sustainable products included labelled organic, energy-efficient and fair-trade goods, bicycles, green financial products, renewable energy, rental, repairs and second-hand goods. Consumers could then spend points on more sustainable products, on public transport, or on leisure activities around the city, such as going to the cinema. 'Sustainable' was taken in the broadest sense: environmentally friendly and low on energy use, but also friendly towards humans and animals, and with regard to solidarity, social issues and quality of life. This was a LIFE Environment co-funded project.

8.6.2 Snapshot of some Green Procurement programmes in other countries

The Netherlands plan to benchmark the green procurement performance of some governmental organisations by independent consultants.

In Sweden a practical tool (EKU) has been developed to guide purchasers with relevant and established environmental information to be used in public and other professional procurement.

Procura+ is a European level Sustainable Procurement campaign from ICLEI (local governments for sustainability).

International Green Purchasing Network (IGPN) promotes green procurement.

The UK has a business-led Sustainable Procurement Task Force which is bringing out a National Action Plan during 2006.

The Danish EPA has 50 product-specific guidelines on which environmental questions to ask and which requirements to set when purchasing a particular product or service. These cover areas ranging from transport to textiles, and from small purchasers to big organisations.

The Swedish IPP plan recognizes the need for Company executives, procurement officers and purchasers training in environmental and sustainability issues.

Denmark has a Panel for professional environment-conscious buyers (ten members from public and private sector):

- advancing green procurement by putting forward tools and information to purchasers and suppliers of goods and services.
- enter into dialogue with different trade associations on how to cooperate on promoting green procurement.

The Netherlands has developed national guidelines for green procurement of company cars - hybrid vehicles and bio-fuelled or hydrogen fuelled vehicles.

8.7 Products to services

A Product Service System (PSS) essentially promotes selling a service instead of a product (in North America this is often referred to as servicising). This then puts a far greater onus on the producer to provide a durable and efficient product that can be reused once its specific lifetime has expired. A PSS is a competitive system of networks which are designed of products, services, supporting network and infrastructure. Everything should be included in the service – maintenance, parts, end-of-life management and replacement – which competitively fulfils the needs of the customer but with a lower environmental impact over the life cycle.

¹⁵⁷ <http://www.nuspaarpas.nl/>

Volkswagen Car Sharing Schemes

The car manufacturer Volkswagen has built partnerships with some apartment complexes in Germany to offer the service of mobility to building tenants. The two programmes, 'Mietermobil' in Wolfsburg and 'Wohn mobil' in Hamburg, offer a fleet of cars of different sizes (including an electric powered Golf) maintained by a Volkswagen dealer, washed by local filling stations, and used exclusively by residents of the buildings. Benefits of these programmes include:

- lower overall living costs for consumers due to elimination of the need for each to purchase a vehicle;
- reduction in environmental impact since cars are well-maintained by local dealership;
- reduction in land used for parking since less vehicles are present;
- upgrade to rental housing makes it a more attractive option; and
- more efficient way to meet mobility needs through different sizes of available vehicles.

On the supply-side, some countries have developed a number of measures to encourage eco-product development, such as product-oriented environmental management systems (POEMS), eco-design grants and awards and product take back and recycling requirements. These countries are also developing demand-side tools, such as eco-labels, product taxes and public procurement. The most advanced are also exploring multistakeholder dialogue tools (e.g. Product Panels in the Denmark) to bring both sides together to work toward greener products. However, no country has yet developed a fully integrated environmental product policy that addresses the entire life cycle.

8.8 Environmental Labelling

One of the most prominent ways in which LCA findings (and ecodesign) are publicly communicated is through eco-labels. Eco-labels generally provide information about the environmental impact of a product and as such take life cycle considerations into account. Ecolabels are used on products and packaging to provide consumers with information about a product's environmental performance – they usually reflect that a certain environmental or social standard has been attained. Various ecolabels are in place around the world covering a range of environmental concerns including chemical content, energy efficiency, water conservation, recycled content and recyclability.

The concern with credibility and impartiality of ecolabels has led to the formation of both private and public organisations providing third-party labelling. In many instances, such labelling has taken the form of ecolabels awarded to products approved by an ecolabelling program operated at a national or regional (i.e. multi-countries) level. A database of all nationally accredited ecolabelling associations has been established.¹⁵⁸

The main European label is the eco flower. Launched in 1992, the Flower certifies that “a product complies with strict ecological criteria but also satisfies high performance standards”. The eco flower is designed to benefit both the consumer and the producer.

8.8.1 Types of Eco-labels

The international standards organisation has developed a set of standards on ecolabelling. The relevant series is *ISO 14020 Environmental labels and declarations – general principles*. This exploratory document sets out the basic rationale and foundation for the three categories of certifiable labelling standards:

Type I – Stamp of approval label

¹⁵⁸ <http://www.gen.gr.jp/members.html>

Type II – Self declaration label

Type III – report card label

In the words of the Standards Council of Canada, this document ‘provides guidance on goals and principles that should frame all environmental labelling programs and efforts.’¹⁵⁹

Type I – ISO 14024 Environmental labels and declarations – Environmental labelling Type I - Guiding principles and procedures.

This standard outlines the most popular form on ecolabelling (often called the stamp of approval) currently used. This Label is awarded for fulfilling a set of criteria. The criteria are set by a third party. If the criteria are met, producer has the right to display the label on the product. Some examples of this type of label are shown in Figure 8.1..



Figure 8.1: ISO 14024 eco-labels

Type II – ISO 14021 Environmental labels and declarations – Self-declarations environmental claims.

Initially made up of three separate standards ISO 14021/22/23, this document provides the procedures, terminology, symbols, testing and verification methodologies for an organisation to use self-declaration on its products. Self-declaration is taken to mean, for example, that a percentage of recycled material is used, or that the products is recyclable, as seen in Figure 8.2.

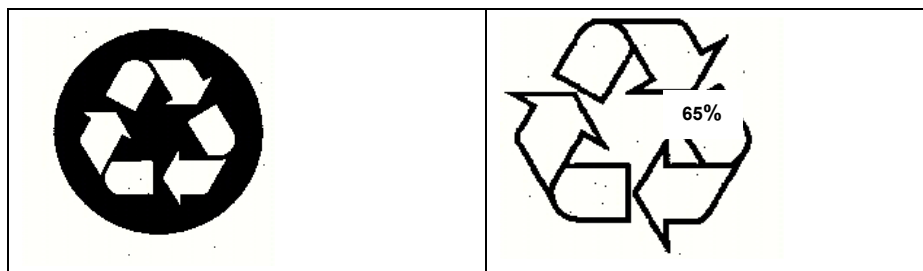


Figure 8.2: ISO 14021 eco-labels

Type III – ISO 14025 Environmental labels and declarations – Environmental labelling Type III - Guiding principles and procedures.

This usually entails voluntary programs that provide quantified environmental data of a particular type of product. It gives principles and protocols on third party practitioner programs allowing the

¹⁵⁹ Standards Council of Canada, *The ISO 14000 Series of Environmental Management System (EMS) Standards*, sourced on the 17/01/2000, <http://www.scc.ca/iso14000/thestnds.htm>

production and dissemination of 'qualified data for a product with pre set categories'. The pre-set categories of parameters are set by a qualified third party and based on life cycle assessment, and verified by that or another qualified third party. Type III labels are different to type I as they produce real information and data (sometimes called 'score card' ecolabelling) rather than just a stamp or label.

During an investigation into ecolabelling by the USEPA the methodologies used by a number of international programmes were examined¹⁶⁰. Of the schemes researched (33 international and over 20 US) LCA was used by 21 and a further 4 used modified LCAs. The remaining used single attributes, such as electricity use, etc., or did not specify a specific method. The use of LCA reflected the desire to try to make the process of criteria development and evaluation as analytical, holistic and scientific as possible – something the USEPA report insists is critical to achieve label credibility. Though LCA is seen as time consuming and costly, most schemes used it to research the products to be labelled, and this was used to decide what criteria those applying for the label needed to meet.

Other than LCA, the criteria can be verified by independent testing, studies conducted by the ecolabelling committee, literature reviews and studies conducted by other programs. Some labelling bodies also sourced information from participating manufacturers, and other stakeholders. Labels have also been documented which are developed collaboratively, for example, Canada's Environmental Choice and the US

Labels for Paints

For example, when the European Union decided to have Type I label for paints, they carried out an LCA. The result of this showed them that the priority areas were:

- pigment,
- VOC,
- aromatics,
- solid waste, and
- product labelling

Thus the committee could determine what the qualifying criteria needed to be to award the EU ecolabel without fear that meeting these criteria would cause a shift of environmental impacts into other parts of the life cycle

8.9 Ireland

Independent of the European legislation, the promotion of IPP or EPR at a policy level is at an early stage. With regard to the current European legislation the status in Ireland is summarized in Table 8.1.

Directive	Status	Success
Packaging and Packaging waste	Well established in Ireland in terms of major producer scheme, The aspect in relation to packaging nature and use requirements (reducing packaging waste at source) would appear to be slower. Some self compliers though most larger organizations have joined REPAK.	Volume of packaging waste diverted from landfill to recycling increased from 14% in 1998 to close to 25% in 2001 and over 56% in 2004. This exceeds the EU target of 50%.
End of Life Vehicles	Draft Waste Management (End-of-Life Vehicles) Regulations 2006 which are intended to facilitate the transposition and	According to the directive the date for achieving an 85% target was the 1 Jan 2006.

¹⁶⁰ USEPA, *Environmental Labelling Issues, Policies, and Practices Worldwide* - EPA report no 742-R-98-009, 1998

	implementation in Ireland of Directive 2000/53/EC on end-of-life vehicles were published on 22 February 2006. Originally meant to be transposed in 2002.	
WEEE and RoHS	The two Directives came into force in 2003 and were transposed into Irish law in August 2005.	Ireland has surpassed its WEEE targets, collecting over 14,500 tonnes of electrical waste in the first seven months. Under EU targets, Ireland is required to produce 4kg of WEEE per person by 2008, but is currently exceeding this by 50 per cent with an annual collection rate of 6.7kg per person.
Energy using Products	Framework Directive 2005/32/EC on Eco-design of Energy Using Products (EUP) must be implemented in national law by 11 th August 2007.	Too early yet. Requirements are general only at this stage – specific implementing measures to come at the EU level.

Table 8.1: IPP and EPR status

8.10 Other Initiatives in Ireland

Environmentally Superior Products

This scheme is designed to support indigenous Irish SMEs in examining ways to reduce the environmental impact of an existing product or that of a new product in development. The ESP grant supports a life cycle assessment to examine where environmental improvements can be made, undertake market research, determine the technical feasibility of the proposed changes and make an assessment of costs associated with the changes. The maximum value of the grant is €31,740 and it can be used to cover up to 50% of evaluating the feasibility of developing an environmentally superior product.

Successful projects have been completed in the following sectors:

- Plastics
- Packaging
- Furniture
- Electronics
- Information Technology
- Construction
- Timber

Cleaner Greener Production Programme (CGPP)

The Cleaner Greener Production Programme (CGPP) was launched by the Environmental Protection Agency (EPA) in 2001. Under the programme, the National Development Plan 2000-2006 has provided €3.7 million in grant aid, to encourage companies in Ireland, particularly SMEs, to adopt a high standard of environmental performance by adapting or improving production processes and services in order to minimise negative impact on the environment. The aim is to encourage companies to apply innovative, integrated preventive environmental strategies to processes, products and services to increase overall efficiency and reduce the risks to humans and the environment.

The second phase of the CGPP, which started in May 2004, is currently supporting an innovative green computer ecodesign project. There is another project looking at supplying pre-manufactured chimney systems in a returnable crate rather than the supply of chimney systems

in single use packaging. Apart from the saving in packaging there is also reduced materials required for construction.

Green procurement

In Ireland the Department of Finance has responsibility for public procurement policy and they have disseminated information about environmentally based procurement (www.etenders.gov.ie).

Ecolabels

Many countries, and even areas within countries (Catalonia), have their own ecolabels which they often coordinate with the European ecoflower scheme. There is currently no Irish scheme which highlights a lack of promotion of environmentally superior Irish products.

9. Industry

9.1 Introduction

Industry is a major consumer of products and resources and in its many sectors utilises a wide variety of technologies. There is great potential for environmental technologies in industry and a wide spread of available technologies is coming on stream. Generally speaking, the utilisation of environmental technologies appears to be at a higher level in larger scale and high-tech industries, rather than small to medium sizes enterprises (SMEs).

Many incentives, from a policy, economic and information or awareness perspective have been and are being implemented at national and international levels. However most of these (e.g. IPPC licensing) promote better environmental practice and improved technologies in larger scale and advanced sectors. It is often the case that the uptake of improved technologies and practices happens first in larger industry and then filters down to small and micro enterprises. However, it is also clear that the uptake of environmental technologies by industry in general and SMEs in particular is still quite low and requires a high level of support.

It should also be noted that many of the environmental technologies that are discussed in other sections of this report, for example in relation to air, water, waste etc. have industrial applications and so are also relevant to this section. Such overlap is inevitable.

9.2 EU initiatives

9.2.1 Regulation and policy

Integrated pollution prevention and control (IPPC)

The integrated pollution prevention and control (IPPC) system has introduced an integrated approach to reduce pollution by considering together all emissions to air, water or soil, and waste from an industrial site in order to achieve a high level of environmental protection while avoiding cross media effects.

Conditions in permits must be based on Best Available Techniques (BAT). BAT is being drawn up at the EU level for sectors in a series of BREF notes¹⁶¹. The "Techniques" in BAT includes both the technology used and the way in which the installation is designed, built, managed, maintained, operated and decommissioned.

In the identification of BAT, emphasis is placed on pollution prevention techniques, including cleaner techniques and waste minimisation, rather than end-of-pipe treatment. Consideration must be given to energy efficient techniques and practices and to the efficient use of raw materials, chemicals and water. Hazardous substances should be substituted by less hazardous substances whenever possible. Measures such as in-plant changes, process recycling and reuse, improved material handling and storage practices, must be employed to effect reduction in emissions.

An example of BAT for organic fine chemical manufacture can be seen in Figure 9.1:

¹⁶¹ <http://eippcb.jrc.es/pages/FActivities.htm>

4.1.4.9 Reactions in supercritical CO₂

Description

Reactions can be carried out in supercritical CO₂ (supercritical point at 73.8 bar/31 °C) using a supercritical reactor system, as illustrated in Figure 4.5 for hydrogenations. Supercritical CO₂ replaces the solvent and shows similar properties to n-hexane. The reaction is no longer mass transfer controlled and hydrogen shows infinite solubility. Reaction conditions such as pressure, temperature, residence time and hydrogen concentration can be manipulated independently. On completion, the CO₂ is evaporated by reducing the pressure.

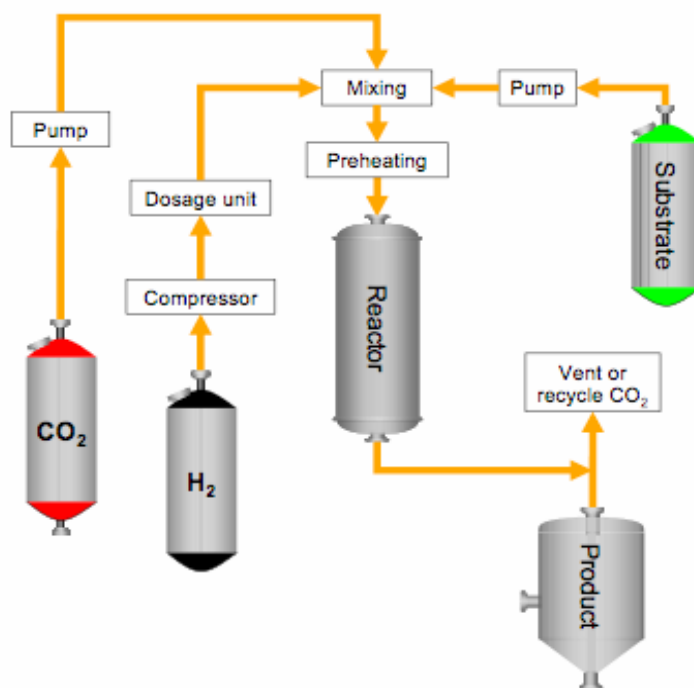


Figure 4.5: A supercritical reactor system

Achieved environmental benefits

- low/no VOCs
- less waste streams
- higher selectivity
- higher yields.

Figure 9.1: An example of BAT for the organic fine chemical manufacturing sector

As well as describing existing techniques and listing those considered to be BAT, the BREF notes also provide a little information on emerging techniques. The requirement of IPPC licensed facilities regarding BAT and BREF notes are a major incentive to a higher take up of environmental technologies across a wide range of sectors. However, this licensing only covers a small number of industries and facilities and does not apply to the vast majority of smaller companies that use technologies with an environmental impact.

Solvents Directive¹⁶²

The Directive on solvent emissions brings in environmental requirements for various solvent using companies. There are many different types of businesses that will be affected by these Regulations, many of which are previously unregulated such as dry cleaning, vehicle refinishing, and small scale painting of products. The legislation requires sectors to meet a particular emission limit value or there is a possibility for some sectors to use a reduction scheme.

The implementation of this Directive, in particular in an Irish perspective, is discussed in further detail in the section on air.

Biotechnology

Biotechnology offers new ways to improve efficiency in resource use as well as in industrial processing for various sectors. Advances in biotechnological research have the potential to reduce the consumption of raw material and energy, to allow for the development of clean industrial products and processes, to abate pollution and to yield waste which is recyclable and biodegradable.

The European Commission presented a Communication "Life Sciences and Biotechnology - A Strategy for Europe" in 2002¹⁶³ and a subsequent status report in 2003¹⁶⁴.

This strategy aims to respond to the current situation "with responsible, science-based, and people-centred policies on an ethical basis. This strategy aims to allow Europe to benefit from the positive potential of life sciences and biotechnology, to ensure proper governance, and to meet Europe's global responsibilities. This is a proposal for an integrated strategy – its different elements are interdependent and mutually reinforcing. Implementing this strategy requires an open, collaborative and sustained process to develop coherent and credible policies. The Commission also proposes an action plan for concrete measures by the Commission and the Community, as well as recommendations for other public and private actors, respecting the subsidiarity principle."

This Communication also notes that "during the 1980s, biotechnology in Europe developed primarily within large companies whereas, unlike the US, the small company sector remained mostly stagnant. While large companies in the pharmaceutical and chemical sectors continue to exploit the technology to provide innovative products, we have seen a rapid expansion of the small companies sector in Europe in the recent past. There are now more dedicated biotechnology companies in Europe (1570), than in the US (1273). This is an encouraging demonstration of entrepreneurial potential in Europe." This trend can be seen from Figure 9.2.

¹⁶² Directive 99/13/EC on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain activities and installations

¹⁶³ http://europa.eu.int/eur-lex/en/com/cnc/2002/com2002_0027en01.pdf

¹⁶⁴ http://europa.eu.int/comm/biotechnology/pdf/sec2003-248_en.pdf

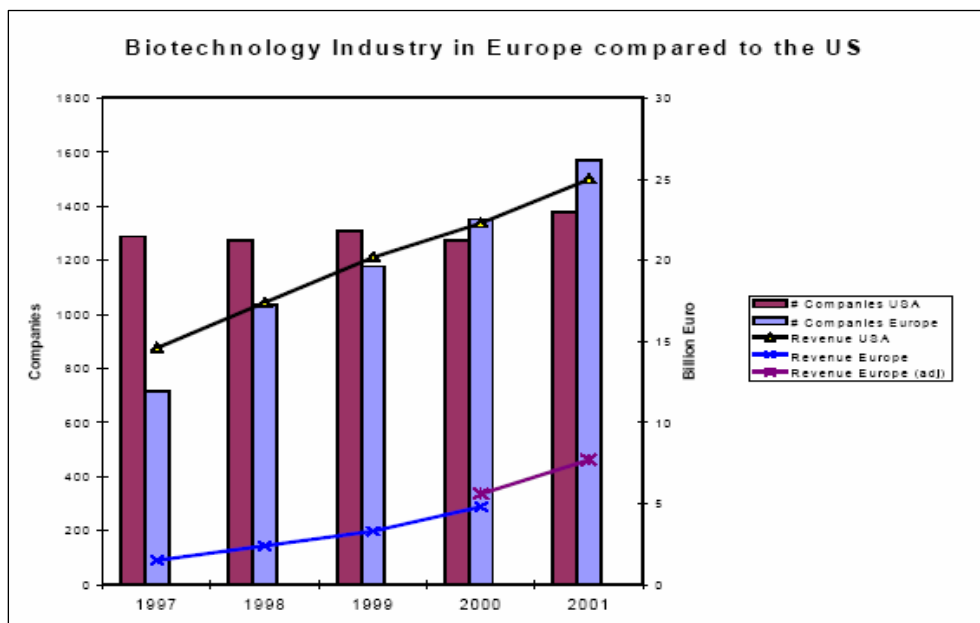


Figure 9.2: uptake of biotechnology in Europe and the USA

There is also a *Directive on the Legal Protection of Biotechnological Inventions (98/44/EC)*.

Nanotechnology

The European Commission presented a Communication “Towards a European Strategy for Nanotechnology”¹⁶⁵ in 2004 on how to boost nanotechnology R&D, which was followed by an Action Plan for 2005- 2009 defining actions.

The Communication notes that over the last decade “the European Union (EU) has established a strong knowledge base in nanosciences. Our ability to maintain this position is in doubt since the EU is investing proportionately less than its main competitors and lacks world-class infrastructure (“poles of excellence”) that muster the necessary critical mass. This is despite the fact that investment in national EU programmes is growing in a rapid but independent way.

European excellence in nanosciences must finally be translated into commercially viable products and processes. Nanotechnology is emerging as one of the most promising and rapidly expanding fields of R&D to provide new impetus towards the dynamic knowledge-based objectives of the Lisbon process. It is crucial, however, that a favourable environment for innovation is created, in particular, for small and medium sized enterprises (SMEs).

The Communication proposes a series of actions as part of an integrated approach to maintain and strengthen European R&D in nanosciences and nanotechnologies. It considers the issues that are important to ensure the creation and exploitation of the knowledge generated via R&D for the benefit of society. In this context, the time is right for launching a debate at an institutional-level in view of coherent action to:

- increase investment and coordination of R&D to reinforce the industrial exploitation of nanotechnologies whilst maintaining scientific excellence and competition;
- develop world-class competitive R&D infrastructure (“poles of excellence”) that take into account the needs of both industry and research organisations;
- promote the interdisciplinary education and training of research personnel together with a stronger entrepreneurial mindset;
- ensure favourable conditions for technology transfer and innovation to ensure that European R&D excellence is translated into wealth-generating products and processes;

¹⁶⁵ <http://cordis.europa.eu.int/nanotechnology/actionplan.htm>

- integrate societal considerations into the R&D process at an early stage; address any potential public health, safety, environmental and consumer risks upfront by generating the data needed for risk assessment, integrating risk assessment into every step of the life cycle of nanotechnology-based products, and adapting existing methodologies and, as necessary, developing novel ones;
- complement the above actions with appropriate cooperation and initiatives at international level.

9.2.2 Information/awareness raising

Through its policies and strategies (for example in relation to biotechnology and nanotechnology described above) the EU is engaged in a broad awareness raising campaign, not least also through the ETAP programme. Much of this awareness raising relates to an improved knowledge and understanding of the subjects in question and in support for the policies and strategies being implemented.

The European Pollutant Emission Register (EPER)¹⁶⁶

A greater knowledge of data and information, for example, relating to pollution and the impact of technologies is also an important awareness raising tool, exemplified by the EPER:

The EPER is a web-based database of emission data (above certain thresholds) reported by Member States on individual major industrial activities which can be searched by facility, region, etc.. EPER will be replaced by the European Pollutant Release and Transfer Register (E-PRTR), which follows the UN system, from 2007 onwards. The EPER has been seen as an incentive for some companies to lower emissions in order to fall under of the Register's scope.

EU Projects and Programmes

The EU has funded environmental programmes and projects for several years with the aim in increasing environmental awareness in industry and promoting the uptake of environmental technologies and more sustainable production methods.

PRODESTS¹⁶⁷

PRODESTS is a Co-ordination action within Framework Program 6 of the European Community that set up a market-Oriented Methodology for joining SMEs within Integrated EU research Projects on Innovative Clean and Environmental Technologies. 27 Partners, spread over 17 European Countries, work together within this co-ordination action to join forces towards the stimulation of introduction of environmentally friendly technologies at SME scale.

The strategic objectives of PRODESTS are:

1. Development, validation and application of a methodology that stimulates SMEs to participate in integrated programmes (IPs) for the development and demonstration of environmentally-friendly and clean technologies. The final objective is that at the end of the project at least 100 SMEs of different sectors will be actively involved in at least 2 IPs that are defined within the network and 5 IPs that are prepared by other groups, using the tool box developed.
2. Set-up of a market-driven innovation roadmap for environmentally-friendly technologies based on gaps within present Best Available Technologies and needs of SMEs towards introduction of clean technologies.
3. Creation of a virtual market platform where a strong interaction between RTO organisations (as sensors for needs) and small and medium-sized technology suppliers and technology users is structured to support an efficient technology transfer and to catalyse innovation within environmental and clean technologies.

¹⁶⁶ <http://eper.cec.eu.int/eper/>

¹⁶⁷ <http://www.prodests.org/>

4. Creation of long-term cooperation and technology know-how transfer between European RTOs that have experience with promotion and demonstration of environmentally-friendly technologies in SME friendly language to enhance regional connectivity between European SMEs and to improve the impact of available local and European resources.

Stakeholders (research organizations, Federations, Chambers of Commerce, Governmental services, SME clusters, etc.) around Europe were invited to be actively involved in the follow-up of the project progress, so that the Co-ordination action can result finally in a European platform with focus on promotion of clean technologies on SME scale.

EU based Research

Nanotechnology

Under the European Commission's Fifth Framework Programme for Research and Technological Development (RTD) there has been considerable funding of nanotechnology projects. Nanotechnology is a scientific priority under the Commission's Sixth Framework Programme (FP6). The new programme covers nanotechnologies, intelligent materials and new production processes, and is included under the new IST programme (as nanoelectronics).

Examples of some of the areas for which nanotechnology is expected to yield materials with new and improved properties include use in solar panels and in anti-corrosion coatings.

The European commission also launched a consultation on research into health and environmental risks posed by nanotechnologies in 2004.

The Commission's proposals for the 7th Framework Programme and the specific programme "co-operation" foresee nanosciences and nanotechnologies as a priority theme.

Biotechnology

The Commission's Sixth Framework Programme (FP6) also supports biotechnology research. There are some aspects of this research which will have a concomitant effect on the environment including the research of new, safer, more effective drugs including the use of biosynthesis and the use of alternative delivery methods. Another aspect with possible positive effects for the environment includes the development of new in vitro tests to replace animal experimentation.

9.2.3 Economic Instruments

Several economic instruments are being implemented at EU and national level. At the European level, one of the five areas for LIFE-Environment funding is "minimising the impact of economic activities – industrial processes"

Two examples from the best LIFE-Environment projects (2004 – 2005)¹⁶⁸ are:

- "Giada" in Italy's Vicenza Province which is the largest tannery district in the EU with about 800 factories, mostly small to medium-size family-run companies. The LIFE-funded project aims to increase uptake of an EMAS type approach to environmental management by these SMEs.
- "Enerwaste" which developed a pilot-scale biogas plant for slaughterhouse waste at a Spanish slaughterhouse.

9.3 Initiatives in Other Countries

There is a plethora of demonstration programmes and assistance programmes in other countries: Some examples include:

The UK's **Envirowise** programme offers businesses free, independent, confidential advice and support on practical ways to increase profits, minimise waste and reduce their environmental impacts.

¹⁶⁸ <http://europa.eu.int/comm/environment/life/project/bestlifeenv.htm>

Austria's industry sub-programme: **Factory of Tomorrow** supports research studies, cooperative research involving both companies and researchers and the development of components and technologies.

Other international initiatives

Almost every EU country has initiatives to promote environmental technologies and improved practices in industry. These usually take the form of some kind of economic support, through grant aid etc. However this grant aid must meet EU regulations regarding state support. Other initiatives (such as Envirowise) take the form of state supported awareness raising and information provision, either through state agencies and/or intermediaries.

The following are 12 such national initiatives

1. The WRAP Capital Grants Scheme (UK)
2. The WRAP Business Development Service (UK)
3. The City of Vienna advisory services (Austria)
4. The Carbon Trust's Low Carbon Innovation Programme and Enhanced Capital Allowance Measure (UK)
5. The KfW Bank's ERP Environmental Protection and Energy Saving Programme (Germany)
6. The KfW Bank's Environmental Protection Programme (Germany)
7. The KfW Bank's Programme to Promote Renewables Energies (Germany)
8. The Fideme Investment Fund (France)
9. SenterNovem's CO2 Reduction Plan (Netherlands)
10. SenterNovem's Energy Investment Tax Relief Scheme (Netherlands)
11. The Green Financing Measure (Netherlands)
12. The Programme for Cleaner Technology (Denmark)

9.4 Initiatives in Ireland

9.4.1 Regulation and policy

Several regulations are in place in Ireland with regard to improved environmental practice. Some of these are discussed in more details in the sections on waste, air, water etc.

IPPC

The Commission's November 2005 report¹⁶⁹ into implementation of IPPC raises concerns about some Member States' delay in issuing permits. By contrast, Ireland has been considerably to the fore in Europe in the implementation of IPPC. The first IPC licences for existing installations were actually issued in October 1994, a full two years before the Directive was even finalized and adopted in October 1996. The original Irish legislation¹⁷⁰ has been amended¹⁷¹ to take account of the finalized version of the IPPC Directive. The EPA is in the process of reviewing all existing licences to see if they need to be completely revised to take the 2003 Act into account, or if this is not deemed necessary, to see if some of the conditions of the licences can be amended/inserted.

BAT must be applied to all new activities on start up and to existing activities before October 2007. The EPA is in the process of drawing up BAT guidance documents for each of the sectors which refer to the EU BREF documents. The first two of these are now up for consultation¹⁷². At the level of individual installation, the most appropriate techniques will depend on local factors (the technical characteristics of the facility, geographical location, local environmental

¹⁶⁹ http://europa.eu.int/comm/environment/ippc/ippc_report.htm

¹⁷⁰ The Environmental Protection Agency Act 1992 (No. 7 of 1992)

¹⁷¹ No. 27 of 2003 Protection of the Environment Act 2003

¹⁷² <http://www.epa.ie/Licensing/BATConsultation/>

considerations, economic and technical viability of upgrading existing installations).

AIC Scheme for solvents Directive implementation in Ireland

Ireland has taken a unique approach in implementing the solvents Directive¹⁷³ using the so-called Accredited Inspection Contractor (AIC) Scheme for non-IPPC installations.

The Solvents Regulations require that specified activities not requiring an IPPC licence, be registered and operate in accordance with a certificate of compliance issued by the competent authority. The competent authority is the local authority (County Council or City Council) in whose functional area the specified installation is located.

A certificate of compliance will be issued to the operator on the basis of an annual inspection and report by an Accredited Inspection Contractor (AIC) confirming that the installation is in compliance with the Regulations. The inspection and report by an AIC will be at a cost to the operator. The AIC must be selected from a panel of such contractors established by the Irish National Accreditation Board (INAB).

While it is too early to assess the effectiveness of the AIC scheme, it could be an innovative method of regulating industry and supporting improved practices and environmental technologies and may have potential in the future implementation of environmental legislation in Ireland.

9.4.2 Information/awareness raising

There are several sources of environmental information available to industry in Ireland. Advice and consultancy is available from several commercial sources and consultants, but there are also free or low cost sources of information from the EPA, DEHLG, Enterprise Ireland, IBEC, local authorities, Race Against Waste etc. Some of these are discussed in more detail in other sections of this report.

The Cleaner Greener Production Programme (CGPP)

While this programme is described further under economic instrument, a key requirement for participation in the Cleaner Greener Production Programme (CGPP) is willingness to publicise results. In addition, one of the criteria for assessment of successful grantees is transferability of the results.

Enterprise Ireland service: www.envirocentre.ie

www.envirocentre.ie is a free and regularly updated environmental information portal from Enterprise Ireland, designed to enhance environmental awareness in Irish industry, with particular emphasis on small and medium enterprises (SMEs). The aim is to improve business in Ireland through the environment and to assist Irish companies to increase profitability, competitiveness and export growth through improved environmental performance and/or the development of products or services related to environmental protection.

Several services are available through the environment unit of Enterprise Ireland or the website, including financial grant aid. Consultancy to industry is given directly or through documents provided on the site on a variety of environmental subjects. Advice on recent legislation, contact details of consultants, best practice guides, case studies and useful links are given.

Enterprise Ireland supports business through the Environmental Management Systems (EMS) for Irish industry with a key focus on SMEs.

Local Authority Supports

All local authorities in Ireland provide support to the public and businesses in their area. This is done primarily through environmental awareness officers (EAOs) whose specific role is to raise

¹⁷³ *Emissions of Volatile Organic Compounds from Organic Solvents Regulations 2002* (S.I. No. 543 of 2002).

environmental awareness in their region. While the EAOs work mainly with the general public and schools, they also do provide some support to businesses and inform them of their obligations and possible solutions, especially in relation to waste.

In some regions more detailed advice is given to business, and commitments have been made in the recent series of regional and local Waste Management Plans. For example in the Limerick, Clare and Kerry region a Waste Minimisation Office has been set up since 2003.

The Limerick Clare Kerry Regional Waste Management Office

The Limerick Clare Kerry Regional Waste Management Office was set up in 2003. Since then the Regional Waste Minimisation Advisor has been actively engaging with industry/business to support their waste reduction efforts. The activities undertaken include:

- Site visits to companies, support with environmental management issues
- Contacts with main stakeholder groups
- Organisation of seminars, presentations at seminars
- Guidance to companies, distribution of booklets etc.
- Network development
- Demonstration/pilot projects
- A dedicated website: www.managewaste.ie
- Compilation of best practice examples
- The Business to Business (B2B) Green Mentor Scheme with EPA co-funding
- Newsletter publications
- Annual reports
- Promotion of national Race Against Waste campaign
- Promotion of the concept of Cleaner Production
- Development of a Waste Prevention Guide for Business and Industry

IBEC Environment Awards

In recognition of the importance of the technical achievements and the commitment to environmental protection of all sectors of Irish industry, IBEC launched an environment awards scheme for industry in 2000. These awards are part of an EU-wide scheme that aims to foster innovative environmental practices in industry.

The IBEC Environment Awards encourage and promote companies who develop innovative solutions to environmental problems faced by various sectors of industry. Previous Irish winners have reaped competitive and publicity benefits at home and abroad, while highlighting their policy commitment to innovative environmental management practices.

Some of the technical issues that face individual Irish companies include developing and implementing -

- Effective waste management strategies
- An environmental management system which caters for the needs of their business situation
- Cleaner production processes
- Monitoring and controlling emissions from their industrial activities to ensure regulatory compliance
- Energy and resource management strategies
- Designing environmentally friendly products or services

Making Environmental Information available to the Public

Klinge Pharma & Co. was the overall winner of the IBEC environment awards, 2004 for managing sustainable development. In addition to significant reductions in waste and emissions to air and water, one aspect of the site's operation is that a large amount of detailed environmental information is publicly available on the company's website (www.klinge.ie). This includes details of all monthly monitoring of emissions to air and water and monthly quantities of wastes recovered and disposed, as well as the company's detailed environmental management programmes.

9.4.3 Economic Instruments

The Cleaner Greener Production Programme (CGPP)

The EPA's Cleaner Greener Production Programme (CGPP) provides grant aid to selected businesses seeking to improve their environmental performance using preventive approaches.

The Environmentally Superior Products Programme

This scheme is designed to support indigenous Irish SMEs in examining ways to reduce the environmental impact of an existing product or that of a new product in development. It is discussed in more detail in the Products Section.

An example from CGPP Phase 2 True Temper shovels and spades

By changing the type of steel they use to that which includes only a minute amount of boron, the company will be able to completely eliminate the use of oil for quenching. A closed water loop for quenching will be used instead. Thus a hazardous waste stream of 7,000 litres of waste oil per annum will be eliminated. There will be a reduced product processing time, and savings in energy requirements. A further benefit is the improved performance of the product in terms of hardness, durability, etc.

10. Chemicals

10.1 EU Initiatives

10.1.1 Regulation and policy

REACH

REACH (Registration, Evaluation and Authorisation of Chemicals) will replace existing legislation on classification, packaging and labelling of dangerous substances & preparations (see 1.1.2). It will shift the responsibility to industry for chemical risk identification and management and provision of safety information. Enterprises that manufacture or import > 1 tonne of a chemical substance per year will be required to register it in a central database. Stated aims of REACH are to improve the protection of human health and the environment while maintaining competitiveness and enhancing the innovative capability of the EU chemicals industry.

The objectives of REACH in terms of promotion of R&D and innovation and development of safer substitutes will be achieved through the following:

- Substances manufactured or imported for the purposes of product or process-oriented R&D (PPORD) do not need to be registered for up to 10 years, and for substances used in medicinal products, 15 years. A very wide definition of PPORD is given in the proposed legislation.
- The REACH threshold for registration (1 tonne/year) is much higher than the current 10 kg threshold for new substances.
- The costs of registering a new substance will be significantly lower than the current cost of notification.
- Registration will be quicker than the current notification, thus reducing the time to market.
- The requirements for authorisation in relation to more dangerous substances will encourage companies to increase their search for safer substitutes.
- The discrimination of new substances versus existing substances will be significantly reduced.
- Less information requirements for lower volume substances.

Classification, Packaging and Labelling of Dangerous Substances & Preparations

Under the existing legislation on classification, packaging and labelling (CPL) of dangerous substances¹⁷⁴ & preparations¹⁷⁵, manufacturers must classify the substance/preparation they are putting on the market and appropriately package and label it. Safety Data Sheets (SDSs) must be supplied to professional users.

Phase out and Control of Fluorinated Gases

An EU Regulation on the fluorinated gases hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF₆), which are all greenhouse gases, is to be adopted mid 2006. It will introduce leakage checks and containment measures for certain uses of these gases (refrigeration and air conditioning systems, electrical switchgear, etc.) and bans for other applications (non-refillable containers, fire protection systems, car tyres, windows). A separate Directive on f-gases in vehicle air conditioning systems (MACs) will also be adopted which will effectively result in an eventual phasing out of HFC-134a in MAC systems.

¹⁷⁴ Directive 67/548/EEC relating to the Classification, Packaging, Labelling of Dangerous Substances and its 29 amendments.

¹⁷⁵ Directive 1999/45/EC relating to the classification, packaging and labelling of dangerous preparations and its 2 amendments.

Community strategy for endocrine disruptors

Endocrine disruptors are chemicals in the environment that can disrupt the normal functioning of hormone systems of humans and wildlife. A Community strategy for endocrine disruptors was adopted in 1999, and reported on in October 2004. The 2004 working document establishes a priority list of substances for further evaluation of their role in endocrine disruption. Under REACH endocrine disruptors are covered by the authorisation procedure for substances of very high concern.

EU Strategy on dioxins, furans and PCBs

An EU Strategy on dioxins, furans and PCBs was adopted in 2001¹⁷⁶. A 2004 report¹⁷⁷ summarises progress in relation to the Strategy. The activities include projects targeted on the New Member States, work on integrated environment and health information focused on the Baltic Sea, work on BAT (some of the relevant BREFs have dioxin-related prevention and control measures), research, limit values for dioxins in feed and food and work on screening methods.

Biocidal Products

The legislation¹⁷⁸ in relation to biocidal products requires producers and formulators putting biocidal products on the market to apply for authorisation and submit all necessary studies and other information needed for assessment and decision making.

Plant Protection Products

Under this legislation¹⁷⁹, all active ingredients used in plant protection products in the EU must be proven to be able to be used safely regarding human health, the environment, ecotoxicology and residues in the food chain.

10.1.2 Information/awareness raising Instruments

REACH will bring down stream chemical users into the equation. REACH will also run a public database in which consumers and professionals will be able to find hazard information on chemicals. In addition it is also hoped that the quality of Safety Data Sheets (SDSs) will improve as a result of the new registration system under REACH.

10.1.3 Economic Instruments

The fifth and sixth framework programmes cover many areas related to chemicals, for example the fifth framework programme has spent over €60 million on endocrine disrupter research projects. The CREDO cluster (Cluster of Research into Endocrine Disruption in Europe)¹⁸⁰ has projects funded under both the fifth and sixth framework programmes researching into endocrine disruption.

¹⁷⁶ http://europa.eu.int/eur-lex/en/com/pdf/2001/com2001_0593en01.pdf

¹⁷⁷ http://europa.eu.int/eur-lex/en/com/cnc/2004/com2004_0240en01.pdf

¹⁷⁸ Directive 98/8/EC of the European Parliament and of the Council of 16 February 1998 concerning the placing of biocidal products on the market.

¹⁷⁹ Council Directive 91/414/EEC of 15 July 1991 concerning the placing of plant protection products on the market and its amendments.

¹⁸⁰ <http://www.credocluster.info>

10.2 Initiatives in Other Countries

Danish List of Undesirable Substances

This list contains the names of substances that have effects on health and the environment, are used in large quantities or are considered problematic by the Danish EPA for some other reason. Monitoring and information gathering on the most problematic substances is carried out continuously, so new substances can be added to the list and others can be removed, based on criteria such as toxicity, carcinogenicity, ability to cause genetic damage or impair fertility, allergenic features or negative environmental impact. The fact that a substance appears on the list does not necessarily mean that it should be banned altogether, but it should be seen as a hint to either restrict its use to the lowest possible level or find a more viable substitute.

Denmark, as the world's largest pork exporter, has pioneered reductions in routine agricultural use of antibiotics in livestock and poultry through bans. In 2003 a WHO expert panel concluded that Denmark's phase-out led to an overall drop in the use of antibiotics in food animals by 54%, and "dramatically reduced" levels of resistant bacteria in animals, with the impact on agricultural productivity and animal welfare being minimal to nonexistent.

The **Czech Republic** will ban production and sale of laundry **detergents** containing more than 0.5% **phosphates** (excluding dishwasher detergent tablets) from 1st July 2006 in a bid to combat eutrophication of watercourses, since a voluntary agreement with industry proved ineffective.

A **charge on emission of nitrogen oxides** (NO_x) from energy generation at combustion plants was introduced in **Sweden** in 1992. The charge has been seen by the Swedish EPA as a crucial factor in the considerable reduction in emissions of nitrogen oxides that has taken place from these plants during the 1990s.

Germany has banned the use of ozone-depleting hydrochlorofluorocarbons (HCFCs) in medical applications which includes **metered-dose inhalers** since January 2006, making it one of the first in the world to do so. Under the UN Montreal protocol on ozone layer protection HCFCs can still be used in certain applications such as metered-dose inhalers despite a general ban on the gases.

10.3 Initiatives in Ireland

10.3.1 Regulation and Policy

Substitution

Ireland's IPPC regime requires all licensees to address List I & II substance reductions under the dangerous substances legislation.

10.3.2 Implementation of EU Legislation

Ireland has directly transposed the Classification, Packaging, Labelling (CPL) Directives¹⁸¹ and the system is operated by the Health and Safety Authority (HSA).

EU controls on the use of creosote and lead paint are also implemented in Ireland. Creosote can only be used in industrial applications while lead paint can only be used in the restoration of historic buildings..

¹⁸¹ European Communities (Classification, Packaging, Labelling and Notification of Dangerous Substances) Regulations 2003-2006 (S.I. No. 116 of 2003 & S.I. No. 25 of 2006); European Communities (Classification, Packaging, and Labelling of Dangerous Preparations) Regulations 2004 (S.I. No. 62 of 2004).