

**Update and Revision of the
National Programme for Ireland**

**under Article 6(3) of Directive 2001/81/EC for
the progressive reduction of national emissions of
transboundary pollutants by 2010**

Executive Summary

Since 2001 Ireland has made significant progress in reducing emissions of all four pollutants covered by Directive 2001/81/EC on national emissions ceilings for certain atmospheric pollutants. The trend is projected to continue with further significant decreases forecast out to 2010 and beyond. The reductions to date are the result of the adoption and implementation of policies and measures, including regulatory, fiscal and voluntary instruments, across all sectors in the economy but particularly in the powergen, transport and agriculture sectors.

Projections indicate that emissions for all four pollutants will continue to fall in the period to 2010 and beyond as a result of further implementation of policies and measures across the economy, again with particular significance in the powergen, transport and agriculture sectors and also with significant reductions in NO_x in the industry sector from the revision to BAT under the IPPC directive (96/61/EC). For three of the four pollutants, SO₂, VOCs and NH₃, Ireland is on target to comply, or significantly over-comply, with the ceilings set out in Annex I of the directive. However, for NO_x, the ceiling as it is currently set presents a difficulty for Ireland even with the implementation of additional measures. This is in part a result of a number of factors relating to both inventory and projection estimates. Further additional measures including possible regulatory, fiscal or voluntary instruments will be considered to assess the viability and cost effectiveness of introducing such measures to reduce NO_x emissions further. The directive sets *absolute* ceilings for 2010 for each of the pollutants, however, the overarching principle of the integrated 'effects-based' philosophy, which underpins the NEC directive and the Gothenburg Protocol, is to seek to reduce certain inter-related environmental and health effects in a cost optimal way and not to reduce the emissions of specific pollutants *per se*.

Ireland is committed to playing its part in delivering the Community's interim environmental objectives set out in Article 5 of the directive. As stated, Ireland is on target to comply or over-comply with three of the four emission ceilings, SO₂, VOCs and NH₃. However, for NO_x it now seems clear the ceiling does not provide a cost effective or proportionate route to delivering these objectives. Apparent evidence to support this view is contained in the updated RAINS analysis conducted for the revision of the directive which shows that for Ireland to play its part in delivering the more ambitious objectives of the Thematic Strategy on Air Pollution in 2020, further reductions in SO₂ and NH₃ are required; for NO_x and VOCs the analysis indicates that the current target date for the 2010 ceilings can be pushed back to 2020.

Further national consultation and analysis is required to assess the viability of potential further additional measures. Such analysis will need to consider, inter alia, the lesson learned through the EC national programme workshop and from the implementation of innovative measures applied in other member states. This analysis will help to better understand what might constitute a cost effective ceiling for NO_x for Ireland in 2010 consistent with the directive's interim environmental objectives and taking into account cost effectiveness and sectoral equity considerations.

Transboundary Air Emissions in Ireland: 2001 - 2010¹

Pollutant	2001	2002	2003	2004	2005	% change 2001 - 2005	2010		NEC Ceiling	Projected performance
	Inventory						'With' measures	'With' additional measures		
SO ₂	130	100	78	72	70	-46%	33	-	42	Over compliance
NO _x	123	116	111	109	110	-11%	98	93	65	Non compliance
VOCs	78	71	68	64	62	-20%	55	-	55	Compliance
NH ₃	117	115	114	113	113	-4%	102	-	116	Over compliance

Key Measures

The following are the principal additional measures, which have been adopted and/or implemented by Government since the previous projections estimates of the National Programme.

Energy Supply

- Secondary SO₂ and NO_x Abatement Retrofits at Moneypoint, the country's largest, and only coal-fired power plant
- 15% of electricity to be generated from renewable sources by 2010 and 33% by 2020
- Grant Aid Support for Combined Heat and Power projects
- National Ocean Energy Strategy to stimulate R&D of emission free energy technologies

Transport

- Modal shift to public transport as a result of Transport 21 investment
- National efficient-driving awareness campaign
- Sustainable Transport Action Plan to be published in 2008
- Euro Vehicle Standards

Industry, Commercial and Services

- Building Regulations and Building Energy Rating
- Energy Agreements Programme
- CHP programme

¹ National NO_x emissions are adjusted to account for fuel tourism (see section 8.1.2)

- Support for eco-efficient technology and practices
- Introduction of secondary NO_x abatement in the cement sector

Residential

- Revised Building Regulations in 2008 to aim for 40% improvement on current thermal performance standards
- Building Energy Rating certification introduced from 2007
- Grants for renewable energy heating under Greener Homes Scheme
- Levy on incandescent bulbs to encourage shift to low-energy bulbs
- Smart meters to be supplied to all electricity customers
- Energy efficiency measures to be funded in social housing programmes

Part 1 – Introduction

1. Introduction

As required by Article 6(3) of the directive, this document updates and revises the national programme which was finalised and reported to the Commission in 2005. This updated and revised national programme takes account of the:

- on-going monitoring and review of the efficacy of implemented and planned policies and measures,
- improvements in emissions estimates for the inventory and projections,
- evolution of national projections for the main drivers of transboundary emissions consistent where appropriate with projections underpinning climate change policy.

This update and revision of the National Programme was compiled by the Department of Environment, Heritage and Local Government (DEHLG) in consultation with other relevant Government departments and agencies. A comprehensive public consultation process was conducted for the original national programme; further consultation with the public for this update and revision has not been conducted. Details of respondents and their responses to the original consultation process can be found in summary form in the National Programme finalised in 2005 and in full on the DEHLG website (www.environ.ie).

The document applies, where possible and appropriate, the recommendations developed by the CAFE Working Group on Implementation for developing and reporting national programmes (EC, 2006).

2. Overview of Developments since publication of the first National Programme

Since 2005, there have been significant policy developments, particularly in terms of energy policy and climate change, that will lead to improvements in Ireland's transboundary emissions profile. The measures introduced in each sector are outlined in Part 2, together with an update on the measures included in the first National Programme.

Part 2 - Sectoral Areas

3. Power Generation Sector

3.1 Overview

Since the National Programme was finalised, substantial work has been undertaken by Government to put in place a sustainable energy framework for the period up to 2020. This has been driven by environmental, security of supply and competitiveness concerns with a view to Ireland having a fully sustainable, secure, efficient, affordable and competitive all-island energy market using diverse energy sources.

The 2005 National Programme highlighted measures to be undertaken in respect of the National Emission Reduction Plan (NERP) of the Large Combustion Plant Directive (2001/80/EC), and the commissioning of new power plant, which are updated below. In addition, the Department of the Environment, Heritage and Local Government commissioned consultants to carry out emission projections in the sector out to 2020 taking account of recent policy developments.

Overall, the outlook for environmentally sustainable power generation in Ireland is favourable, although many of the measures outlined in the new national energy policy (see Energy White Paper below) will have more relevance in the 2010-2020 period.

3.2 Emissions and Projections from the Power Generation Sector

The overall trend of emissions from the power generation sector is one of decline. Over the period 2006 – 2010, it is projected that emissions of SO₂ will decrease by 73% and NO_x will decrease by 54% under the ‘with’ measures scenario and 56% under the ‘with additional’ measures scenario. The projected reduction in emissions from this sector follows on from a 45% reduction in SO₂, and 21% reduction in NO_x from 2001 – 2005. The measures highlighted below are contributing to this decline, and it is expected that there will be a further decline in emissions from this sector in the 2010 – 2020 period as measures included in the Energy White Paper take effect.

3.4 Emissions Reductions in Power Plants

The strategy of reducing emissions from power plants has two facets; closure of plants and installation of abatement technologies.

Ireland has opted to develop a national emissions reduction plan (NERP) under Article 4 (6) of the Large Combustion Plants directive (2001/80/EC) to address emissions from ‘existing plant’ as defined in the directive. The NERP sets ceilings for emissions of SO₂ and NO_x 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. 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 closure of older inefficient plants has been hastened by fuel costs and dependency on oil. While oil is still contributing significant amounts to electricity generation today (13% in 2005), it is expected that this will reduce significantly by 2010, due to the closure of older power stations using oil.

Moneypoint is a coal-fired electricity generation plant (915 MW), which meets about 24% of Ireland's electricity needs. The station was built in the 1980s as part of a fuel diversity strategy, which evolved following the 1970s' oil crisis. To comply with the Large Combustion Plant Directive, the Government approved in 2004 the installation of significant emissions abatement equipment to ensure its continued operation. The project involves a retrofit of both SCR and FGD abatement technologies² at Moneypoint costing €264 million. In addition, there will be a substantial refurbishment of the plant costing €104 million. The refurbishment will be carried out in tandem with the environmental installation and the aim is to have the project completed by January 2008 in line with EU Directive requirements.

3.5 Energy White Paper

The Government has published a White Paper, *Delivering a Sustainable Energy Future for Ireland (DCMNR, 2007)*, which sets out the broad energy policy framework for the long-term development of the energy sector. While the White Paper also covers energy use in transport and the built environment, there are a number of strategic goals to promote the sustainability of energy supply and use by:

- Accelerating the growth of renewable energy sources including wind and wave technologies
- Delivering an integrated approach to the sustainable development and use of bioenergy resources
- Accelerating Energy Research Development and Innovation Programmes in support of sustainable energy goals.

There are significant synergies between the White Paper and this Strategy. Investment in modern energy infrastructure, including the progressive deployment of emerging technologies will, over the longer term, contribute to greater reductions in emissions by increasing the efficiency and sustainability of energy consumption.

² Selective catalytic reduction (SCR) and flue gas desulphurisation (FGD).

3.6 Summary of Sectoral Measures 2007 - 2020

Power Generation Sector Measures

Specific measures by which the energy sector will contribute to reduced emissions are described below:

- **Implementation of NERP and abatement retrofitting of Moneypoint.**
- **Fuel switching:** a broad set of measures aimed at using less emission intensive fuels in the supply of energy throughout the economy, including in power generation.
- **Gas production and distribution:** the expansion and modernisation of the gas transmission and distribution networks is resulting in cleaner fuels in domestic and industrial sectors.
- **Renewable energy:** Ireland has a national target of 15% renewables by 2010, over and above the 13.2% required under Directive 2001/77/EC. Government has agreed a 33% target for 2020.
- **Combined heat and power:** to build on the currently installed CHP capacity of 282 MW, the government is providing grant-aid to stimulate the further deployment of CHP in the industrial, commercial and services sectors.
- **Improving efficiency of electricity supply:** the efficiency of electricity supply is increasing owing to the replacement of older generating plant with more efficient gas and peat plants and the increasing contribution of renewables to electricity generation. This trend is expected to continue as additional high efficiency gas-fired power plants are commissioned in coming years.
- **Transmission and distribution losses:** energy losses from electricity transformation and distribution are being reduced owing to an ongoing network replacement programme.
- **Demand side management:** Sustainable Energy Ireland (SEI) programmes to promote environmentally and economically sustainable production, supply and use of energy across all sectors of the economy and energy efficiency programmes by the main electricity supplier contribute to reduced energy consumption. The energy regulator has also set targets for the principal electricity supplier to achieve energy efficiency gains in electricity end-use

4. Transport Sector

4.1 Overview

With Ireland's rapidly increasing population and growing economy, emissions from the transport sector have continued to increase. National estimates for NO_x emissions from road transport are projected to be 43.3 kt in 2010 or 44% of overall emissions under the 'with' measures scenario or 47% of emissions under the 'with additional' measures scenario. In contrast RAINS projections from 1998 indicate a figure of 29 kt or 35.8% of overall emissions (EPA, 2007). In 2005 around 42% of emissions of

NO_x from the road transport sector resulted from light duty vehicles (LDVs), and a quarter from heavy duty vehicles (HDVs) and captive fleets.

The focus of Ireland's policies is to reduce the number of vehicle journeys through modal shift to public transport, and to reduce emissions from vehicles on the road. In terms of the latter, as a technology taker, Ireland is very much dependent on community wide measures such as the Euro standards, and therefore welcomes more ambitious standards.

4.2 Emissions and Projections from the Transport Sector

Emissions from the Transport sector continue to represent a challenge for Ireland, however this is offset by more stringent Euro and Fuel Quality standards. Emissions projections for SO₂, NO_x and VOCs from the transport sector indicate a decline over the period 2005 - 2010. The expectation is that emissions from this sector will continue to decline in the 2010-2020 period with the introduction of new EURO 5/6 standards, assuming they deliver expected emission reductions. Also, the increase in the modal shift to public transport as public transport infrastructure improves will assist this trend.

4.3 Sulphur free fuel

The first National Programme set out Ireland's commitment to an excise differential for sulphur free fuels. It was decided in 2006 that this differential would not be introduced, as there was concern that there would not be sufficient supply from refineries. Ireland is dependent on refineries based in the UK for 66% of national fuel supply. Notwithstanding this, the remaining 33% of fuel refined in Ireland has been sulphur free since 2005. Analysis of fuel supply entering the market from UK based refineries is demonstrating lower levels of sulphur, and Ireland is confident that it will meet the deadline of full market penetration of sulphur free fuels by 2009. Furthermore, the Irish Petroleum Industry Association has confirmed that diesel will be sulphur free by the end of 2007, and petrol sulphur free in 2008. Ireland welcomes the proposed fuel quality directive, which will lower sulphur levels for non-road land vehicles and waterway craft. Ireland will shortly introduce national regulations to transpose the Directive on the sulphur content of marine fuels (Directive 2005/33/EC). Administrative measures to enforce this have been agreed following extensive consultation with the marine sector.

4.4 Transport 21

The provision of infrastructure through the continued implementation of Transport 21, a €34.3 billion capital investment framework for the transport system between 2006 and 2015, will result in a switch from private to public forms of transport. Overall €8.5 billion will be invested in the national roads programme, while €15.8 billion will be provided for public transport projects and for regional airports.

An integral part of planning for future public transport provision will require

encouraging commuters to move from private car use to more sustainable modes of travel. Existing traffic management measures in urban areas, such as quality bus corridors and park-and-ride facilities, will be enhanced under Transport 21 with further bus priority measures, car restraint measures, park and ride facilities, and improved cycling and pedestrian facilities.

Transport 21 will facilitate a switch to more sustainable modes of transport such as public transport, cycling and walking, and create greater certainty in knowing where best to focus higher density development within the greater Dublin metropolitan area, as well as concentrating development in the hinterland in strategically placed dynamic urban conurbations.

Modelling of the impacts of Transport 21 in the Greater Dublin area shows a reduction of 20% in fuel consumption, which will, in tandem with a more modern fleet, lead to a reduction in emissions from this sector.

Further details of this programme are available on www.transport21.ie and www.ndp.ie.

4.5 Euro Standards

Ireland welcomes the negotiation of the Euro standards for goods and passenger vehicles, and see them as a key component of reducing emissions from the transport sector. Going forward, Ireland will continue to support more ambitious standards, which will be complemented by national measures.

4.6 Other Measures

A number of other domestic measures are currently being developed. The Government has committed to rebalancing Vehicle Registration Tax and Motor Tax (annual circulation tax) to more closely align these with CO₂ emissions, with effect from 1 January 2008. In addition, the Department of Transport will be launching a national efficient-driving campaign, which will aim to reduce emissions from the transport sector, through measures such as correct tyre pressure, more efficient driving etc. It is also expected that a Sustainable Transport Plan will be launched in 2008. It is also intended to assess the potential for a retrofit programme to address NO_x emissions in particular from HGVs and captive fleets.

4.7 Summary of Sectoral measures

The following is a summary of measures adopted and/or implemented in the transport sector. The transport sector and road transport in particular is the predominant source of NO_x emissions. While around 40% of emissions of NO_x from the transport sector result from light duty vehicles (LDVs), approximately a quarter of emissions result from heavy duty vehicles (HDVs) or captive fleets. Further consideration will be given to options for programmes to promote retrofitting of these aspects of the national fleet and in particular the recommendations of the recent European

Commission report (EC, 2006) on the viability of applying retrofit technologies to address NO_x emissions from HDVs and captive fleets.

Transport Sector Measures

- **Modal shift to public transport** as a result of Transport 21 investment.
- **Rebalancing of VRT and motor tax**, supported by improved mandatory labelling
- **National efficient-driving awareness campaign**
- **Sustainable Transport Action Plan**
- **Examine early implementation of Euro standards**

Potential further additional measures.

- **Assess potential for a retrofit programme to address NO_x emissions in particular from HGVs and captive fleets.**

5. Industry and Commercial Sector

5.1 Overview

Major industrial installations in Ireland are regulated by the Environmental Protection Agency (EPA) under the Integrated Pollution Prevention and Control (IPPC) Directive (96/61/EC). The directive has been in force since 1999 and requires that older installations, existing before 1999, be licensed by October 2007. The EPA is currently reviewing arrangements for these installations with a view to drawing up IPPC licences by the required date. This will provide an opportunity to consider and apply appropriate emission controls to reflect the best available techniques to these older industrial installations.

In terms of additional measures, much of the focus of measures in this sector relate to energy efficiency, improved building regulations and support for the deployment of alternative energy.

5.2 Emissions and Projections

The Industry sector has not performed as well as other sectors in reducing emissions. This can primarily be attributed to increased economic activity resulting in increased energy demand and infrastructural development, for example, in terms of cement production. For the 'with measures scenario', emissions are expected to rise by 2.8% in the case of NO_x and 11.2% in the case of SO₂ between 2006 and 2010.

In the Commercial and Institutional sector, SO₂ decreased by 4.5% between 2001 and 2005 and is projected to fall by a further 27.9% between 2006 and 2010, reflecting the maximum level of 0.1% sulphur in gasoil from 2008 under Directive 99/32/EC. Emissions of NO_x rose by 8.4% over the period 2001 to 2005 and are projected to rise by a further 8.64% between 2006 and 2010 reflecting anticipated increased energy demand in the sector.

5.3 Advanced NO_x Abatement in Cement Sector

The 2005 National Programme reported on the feasibility study for the installation of advanced NO_x abatement techniques in the cement sector. The study is complete and it is anticipated that the two largest and oldest cement plants in the country will install SNCR to comply with revised BAT standards under the IPPC regime. Between 2001 and 2005, NO_x emissions from this sector increased by 72% and in 2005, the cement sector accounted for 55.7% of total industry NO_x emissions and 8.6% of total national emissions.

5.4 Building Regulations

The introduction of more stringent energy performance requirements for non-residential buildings, through amendments to Part L of the Building Regulations from July 2006, will lead to significant annual savings on energy use. This is complemented by a requirement for a feasibility assessment of alternative heating and energy supply systems for buildings over 1000m² before construction begins. The requirement under the European Performance in Buildings Directive to assess the overall energy performance in the design of new non-domestic buildings will be introduced in July 2008 and is intended to promote the development of optimum energy solutions at the design stage.

5.5 Building Energy Rating

The introduction of Building Energy Rating (BER) for new non-domestic buildings for sale or rent from 1 July 2008 and for existing buildings for rent or sale from 1 January 2009 will provide building facilities managers with an additional tool to assess energy consumption in buildings. The BER will provide a transparent assessment of a building's energy performance and the measures that may be put in place to increase performance.

5.6 Supporting the achievement of greater energy efficiency

The Government will shortly publish a comprehensive Energy Efficiency Action Plan to deliver a significant reduction in energy demand for Ireland by 2020, building on achievements to date. Programmes will target energy efficiency across all sectors, including business, with the public sector expected to lead by example with an energy efficiency target of 33% by 2020.

Existing measures to reduce energy use by the industry and commercial sector include:

- The Irish Standard for Energy Management, (IS 393).
- The Energy Agreements Programme.
- Energy Management Action Programme (EMAP).
- Large Industry Energy Network.

5.7 Support for the deployment of alternative energy

The €1 million Combined Heat and Power (CHP) programme provides grants for the installation of CHP units. The scheme is aimed at small-scale units (up to

1 MW), which can be deployed in hotels, leisure centres, small hospitals, offices or commercial buildings, which have a substantial heat requirement. The programme is running over a five-year period. A target deployment of 400MW by 2010 has been set by the Government, with a further target to achieve 800MW by 2020.

5.8 Summary of Sectoral measures

Industry and Commercial Sector Measures

- Continued application of BAT in IPPC Licensing including SNCR in cement sector.
- Building Regulations and Building Energy Rating
- Energy Agreements Programme
- CHP programme

6. Residential Sector

6.1 Overview

Measures in the residential sector focus primarily on energy used. The focus has been on the use of cleaner fossil fuels for home use, the continued roll-out of the natural gas network which displaces solid fuel and oil in terms of home-heating, and making homes more energy efficient whether through demand measures, mitigation measures in existing homes and improved standards for new homes.

6.2 Emissions and Projections

The general trend over the period 2001 – 2005 and projections out to 2010 is that emissions from the residential sector are declining for SO₂ and VOCs, and are holding fairly steady for NO_x, despite a significant increase in residential units. The significant shift from solid fuel heating systems to gas and oil-fired central heating systems is a significant factor in this trend. SO₂ in the residential sector is projected to fall by 37% over the 2005-2010 period.

6.3 Solid Fuel Trade Group Voluntary Agreement

In April 2006, the DEHLG 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 follows on from a previous agreement in 2002. The new Agreement runs until the end of the fuel season in April 2008 and locks in place the significant environmental gains achieved by the first agreement through ambitious limits on sulphur levels in bituminous coal and petcoke.

The provisions of the new Agreement required that, with immediate effect, all imports of bituminous coal are to be limited to a maximum sulphur content of 0.7%

and an annual average sulphur content of 0.6% and, by 1 August 2007, a maximum sulphur content of 2% be observed on all imports of petcoke.

Tonnages in the residential solid fuel sector have been falling steadily over the last number of years. The latest import data for 2006 indicates a fall of 5% in tonnages of bituminous coal and 29% in tonnages of petcoke compared to 2005. In fact, actual sulphur levels over-comply with the requirements as set out in the assumptions for projections in Annex III.

6.4 Energy Efficiency

As with the industry and commercial sector, much of the focus in this sector has been on reducing energy usage, which contributes at generation stage to reduced pollutants. A number of the energy efficiency measures adopted by Government are outlined below.

a) Residential Density Guidelines

The Government will replace the current Residential Density Guidelines with Guidelines on Sustainable Residential Development. These will be issued in draft for consultation in Autumn 2007. The new guidelines will encourage more energy-efficient housing layouts by, inter alia, setting more quantifiable sustainable development standards, maximising access to sunlight and daylight, facilitating greater movement by pedestrians and cyclists, facilitating use of public transport, and using efficient energy supply (such as combined heat and power), where appropriate.

b) Building Regulations

The Building Regulations are steadily enhancing the thermal performance standards of new and refurbished buildings. The first thermal performance requirements in national building regulations came into force in 1992 and since then, the energy efficiency of new buildings has increased significantly. The Government has commenced a full review of the scope, structure and form of the current building regulations to prepare for the next revision to the Part L thermal performance requirements. This review will examine the scope for extending the coverage of Part L to include a requirement for high efficiency boilers, renewable energy systems, energy efficient lighting, as well as the scope for tighter insulation and air infiltration requirements. Revised Part L standards will come into force in 2008 and will aim to achieve up to a 40% improvement on current standards. Compliance with Building Regulations is mandatory for all providers of new buildings and major improvement works to existing buildings. The Government is working to achieve strengthened compliance with the regulations. The Building Control Act 2007 will strengthen the legal enforcement powers of Building Control Authorities (Local Authorities), with increased maximum penalties for breaches of the Building Regulations.

c) Building Energy Rating

From 1 January 2007, an energy rating requirement for new dwellings, in the form of a Building Energy Rating (BER) certificate, has been introduced. This certificate will also be introduced for new non-domestic buildings from 1 July 2008 and for existing buildings when being let or sold from 1 January 2009. A BER gives an objective scale of comparison for the energy demand and CO₂ performance of buildings, which

will allow prospective tenants or buyers to objectively compare the energy performance of buildings and factor energy performance and costs into purchase or tenancy decisions. An advisory report attached to the BER certificate will set out cost effective ways of improving building energy performance for the information of building owners and landlords in planning future upgrade works.

d) Switch to low-energy light bulbs

Traditional incandescent light bulbs are extremely inefficient; modern CFL bulbs use 80% less energy for equivalent light and last up to 15 times longer. While they are therefore more economical for the consumer in the long-run, their initial cost is higher. The European Commission intends to bring forward a proposal for an EU-wide ban on incandescent bulbs, but this may take a number of years to be agreed and implemented. To bridge the gap, the Government will introduce an environmental levy on incandescent bulbs, to reduce their price advantage and encourage consumers to switch to CFL bulbs. The intention, as with the very successful plastic bag levy, is to alter consumer behaviour rather than to generate revenue, but any income from the new environmental levy will be channelled through the Environment Fund to support environment awareness initiatives. This is an electricity demand management policy which, in accounting terms, will deliver emissions reductions in the powergen sector.

e) Smart meters

Smart meters have demonstrable potential to deliver benefits for energy consumers, including more flexible tariffs offering greater choice and energy saving opportunities, and remote meter reading resulting in reduced costs and full accuracy. Smart meters can also facilitate the incorporation of on-site generation at consumer premises, including renewable generation. The Government will initiate steps in 2007 to roll out the provision, over the next five years, of smart meters for all electricity customers in both new and existing housing stock.

f) Awareness Initiatives

Consumer information plays a key role in driving energy efficient behaviour. Support for energy awareness initiatives is provided through Sustainable Energy Ireland campaigns and through the national Power of One awareness campaign. This campaign will be sustained over the next three years at national, regional and community level as well as across economic sectors.

g) Energy efficiency of social housing

The Best Practice Guidelines, *Quality Housing for Sustainable Communities*, published in March 2007, focus on promoting high standards in design, construction, environmental performance and durability. Sustainable development can be achieved through settlement patterns that are planned in accordance with urban design principles that create high quality neighbourhoods at a density which supports schools, shops and amenities within easy walking distances of dwellings. The guidelines set the ambition of optimising the energy performance of new homes with the aim of reducing emissions and improving energy efficiency by 40%.

Energy efficient practices that meet national criteria will be approved for funding as part of social housing projects through existing capital programmes such as the Local

Authority Housing Regeneration Programme and the Central Heating Scheme, and future programmes to be developed. As the benefits of innovative practices are validated through implementation experience, they will be included in recommended guidelines.

A proposed audit of social housing stock will provide an important incentive to continual improvement of the general quality of social housing including energy efficiency. It will also provide a basis for considering the potential for further cost-effective measures to be readily employed to improve the sustainability of housing.

The particular circumstances of low income households require coordinated action to ensure that homes which are subject to fuel poverty have access to cost-effective heating, hot water and lighting through the installation of energy efficiency measures. The national Warmer Homes Scheme administered by Sustainable Energy Ireland (SEI) is the primary intervention in this area.

6.5 Summary of Sectoral measures

Residential Sector Measures

- **Solid Fuel Trade Group Voluntary Agreement 2006 – 2008**
- **Residential Density Guidelines**
- **Enhancement Building Regulations**
- **Implementation of Building Energy Rating**
- **Switch to low-energy light bulbs** through an environmental levy on incandescent bulbs
- **Introduction of Smart Meters**
- **Public awareness initiatives**
- **Energy efficiency programmes in social housing**

7. Agriculture

7.1 Full Decoupling under CAP

The National Programme adopted a conservative approach to assessing likely future ammonia emission reductions in 2010 as there was at that time a lack of certainty as to what approach Ireland would opt for under the EU CAP reforms. Since publication of the discussion paper, Ireland has formally opted for full ‘decoupling’ of direct support payment and this is projected to result in significant decreases in the livestock population in the period to 2010. It should be noted that the Luxemburg Agreement that provides the framework for CAP reform is based on a ‘freedom to farm’ regime and so while reductions in livestock numbers (and hence emissions) are highly likely they are not fully guaranteed.

A programme to promote the uptake of low ammonia emission application of organic fertiliser was introduced in 2005. The programme provides for a 40% subsidy for low emission 'trailing shoe' slurry spreading technology. To date the response to the 'trailing shoe' grant has been slow and the scheme will be kept under review to ensure it provides an appropriate incentive to promote the use of low ammonia emission application of organic fertiliser. The proposed new Rural Environment Protection Scheme (REPS) under the 2007 – 2013 Rural Development Programme also contains options aimed at increasing the uptake of low emissions 'trailing shoe' technology and encouraging minimum tillage practices. These measures are in addition to the nutrient management planning requirement for participation in REPS. The requirement aims to improve the efficiency of manures and reduce the use of chemical fertilisers.

Part 3 – Emissions Trends and projections

8.1 Emissions Inventory

Emission inventory estimates are the fundamental instrument to assess compliance with the basic obligation of the directive, that is, to limit overall national emissions to the *absolute* ceilings specified for each Member State in Annex I of the directive. Development of the inventory is a process of continuous improvement and such improvement, by revising emission estimates, will change the ‘distance to target’ to the absolute emission ceilings of Annex I and hence can imply a change to the substantive obligations of the directive.

8.1.1 Improvements to the National Inventory

Several aspects of the national emissions inventory have undergone revision since the national programme was finalised. A National Atmospheric Inventory System (NAIS) has recently been adopted by Government (DEHLG, 2007) addressing both greenhouse and transboundary emissions to the atmosphere. This establishes the institutional, legal and procedural arrangements for compiling the inventory and provides a formal framework for the collection, processing and quality control and assurance of data used in the inventory estimation process. It also provides the basis for review of the activity data and estimation methodology by independent experts.

Estimates of fuel used in the industrial sector have improved as a result of the data verification process under the Emissions Trading Directive (2003/87/EC). The basis of the estimate for ammonia emissions from agriculture has moved from a Tier 1 to a Tier 2 methodology. The effect of fuel tourism, which is particularly significant for NO_x estimates, is now quantified in the inventory. Other areas where methodological changes have affected emissions estimates since the original RAINS analysis was conducted for the Gothenburg Protocol and the NEC directive include emissions from fuel used in the agriculture sector and international aviation.

At present the inventory is not formally documented but it is planned that a formal IIR³ report will be submitted to the UNECE CLRTAP with the 2008 submission. Uncertainty is not currently estimated but will be addressed in future submissions consistent with the work of the TFEIP⁴. The methodological changes referred to above have had the effect of increasing the absolute estimate of emissions and therefore increasing the ‘distance to target’ for the absolute ceilings of the NEC directive.

8.1.2 Fuel Tourism

Fuel or ‘tank’ tourism as it is sometimes called occurs where fuel is sold in one jurisdiction but consumed in another. It can occur as a result of a significant

³ Informative Inventory Report.

⁴ CLRTAP Task Force on Emission Inventories and Projections.

differential in retail price or as a result of significant transit traffic. Depending on the methodology used, fuel tourism can affect the overall estimate of national emissions. For example, if estimates are based on the amount of fuel sold by a Member State, then fuel tourism will result in an over or under estimation of emissions. This distortion can be corrected using other estimation methodologies, for example, by using vehicle kilometres or similar methodologies to give a more accurate indication of actual emissions from transport mobility in a particular Member State's economy. Unilateral measures to address fuel tourism by one Member State may not effectively address fuel tourism. In any case the resultant emissions are generally a displacement from one jurisdiction to another rather than a significant increase in overall emissions.

As fuel tourism has a particularly significant effect on the estimates of emissions of NO_x in Ireland, two sets of estimates are compiled and reported. The CLRTAP's Implementation Committee has accepted the data and considers Ireland's compliance with the Sofia Protocol using the fuel-tourism adjusted inventory. At present there is a net outflow of 'retailed' fuel from Ireland inflating estimates of emissions based on 'fuel sold' statistics; the situation was reversed in the early 1990 and so an emissions profile based on this methodology shows a significantly exaggerated upward trend in emissions. The NO_x estimate for the road transport sector for 2005, adjusted for fuel tourism, is 33.5 kt whereas the unadjusted figure is 42.9 kt, an increase of 28% or 9.4 kt.

8.1.3 Methodological Changes to Transport Emissions Estimates

Estimates of emissions from road transport were made using COPERT II until 2001 when COPERT III was introduced. COPERT III generally revised downwards the emission abatement potentials of vehicle emissions standards to address the issue of 'cycle beating'⁵ and thus to better reflect actual 'on road' emission performance. As a result estimates of NO_x from road transport increased by 20% overall with a 59% increase in estimates for diesel passenger cars and 54% increase for diesel LDVs. Using COPERT III rather than COPERT II for 2005 increases the NO_x estimate by 20% or 7 kt.

An update of the model, COPERT IV, is now available and will be used to compile estimates (and revise the time series) for the 2007 annual NEC submission. Preliminary analysis using COPERT IV indicates further significant increases to the estimates of NO_x into the future. For 2005, COPERT IV NO_x emission estimates increase by around 14% compared to COPERT III estimates.

A separate preliminary estimate of the effect of the revision of the RAINS removal efficiency factors between 1998 and 2006/7 has also been conducted (EPA, 2007). This indicates that the revision to the abatement factors imply an increase in the NO_x ceiling of approximately 20% or 8 kt.

⁵ The term 'cycle beating' describes the phenomenon where a vehicle's test cycle emissions comply with the relevant Euro Standard, but actual 'on road' emissions fall short of the cycle performance.

8.1.4 Other Changes to Inventory Methodology

Based on improved activity data, a revision to the assumptions regarding the final end use of gas oil fuel in the agriculture sector (split between space heating and mobile machinery) increased NO_x estimates considerably. Estimates for the sector based on the revised assumption are 125% higher than the original estimate. For 2005 the revision increased the estimate by 6.5 kt.

The NEC annex I ceilings for Ireland are identical to those set in the Gothenburg Protocol, though for aviation emissions reporting obligations under the Gothenburg Protocol differ somewhat from those under NEC. The Gothenburg Protocol requires reporting of emissions from domestic flights (landing and take off (LTO), and cruise) whereas NEC requires reporting of emissions from LTOs (both domestic and international) only. For 2005, NEC reporting increases NO_x estimates by 3.3 kt compared to Gothenburg reporting, largely as a result of the inclusion of emissions from international LTOs.

8.1.6 Implications for Consistency

International reporting guidelines for inventories stipulate that Parties or member states shall ensure that their national emission inventories meet certain criteria, including consistency. Consistency is defined to mean that estimates for different inventory years, gases or source categories are made in such a way that differences in the estimates between years and source categories reflect real differences in emissions rather than a change in methodologies or data sets. The improvements to methodologies and data sets in Ireland and other member states creates a problem for assessing progress towards the Annex I ceilings as without compiling separate inventory estimates of emission outturns for the years to 2010 based on older, superseded methodologies and data sets, the comparison of outturn estimates with the ceilings are not considered consistent under international reporting guidelines.

8.2 Emissions Projections

Since the National Programme was finalised, emissions projections have been updated and revised. In most instances, the basis of the projection estimates are consistent with the national greenhouse gas projections (DEHLG, 2006) used to inform the second national allocation plan under the emissions trading directive (2003/87/EC). The projections set out in Annex II include 'with' measures scenarios for all emissions and a 'with additional' measures scenario for NO_x. The key assumptions are set out in Annex III. Projected data is presented from 2006 in Annex II alongside actual inventory data up to 2005. Annex III includes a number of potential further additional policies and measures which will be considered but whose effect has not been quantified in the scenarios. The inventory and projection trend for each of the emissions is set out in the graphs below in section 8.3. The emission projections will be reviewed annually to incorporate the effects of updates to national economic, energy and other projections and the effects of policies and measures along with changes to other relevant parameters. Uncertainty estimates were conducted for the powergen projections though not for projections in the other sectors.

8.2.1 ‘With’ Measures and ‘With Additional’ Measures Scenarios

The ‘with’ measures and the ‘with additional’ measures differ by the inclusion of additional measures in the powergen and industry sectors affecting primarily NO_x emissions. The baseline or ‘with’ measures scenario assumes implementation of the NERP under directive 2001/80/EC and a 13% penetration of renewable in the powergen sector by 2010. For the industry sector, the ‘with’ measures scenario assumes BAT in the cement sector at 800 mg/m³ NO_x. The ‘with additional’ measures scenario assumes a ‘high renewables’ scenario in the powergen sector which leads to substantial reductions for all pollutants by 2010, though by 2020 projections for VOC and PM are higher than the ‘with’ measures scenarios as a result of the increased share of renewables sourced from biofuels. For the cement sector BAT is assumed at 500mg/ m³ NO_x. Emission projections for the powergen sector were developed by an external study (AEAT, 2007) while transport projections are based on modified national projections (ESRI, 2005) for the sector. The main energy activity data projection for the residential, commercial, and agriculture sectors are based on a macroeconomic model maintained by the Economic and Social Research Institute (ESRI). Ammonia emissions from the agriculture sector are estimated using national projections for activity data using the FAPRI model which were converted to emissions estimates by the EPA (Teagasc, 2003).

8.2.1 Institutional Arrangements

The national regulation⁶ giving a legal framework in Ireland to the NEC directive designates the Environmental Protection Agency (EPA) as the national body responsible for compiling transboundary emission inventories and projections. The EPA has recently consolidated its structures to, inter alia, address more effectively the issues of transboundary air pollution and climate change and the synergies and trade-offs between these areas. The new unit will bring together expertise from the inventory, projections, emissions trading and research areas and will ensure a unified approach to the task of producing inventories and projections for both transboundary and greenhouse gas emissions. A national system for projections, building on the NAIS for inventories, will be developed in due course.

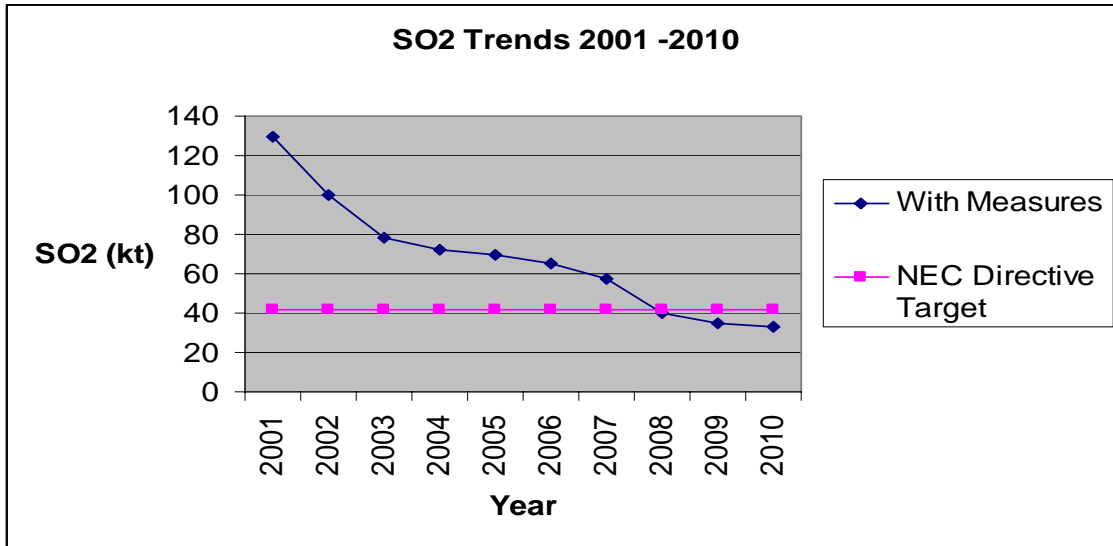
8.3 Update in Emission Trends

This update and revision to the national programme now includes national inventories for the years 2004 and 2005 contained in Annex I. There has been a progressive reduction for all pollutants up to 2005 and projections indicate that emissions of all four pollutants will reduce to 2010 and beyond, and that Ireland will comply or over-comply, with 3 of the 4 emission ceilings. However, for NO_x the

⁶ European Communities (National Emission Ceilings) Regulations 2004 (S.I. No. 010 of 2004)

projections indicate that the current ceiling cannot be cost effectively achieved by 2010 - this is a result of a range of factors, which are addressed in Part 4 below.

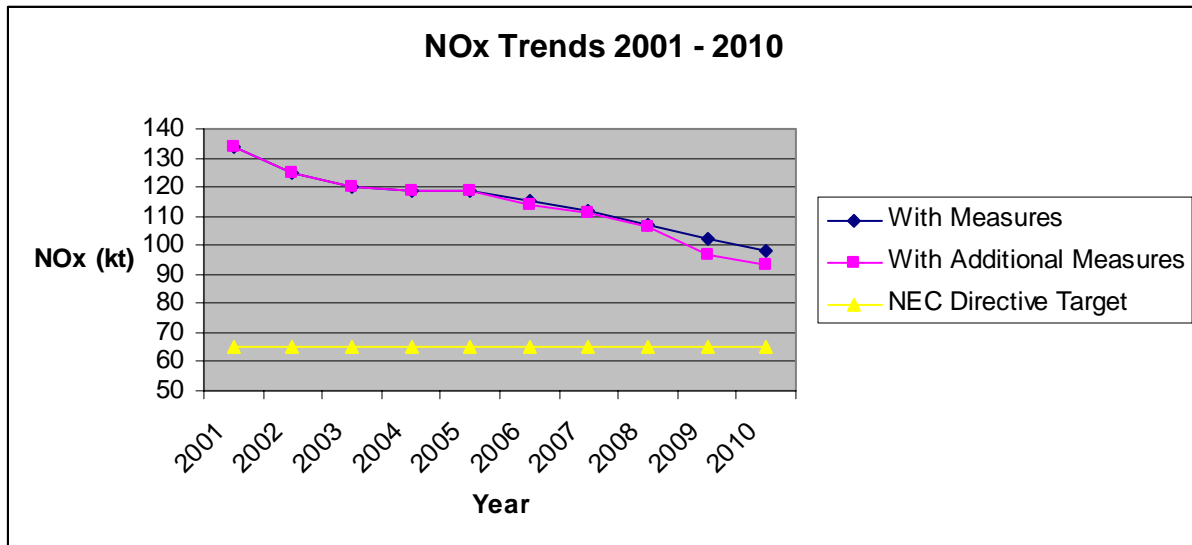
8.3.1 Sulphur Dioxide (SO₂)



Total emissions of SO₂ have fallen sharply in recent years, from a high of 129.6 kt in 2001 to 70.4 kt in 2005, a fall of 45.7% over the period. This reduction was driven by sharp falls in the powergen sector, which fell by 44.6% from 76.7 kt to 42.5 kt. Emissions from the construction and industry sector fell by 65.3% over the same period, a reduction of 19.1 kt. The most significant reduction within the sector came from the non-ferrous metals sub-sector which, as a result of conversion from conventional oil-fired boilers to gas-fired CHP, fell 71.2% over the period, a total of 10.8 kts.

Emissions are projected to fall further in the run up to 2010 particularly in the powergen sector with the installation of FGD in the country's largest single, and only coal-fired power station at Moneypoint, and the further increased penetration of renewables and gas. Emissions from the powergen sector are projected to fall by approximately 70% over the period. The next most significant change is in the residential sector, which is projected to fall by 32% over the period. Against the trend, emissions from industry are projected to rise by approximately 11% as a result of increased energy consumption across all fuels, notably petcoke. Overall emissions are projected to fall by 49% between 2006 and 2010 to around 33 kt, below the emission ceiling of 42 kt.

8.3.2 Oxides of Nitrogen (NO_x)

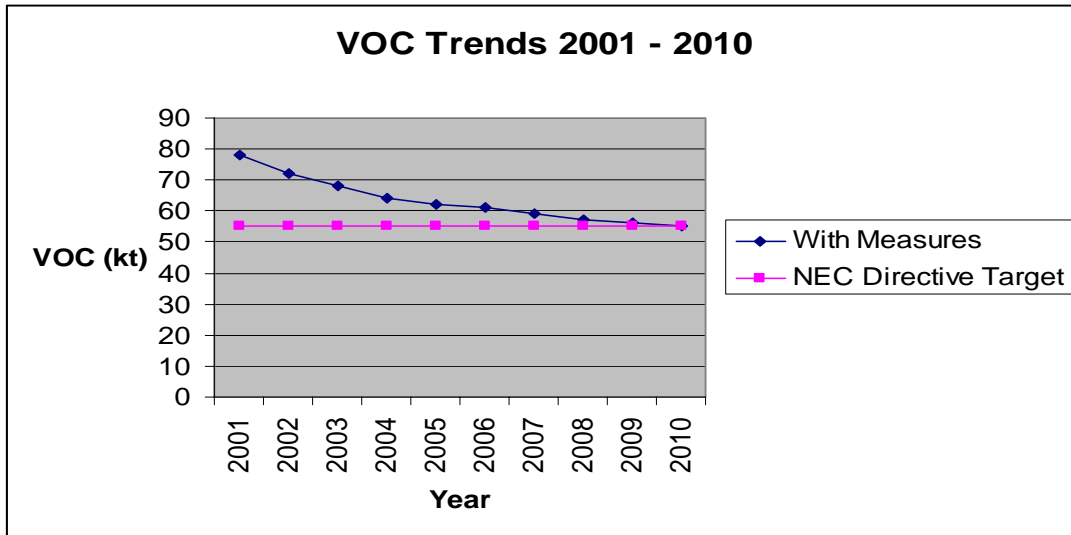


Total emissions of NO_x, adjusted for fuel tourism, have fallen by around 11% since 2001. Between 2001 and 2005, emissions (unadjusted emissions in parenthesis) have fallen from 122.9 kt (134.8 kt) to 109.7 kt (119.1 kts) though appear to have stabilised since 2004. Emissions have fallen by 21.3% in the powergen sector from 41.2 kt to 32.4 kt as a result of increased penetration of renewables, increased efficiency of generation, and reduced NO_x intensity of the fuels used. Emissions from road transport, adjusted for fuel tourism, fell by 14.4% from 39.2 kts to 33.5 kts. As for SO₂, emissions of NO_x have risen in the industry sector, up 10% from 15.4 kt to 17.0 kt.

Emissions of NO_x are projected to undergo a further significant fall of around 14% by 2010 primarily as result of reductions in the powergen sector resulting from major SCR retrofits at Moneypoint. Between 2006 and 2010 emissions from the powergen sector are projected to fall by over 50% from 28.9 kts to 13.3 kts. Emissions from road transport are projected to fall slightly by around 1% with the increased penetration of Euro IV and V standard vehicles. Against the trend, emissions from the industry sector are projected to increase as a result of increased energy demand in the sector met by solid and liquid fossil fuels. However, this trend will be offset by the installation of SNCR at two of the country's largest and oldest cement plants. The overall projected 'with' measures estimate of 98.4 kt and the 'with additional' measures estimate of 92.8 kt is significantly above the emission ceiling of 65 kt. There is a range of factors that have changed since the analysis for the directive was

conducted which alter the cost effectiveness of achieving the ceiling and which are set out below in section 9.

8.3.3 Volatile Organic Compounds (VOCs)

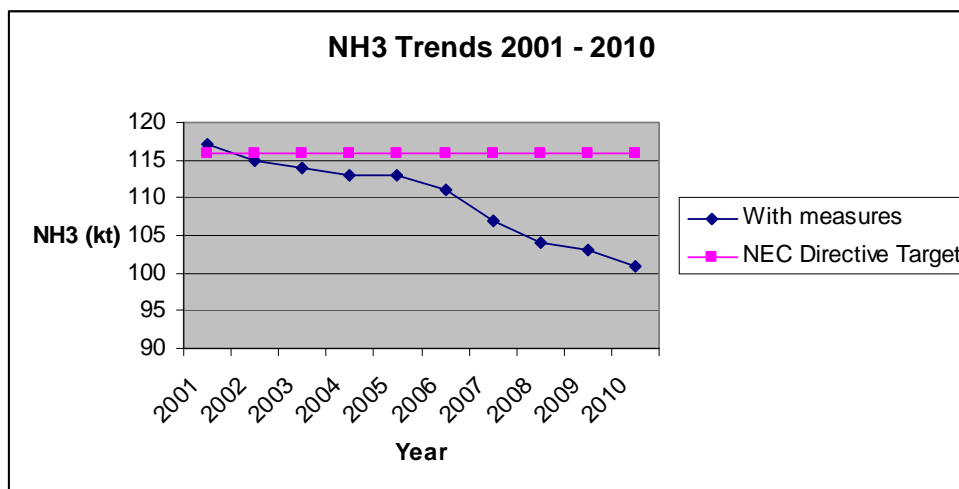


Total emissions of VOCs have fallen by 20.0% overall between 2001 and 2005 from 77.6 kt to 62.1 kt, due predominately to a fall in emissions from road transport, which fell 43.4% from 33.7 kt to 19.0 kt. Emissions from solvent use⁷, the largest source of VOCs in 2005, fell by 5.3% from 25.6 kt to 24.2 kt .

Overall emissions are conservatively projected to decrease by 9.8% between 2006 and 2010 reducing from 61.0 kt to 55.0 kt, primarily as a result of a projected 20% decrease in emissions from road transport. In the medium term, as a result of the increased use of biofuels, there may be an increase in VOC emissions from transport. A potential additional measure to address emissions from transport is the implementation of regulations to reduce fugitive emissions at petrol filling stations. Robust projections of emissions from solvent use, NFR category 3, are not currently available so the projection assumes that these emissions remain as in 2005 though it is anticipated that abatement in the sector, for example, from the decorative paints and varnishes directive (2004/42/EC) will result in reduced emissions. The overall projected outturn for 2010 of 55.0 kt equals the emission ceiling of 55 kt though as indicated above actual 2010 outturn is likely to be lower.

⁷ National Format for Reporting (NFR) category 3.

8.3.4 Ammonia (NH₃)



Overall emissions of ammonia have fallen 3.9% between 2001 to 2005 from 117.3 kt to 112.7 kt., already below the 2010 ceiling of 116 kt. Emissions from manure management, the largest single source fell by 3% over the period. Emissions from transport are a relatively small proportion of overall emissions but grew by 29.5% from 2.0 kt to 2.6 kt.

Overall emissions are projected to reduce by a further 8.8% between 2006 and 2010 from 111.4 kt to 101.5 kt, driven primarily by reductions in manure management associated with cattle rearing in the agriculture sector. While still a small proportion, emissions from transport are projected to rise a further 12.7% between 2006 and 2010 from 2.7 kt to 3.0 kt. The projected emission for 2010 is 102 kt, significantly below the emission ceiling of 116 kt.

8.4 Revision to Directive 2001/81/EC

The EC proposal to revise directive 2001/81/EC is expected in early 2008. The proposal will be based on updated and revised integrated assessment modelling using an updated version of the RAINS model which was used for the analysis underpinning the original directive. As the proposal will set national emission ceilings for 2020, it is not directly relevant for this update and revision of the National Programme, however, the analysis (IIASA, 2007) using updated and revised data for Ireland and EU member states calculates the *cost-optimised* ceiling for

member states to play their part in achieving the more ambitious objectives of the Thematic Strategy on Air Pollution by 2020. The analysis indicates that while further reductions are required for SO₂ and NH₃, the current target date for 2010 for the NO_x and VOCs ceilings can be pushed back to 2020.

As part of the national process to review data sets for Ireland for the RAINS model a revision has been made to the critical loads estimate for nutrient nitrogen deposition in early 2007. This revision will improve the robustness of the data set when it is formally ratified by the CCE and included in the model: the existing data set overestimates the sensitivity of certain ecosystems to nutrient nitrogen deposition by 140%.

Part 4 - Conclusion

9. National Emission Ceiling Challenge for Ireland.

There have been progressive reductions in emissions of all four pollutants since 2001 and further reductions are projected for all four pollutants to 2010 and beyond. Ireland is on target to comply, or over-comply, with the emission ceilings for SO₂, VOCs and NH₃. However for NO_x, it now seems clear that the ceiling cannot be achieved on a cost effective basis. There appear to be two main reasons for this, firstly, the scope, sectoral profile and interpretation of the data set used in the original RAINS analysis, as set out in the 'REF' scenario (IIASA, 1998), appear to have systematically underestimated the future baseline emissions. The REF scenario indicated baseline emissions of 70 kt whereas subsequent projections conducted for the Discussion Paper (DEHLG, 2003) and the CAFE process have all indicated a significantly higher level for 2010 between 90 and 100 kt. Current analysis for the revision of the NEC directive (IIASA, 2007) estimates a baseline emission of 74 kt for 2020. The estimate of projected NO_x is particularly sensitive to the estimate of projected fuel used in road transport and *ex post* analysis shows that this sector shows the greatest discrepancy between projected final use and actual outturns to date. Secondly, improvements to NO_x inventory estimates, set out in section 8.1.1 above, have acted to increase the absolute estimate of NO_x emissions and so acted to increase the 'distance to target' which therefore implies further additional and more costly policies and measures to reduce emissions below the absolute Annex I ceiling. This view has received support from international commentators (IEA, 2007).

10. Conclusion.

Ireland is committed to playing its part in delivering the Community's interim environmental objectives set out in Article 5 of the directive. It is important to note that the overarching principle of the integrated 'effects-based' philosophy, which underpins the analytical basis of the NEC directive and the Gothenburg Protocol, is to seek to reduce certain inter-related environmental effects in a cost-effective way and *not* to reduce the emissions of specific pollutants *per se*. It has not been possible to re-run the RAINS model in optimization mode to assess the impact of updated and improved data sets on the optimal NO_x ceiling. However, the over achievement of the NH₃ target and projected over achievement of the SO₂ target will deliver additional reduced acidification and eutrophication in Ireland and abroad thus offsetting to some degree the shortfall in NO_x. The integrated assessment modeling, conducted at the time for the Gothenburg Protocol, concluded that emission reductions in Ireland are driven in particular by two 'binding' grid squares in the west of the country for acidification and in the east of the country for eutrophication. The 'low ammonia' scenario (IIASA, 1998) developed as part of the analysis for the directive indicates that the desired environmental ambition level for acidification and eutrophication can be achieved through a variety of ceilings for NO_x, SO_x, NH₃. An updated sensitivity

analysis could provide valuable information on the best route for Ireland to play its part in the cost effective delivery of the environmental objectives of the directive. Currently, emissions of NH₃ are projected to over achieve the ceiling of 116 kt by approx. 16 kt or 14% while SO₂ is projected to over achieve the ceiling of 42 kt by approx 9 kt or 21%.

Further national consultation and analysis is required to assess the viability of potential further additional measures. Such analysis will need to consider, inter alia, the lesson learned through the EC national programme workshop (EC, 2007) and from the implementation of innovative measures applied in other member states. Such analysis will help to better understand what might constitute a cost effective ceiling for NO_x for Ireland in 2010 consistent with the directive's interim environmental objectives and taking into account cost effectiveness and sectoral equity considerations.

References.

AEAT, 2007. *Analysis of emissions from the power generating sector*. Harwell: AEAT.

DCMNR, 2007. *Delivering a Sustainable Energy Future for Ireland*.
<http://www.dcmnr.gov.ie/Energy/Energy+Planning+Division/Energy+White+Paper.htm>.

DEHLG, 2007. *National Atmospheric Inventory System*. Adopted by Government Decision, 3rd April 2007.

DEHLG, 2006. *Determining the Share of National Greenhouse Gas Emissions for Emissions Trading in Ireland 2008-2012*. Consultancy study conducted by ICF/BOC.

DEHLG, 2003. *Discussion Paper: Strategy to Reduce Emissions of Transboundary Air Pollution by 2010*.

EC, 2007. *Information on the evaluation of 2006 submissions of national programmes under the National Emission Ceilings Directive 2001/81/EC*. Minutes of meeting 22nd May 2007.

EC, 2006. *Assessment on the impact on costs and emissions of technical measures on existing heavy duty vehicles and captive fleets*. (A report commissioned by the EC to explore ways to support retrofit measures to reduce NO_x and PM from HDVs and captive fleets). UK: Sadler Consultants.

EC, 2006. *RECOMMENDATIONS on developing and reporting national programmes under the National Emission Ceilings Directive*. (Recommendations drawn up by the CAFÉ Working Group on Implementation).

EPA, 2007. *A Disproportionate Challenge? Factors underpinning the 2010 NEC NO_x ceiling for Ireland*. Unpublished paper by EPA Post Doc Researcher, Andrew Kelly (University College Dublin). Dublin: EPA.

ESRI, 2005. *Medium Term Review 2005 – 2012*. ESRI: Dublin.

IEA, 2007. *In-Depth Review of the Energy Policies of Ireland 2007*. IEA:Paris.

IIASA, 2007. *Emission control scenarios that meet the objectives of the Thematic Strategy on Air Pollution. Part 2: Scenario analysis*. Laxenburg, Austria: IIASA.

IIASA, 1998. *Cost effective Control of Acidification and Ground Level Ozone. Part B: Emission Control Scenarios*. Sixth Interim Report to the European Commission. Laxenburg, Austria: IIASA.

Teagasc, 2003. *Baseline Projections of Ammonia Emissions from Irish Agriculture*. (<http://www.teagasc.ie/research/discussionpapers/ammonia.htm>)

Annex I: 2001 – 2005 Inventories

NO_x (kilotonnes)					
NFR sectors to be reported to NEC	2001	2002	2003	2004	2005
1 A 1 a Public Electricity and Heat Production	41.156	37.630	33.820	32.342	32.396
1 A 1 b Petroleum refining	0.869	0.847	0.584	0.822	0.936
1 A 1 c Manufacture of Solid Fuels and Other Energy Industries	0.100	0.126	0.143	0.128	0.090
1 A 2 Manufacturing Industries and Construction	15.361	14.960	15.781	16.688	16.989
1 A 2 a Iron and Steel	0.029	0.029	0.004	0.004	0.004
1 A 2 b Non-ferrous Metals	2.427	2.532	2.684	2.768	2.483
1 A 2 c Chemicals	0.853	0.803	0.757	0.744	0.704
1 A 2 d Pulp, Paper and Print	0.164	0.148	0.136	0.123	0.121
1 A 2 e Food Processing, Beverages and Tobacco	3.754	2.940	2.485	1.844	1.886
1 A 2 f Other (Please specify in a covering note)	8.133	8.507	9.715	11.205	11.790
1 A 3 a ii Civil Aviation (Domestic, LTO)	0.141	0.136	0.133	0.136	0.140
1 A 3 a ii Civil Aviation (Domestic, Cruise)	0.095	0.087	0.085	0.092	0.090
1 A 3 b Road Transportation	51.004	47.338	44.613	43.620	42.860
1 A 3 b i R.T., Passenger cars	22.303	18.839	16.952	15.165	13.809
1 A 3 b ii R.T., Light duty vehicles	16.196	17.551	16.622	17.519	18.125
1 A 3 b iii R.T., Heavy duty vehicles	12.407	10.847	10.930	10.824	10.815
1 A 3 b iv R.T., Mopeds & Motorcycles	0.098	0.101	0.109	0.112	0.111
1 A 3 b v R.T., Gasoline evaporation	0.000	0.000	0.000	0.000	0.000
1 A 3 c Railways	1.553	1.367	1.502	1.953	1.750
1 A 3 d ii National Navigation	1.629	0.779	0.739	0.770	0.736
1 A 3 e i Pipeline compressors	0.269	0.274	0.283	0.359	0.436
1 A 4 a Commercial / Institutional	1.991	1.938	2.055	1.959	2.172
1 A 4 b i Residential plants	5.296	5.240	5.331	5.454	5.451
1 A 4 c Agriculture / Forestry / Fishing	11.801	11.846	11.891	11.395	11.756
1 A 4 c i Stationary	0.057	0.057	0.057	0.055	0.057
1 A 4 c ii Off-road Vehicles and Other Machinery	11.744	11.789	11.834	11.340	11.699
2 B 2 Nitric Acid Production	0.374	0.187	NO	NO	NO
National Total	134.791	125.672	119.958	118.721	119.088
International Aviation (LTO)	3.247	3.005	3.082	3.095	3.378
International Aviation (Cruise)	1.853	2.139	2.062	1.859	2.236
International Navigation	9.167	8.199	9.736	8.540	5.922

NO_x (kilotonnes) Adjusted for Fuel Tourism

NFR sectors to be reported to NEC

	2001	2002	2003	2004	2005
1 A 1 a Public Electricity and Heat Production	41.156	37.630	33.820	32.342	32.396
1 A 1 b Petroleum refining	0.869	0.847	0.584	0.822	0.936
1 A 1 c Manufacture of Solid Fuels and Other Energy Industries	0.100	0.126	0.143	0.128	0.090
1 A 2 Manufacturing Industries and Construction	15.361	14.960	15.781	16.688	16.989
1 A 2 a Iron and Steel	0.029	0.029	0.004	0.004	0.004
1 A 2 b Non-ferrous Metals	2.427	2.532	2.684	2.768	2.483
1 A 2 c Chemicals	0.853	0.803	0.757	0.744	0.704
1 A 2 d Pulp, Paper and Print	0.164	0.148	0.136	0.123	0.121
1 A 2 e Food Processing, Beverages and Tobacco	3.754	2.940	2.485	1.844	1.886
1 A 2 f Other (Please specify in a covering note)	8.133	8.507	9.715	11.205	11.790
1 A 3 a ii Civil Aviation (Domestic, LTO)	0.141	0.136	0.133	0.136	0.140
1 A 3 a ii Civil Aviation (Domestic, Cruise)	0.095	0.087	0.085	0.092	0.090
1 A 3 b Road Transportation	39.150	37.278	35.691	34.310	33.509
1 A 3 b i R.T., Passenger cars	18.519	16.056	14.433	12.983	11.719
1 A 3 b ii R.T., Light duty vehicles	11.644	13.066	12.770	13.122	13.585
1 A 3 b iii R.T., Heavy duty vehicles	8.903	8.067	8.392	8.104	8.105
1 A 3 b iv R.T., Mopeds & Motorcycles	0.084	0.089	0.096	0.101	0.100
1 A 3 b v R.T., Gasoline evaporation	0.000	0.000	0.000	0.000	0.000
1 A 3 c Railways	1.553	1.367	1.502	1.953	1.750
1 A 3 d ii National Navigation	1.629	0.779	0.739	0.770	0.736
1 A 3 e i Pipeline compressors	0.269	0.274	0.283	0.359	0.436
1 A 4 a Commercial / Institutional	1.991	1.938	2.055	1.959	2.172
1 A 4 b i Residential plants	5.296	5.240	5.331	5.454	5.451
1 A 4 c Agriculture / Forestry / Fishing	11.801	11.846	11.891	11.395	11.756
1 A 4 c i Stationary	0.057	0.057	0.057	0.055	0.057
1 A 4 c ii Off-road Vehicles and Other Machinery	11.744	11.789	11.834	11.340	11.699
2 B 2 Nitric Acid Production	0.374	0.187	NO	NO	NO
National Total	122.937	115.612	111.036	109.411	109.737
International Aviation (LTO)	3.247	3.005	3.082	3.095	3.378
International Aviation (Cruise)	1.853	2.139	2.062	1.859	2.236
International Navigation	9.167	8.199	9.736	8.540	5.922

SO₂ (kilotonnes)					
NFR sectors to be reported to NEC	2001	2002	2003	2004	2005
1 A 1 a Public Electricity and Heat Production	76.722	61.226	44.579	44.002	42.503
1 A 1 b Petroleum refining	0.475	0.737	0.459	0.697	0.915
1 A 1 c Manufacture of Solid Fuels and Other Energy Indus	0.299	0.378	0.428	0.385	0.271
1 A 2 Manufacturing Industries and Construction	29.309	18.547	13.840	10.645	10.164
1 A 2 a Iron and Steel	0.003	0.003	0.000	0.000	0.000
1 A 2 b Non-ferrous Metals	15.285	11.970	7.900	5.009	4.408
1 A 2 c Chemicals	2.064	0.768	0.645	0.574	0.544
1 A 2 d Pulp, Paper and Print	0.127	0.069	0.073	0.082	0.079
1 A 2 e Food Processing, Beverages and Tobacco	7.137	2.922	2.377	1.970	2.029
1 A 2 f Other (Please specify in a covering note)	4.694	2.816	2.844	3.010	3.104
1 A 3 a ii Civil Aviation (Domestic, LTO)	0.014	0.013	0.013	0.013	0.014
1 A 3 a ii Civil Aviation (Domestic, Cruise)	0.021	0.020	0.019	0.021	0.020
1 A 3 b Road Transportation	1.723	1.471	1.470	1.344	0.537
1 A 3 b i R.T., Passenger cars	0.693	0.630	0.642	0.635	0.397
1 A 3 b ii R.T., Light duty vehicles	0.647	0.558	0.531	0.461	0.091
1 A 3 b iii R.T., Heavy duty vehicles	0.381	0.277	0.290	0.241	0.045
1 A 3 b iv R.T., Mopeds & Motorcycles	0.002	0.006	0.007	0.007	0.004
1 A 3 b v R.T., Gasoline evaporation	0.000	0.000	0.000	0.000	0.000
1 A 3 c Railways	0.142	0.125	0.137	0.178	0.160
1 A 3 d ii National Navigation	0.862	0.724	0.344	0.363	0.344
1 A 3 e i Pipeline compressors	0.000	0.000	0.000	0.000	0.000
1 A 4 a Commercial / Institutional	2.444	2.095	3.089	2.303	2.334
1 A 4 b i Residential plants	16.555	13.363	12.608	11.301	12.167
1 A 4 c Agriculture / Forestry / Fishing	0.839	0.730	0.733	0.702	0.724
1 A 4 c i Stationary	0.084	0.084	0.084	0.081	0.084
1 A 4 c ii Off-road Vehicles and Other Machinery	0.755	0.646	0.648	0.621	0.641
National Total	129.643	99.651	77.947	72.183	70.402
International Aviation (LTO)	0.260	0.241	0.247	0.248	0.271
International Aviation (Cruise)	0.417	0.481	0.464	0.418	0.503
International Navigation	2.404	3.189	3.905	3.051	1.592

NM VOC (kilotonnes)

NFR sectors to be reported to NEC	2001	2002	2003	2004	2005
1 A 1 a Public Electricity and Heat Production	0.258	0.252	0.229	0.210	0.240
1 A 1 b Petroleum refining	0.004	0.004	0.003	0.004	0.006
1 A 1 c Manufacture of Solid Fuels and Other Energy Industries	0.100	0.126	0.143	0.128	0.090
1 A 2 Manufacturing Industries and Construction	0.570	0.535	0.517	0.556	0.645
1 A 2 a Iron and Steel	0.001	0.001	0.000	0.000	0.000
1 A 2 b Non-ferrous Metals	0.010	0.011	0.013	0.014	0.014
1 A 2 c Chemicals	0.018	0.018	0.018	0.018	0.017
1 A 2 d Pulp, Paper and Print	0.005	0.004	0.004	0.003	0.003
1 A 2 e Food Processing, Beverages and Tobacco	0.145	0.111	0.171	0.144	0.167
1 A 2 f Other (Please specify in a covering note)	0.391	0.390	0.312	0.377	0.444
1 A 3 a ii Civil Aviation (Domestic, LTO)	0.009	0.008	0.008	0.008	0.008
1 A 3 a ii Civil Aviation (Domestic, Cruise)	0.003	0.003	0.003	0.003	0.003
1 A 3 b Road Transportation	33.660	28.206	24.897	21.530	19.037
1 A 3 b i R.T., Passenger cars	16.410	13.757	12.097	10.543	9.198
1 A 3 b ii R.T., Light duty vehicles	2.057	2.073	1.960	2.063	2.041
1 A 3 b iii R.T., Heavy duty vehicles	2.582	2.342	2.375	2.369	2.472
1 A 3 b iv R.T., Mopeds & Motorcycles	1.975	1.858	1.905	1.627	1.216
1 A 3 b v R.T., Gasoline evaporation	10.636	8.176	6.560	4.928	4.110
1 A 3 c Railways	0.201	0.177	0.195	0.253	0.227
1 A 3 d ii National Navigation	0.183	0.087	0.083	0.086	0.083
1 A 3 e i Pipeline compressors	0.000	0.000	0.000	0.000	0.000
1 A 4 a Commercial / Institutional	0.327	0.318	0.626	0.573	0.601
1 A 4 b i Residential plants	4.696	4.488	4.328	4.221	4.366
1 A 4 c Agriculture / Forestry / Fishing	1.747	1.754	1.761	1.687	1.741
1 A 4 c i Stationary	0.011	0.011	0.011	0.011	0.011
1 A 4 c ii Off-road Vehicles and Other Machinery	1.736	1.743	1.749	1.676	1.729
1 B 2 a Oil and Natural Gas	6.780	6.827	6.833	6.865	7.309
1 B 2 a iv Refining/Storage	1.345	1.272	1.286	1.171	1.324
1 B 2 a v Distribution of oil products	5.436	5.555	5.548	5.695	5.985
3	25.558	24.824	24.376	24.288	24.206
3 A Paint Application	8.375	8.649	8.625	8.700	8.785
3 B Degreasing and Dry Cleaning	1.660	1.067	1.141	1.155	1.079
3 C Chemical Products, Manufacture and Processing	3.168	2.986	2.805	2.622	2.440
3 D Other	12.355	12.121	11.805	11.811	11.901
4 D Agricultural Soils	3.352	3.349	3.320	3.304	3.304
National Total	77.680	71.174	67.542	63.939	62.108
International Aviation (LTO)	0.235	0.218	0.223	0.224	0.245
International Aviation (Cruise)	0.056	0.064	0.062	0.056	0.067
International Navigation	0.386	0.346	0.410	0.360	0.250

NH₃ (kilotonnes)

NFR sectors to be reported to NEC	2001	2002	2003	2004	2005
1 A 3 b Road Transportation	1.995	2.168	2.262	2.408	2.583
1 A 3 b i R.T., Passenger cars	1.962	2.135	2.230	2.376	2.550
1 A 3 b ii R.T., Light duty vehicles	0.023	0.023	0.022	0.022	0.023
1 A 3 b iii R.T., Heavy duty vehicles	0.009	0.009	0.009	0.009	0.009
1 A 3 b iv R.T., Mopeds & Motorcycles	0.001	0.001	0.001	0.001	0.001
1 A 3 b v R.T., Gasoline evaporation	0.000	0.000	0.000	0.000	0.000
2 B 2 Nitric Acid Production	0.123	NO	NO	NO	NO
4 B Manure Management	106.299	105.523	104.660	103.768	103.107
4 B 1 Cattle	91.549	91.095	90.503	89.491	89.075
4 B 1 a Dairy	32.982	32.810	32.390	32.666	32.308
4 B 1 b Non-Dairy	58.567	58.285	58.113	56.825	56.767
4 B 3 Sheep	5.225	4.951	4.809	4.765	4.656
4 B 8 Swine	7.038	7.089	6.855	6.830	6.824
4 B 9 Poultry	2.487	2.388	2.493	2.682	2.552
4 D Agricultural Soils	8.887	7.314	6.652	6.957	7.007
4 D 1 Direct Soil Emission	8.887	7.314	6.652	6.957	7.007
National Total	117.304	115.005	113.574	113.133	112.697

Annex II Emission Trends 2001- 2010

NO_x Emission Trends (tonnes) 2001 - 2010⁸ 'with' measures scenario

		NOx Trends 2001 - 2010.									
Sector	Subsector	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Energy Industries	Powergen	41,156	37,630	33,820	32,342	32,396	28,851	25,852	19,019	16,218	13,254
	Refining	869	847	584	822	936	800	800	800	800	800
	Man. Solid Fuels	100	126	143	128	90	100	100	100	100	100
	<i>SubTotal</i>	42,125	38,603	34,547	33,292	33,422	29,751	26,752	19,919	17,118	14,154
Residential		5,295	5,240	5,330	5,453	5,450	5,760	5,633	5,492	5,388	5,330
Comm/Instit		1,991	1,938	2,055	1,959	2,172	2,465	2,533	2,584	2,631	2,678
Agriculture		11,801	11,846	11,891	11,395	11,756	11,439	11,164	10,903	10,703	10,542
Gas Transport	Gas Transport	269	274	283	359	436	446	458	477	496	515
Industry		15,361	14,960	15,781	16,688	16,989	15,123	15,562	17,235	14,834	15,551
Road Transport	Passenger Cars	22,303	18,839	16,952	15,165	13,809	13,480	12,347	11,355	10,161	9,275
	Light Duty Vehicles	16,196	17,551	16,622	17,519	18,125	19,007	20,279	21,057	22,539	22,422
	Heavy Duty Vehicles	7,860	6,703	6,728	6,619	6,392	6,535	6,327	6,556	6,467	5,974
	Buses	4,547	4,144	4,202	4,205	4,423	4,501	4,668	5,120	5,367	5,465
	Mopeds & Motorcycles	98	101	109	112	111	110	119	112	129	127
	<i>Subtotal</i>	51,004	47,338	44,613	43,620	42,860	43,633	43,740	44,200	44,663	43,263
Aviation		3,388	3,141	3,215	3,231	3,517	3,613	3,696	3,761	3,818	3,882
Rail		1,553	1,367	1,502	1,953	1,750	1,750	1,750	1,750	1,750	1,750
Navigation		1,629	779	739	770	736	736	736	736	736	736
Total		134,417	125,484	119,957	118,720	119,088	114,715	112,026	107,057	102,137	98,400

⁸ Inventory 2001 – 2005 and projection 2006 – 2010.

NO_x Emission Trends (tonnes) 2001 - 2010⁹ 'with additional' measures scenario

		NO _x Trends 2001 - 2010.									
Sector	Subsector	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Energy Industries	Powergen	41,156	37,630	33,820	32,342	32,396	28,230	25,020	18,100	15,600	12,530
	Refining	869	847	584	822	936	800	800	800	800	800
	Man. Solid Fuels	100	126	143	128	90	100	100	100	100	100
	<i>SubTotal</i>	42,125	38,603	34,547	33,292	33,422	29,130	25,920	19,000	16,500	13,430
Residential		5,295	5,240	5,330	5,453	5,450	5,760	5,633	5,492	5,388	5,330
Comm/Instit		1,991	1,938	2,055	1,959	2,172	2,465	2,533	2,584	2,631	2,678
Agriculture		11,801	11,846	11,891	11,395	11,756	11,439	11,164	10,903	10,703	10,542
Gas Transport	Gas Transport	269	274	283	359	436	446	458	477	496	515
Industry		15,361	14,960	15,781	16,688	16,989	15,123	15,562	17,235	10,201	10,685
Road Transport	Passenger Cars	22,303	18,839	16,952	15,165	13,809	13,480	12,347	11,355	10,161	9,275
	Light Duty Vehicles	16,196	17,551	16,622	17,519	18,125	19,007	20,279	21,057	22,539	22,422
	Heavy Duty Vehicles	7,860	6,703	6,728	6,619	6,392	6,535	6,327	6,556	6,467	5,974
	Buses	4,547	4,144	4,202	4,205	4,423	4,501	4,668	5,120	5,367	5,465
	Mopeds & Motorcycles	98	101	109	112	111	110	119	112	129	127
	<i>Subtotal</i>	51,004	47,338	44,613	43,620	42,860	43,633	43,740	44,200	44,663	43,263
Aviation		3,388	3,141	3,215	3,231	3,517	3,613	3,696	3,761	3,818	3,882
Rail		1,553	1,367	1,502	1,953	1,750	1,750	1,750	1,750	1,750	1,750
Navigation		1,629	779	739	770	736	736	736	736	736	736
Total		134,417	125,484	119,957	118,720	119,088	114,095	111,193	106,138	96,886	92,811

⁹ Inventory 2001 – 2005 and projection 2006 – 2010.

SO₂ Emission Trends (tonnes) 2001 - 2010¹⁰ 'with' measures scenario

		SO ₂ Trends 2001 - 2010.									
Sector	Subsector.	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Powergen	Powergen	76,722	61,226	44,579	44,002	42,503	38,900	31,100	17,100	12,500	10,600
	Refining	475	737	459	697	915	750	750	750	750	750
	Man. Solid Fuels	299	378	428	385	271	250	250	250	250	250
	Sub total	77,496	62,342	45,466	45,085	43,688	39,900	32,100	18,100	13,500	11,600
Residential		16,555	13,363	12,608	11,302	12,167	11,324	10,350	8,846	8,179	7,628
Comm/Instit		2,444	2,095	3,089	2,303	2,334	2,743	2,788	1,948	1,963	1,977
Agriculture		839	730	733	702	724	705	688	643	631	622
Gas Transport	Gas Transport	0	0	0	0	0	0	0	0	0	0
Industry		29,309	18,547	13,840	10,645	10,164	9,310	9,442	9,870	10,092	10,351
Road Transport	Passenger Cars	693	630	644	635	397	324	237	146	47	48
	Light Duty Vehicles	647	558	531	461	91	79	67	54	34	35
	Heavy Duty Vehicles	266	188	196	162	31	26	21	17	11	10
	Buses	115	89	94	79	15	13	10	8	5	5
	Mopeds & Motorcycles	2	6	7	7	4	3	3	1	0	0
	Sub total	1,723	1,471	1,472	1,344	538	445	338	226	97	98
Aviation		274	254	260	262	284	292	299	304	309	314
Rail		142	125	137	178	160	160	160	160	160	160
Navigation		862	724	344	363	344	344	344	344	344	344
Total		129,643	99,651	77,949	72,183	70,403	65,222	56,508	40,440	35,273	33,093

¹⁰ Inventory 2001 – 2005 and projection 2006 – 2010.

VOCs Emission Trends (tonnes) 2001 - 2010¹¹ 'with' measures scenario

		NMVOC Trends 2001 - 2010.									
Sector	Subsector	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Powergen	Powergen	258	252	229	210	240	290	280	280	280	280
	Refining	4	4	3	4	6	5	5	5	5	5
	Man. Solid Fuels	100	126	143	128	90	100	100	100	100	100
	Sub total	361	382	375	343	336	395	385	385	385	385
Residential		4,696	4,488	4,328	4,221	4,366	4,076	3,780	3,495	3,253	3,055
Comm/Instit		327	318	626	573	600	775	784	791	797	803
Agriculture	Energy use	1,747	1,754	1,761	1,687	1,741	1,694	1,653	1,614	1,585	1,561
	Soils	3,352	3,350	3,320	3,300	3,300	3,300	3,300	3,300	3,300	3,300
	Sub total	5,099	5,104	5,081	4,987	5,041	4,994	4,953	4,914	4,885	4,861
Gas Transport	Oil and Natural Gas	6,780	6,830	6,830	6,870	7,310	7,310	7,310	7,310	7,310	7,310
Solvent Use	NFR 3	25,558	24,824	24,376	24,288	24,206	23,886	23,570	23,258	22,951	22,647
Industry		570	535	517	556	645	539	550	581	593	610
Road Transport	Passenger Cars	26,230	21,219	17,978	14,838	12,734	11,581	10,355	9,302	8,406	7,865
	Light Duty Vehicles	2,440	2,344	2,162	2,219	2,147	2,359	2,395	2,387	2,494	2,393
	Heavy Duty Vehicles	2,009	1,789	1,809	1,795	1,828	1,916	1,865	1,940	1,920	1,801
	Buses	572	553	567	574	644	664	691	759	795	809
	Mopeds & Motorcycles	2,408	2,303	2,382	2,104	1,684	1,899	1,973	1,774	1,997	1,860
	Sub total	33,659	28,208	24,898	21,530	19,037	18,419	17,279	16,162	15,612	14,728
Aviation		244	226	231	232	253	259	265	270	274	278
Rail		201	177	195	253	227	227	227	227	227	227
Navigation		183	87	83	86	83	83	83	83	83	83
Total		77,678	71,180	67,540	63,941	62,105	60,962	59,186	57,476	56,369	54,988

¹¹ Inventory 2001 – 2005 and projection 2006 – 2010.

NH₃ Emission Trends (kts) 2001 - 2010¹² 'with' measures scenario

Sector	Subsector	NH ₃ 2001 - 2010		With measures							
		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Agriculture	Cattle	91,550	91,095	90,503	89,491	89,075	88,014	83,484	80,903	79,336	78,338
	Pigs	7,038	7,089	6,855	6,830	6,824	6,793	6,610	6,470	6,425	6,405
	Sheep	5,225	4,951	4,809	4,765	4,656	4,334	4,385	4,386	4,341	4,255
	Poultry	2,487	2,388	2,493	2,682	2,552	2,501	2,496	2,492	2,488	2,484
	Grassland & Maize	8,376	6,716	6,059	6,327	6,457	6,515	6,505	6,493	6,480	6,464
	Tillage Crops	511	598	593	630	550	493	490	517	515	515
	Sub total	115,187	112,837	111,312	110,725	110,114	108,650	103,970	101,261	99,585	98,460
Road Transport	Passenger Cars	1,962	2,135	2,230	2,376	2,550	2,675	2,789	2,904	2,950	3,010
	Light Duty Vehicles	23	23	22	22	23	20	23	24	26	26
	Heavy Duty Vehicles	7	7	7	7	7	7	8	9	10	10
	Buses	2	2	2	2	2	2	2	2	3	2
	Mopeds & Motorcycles	1	1	1	1	1	1	1	1	1	1
	Sub total	1,995	2,168	2,262	2,408	2,583	2,705	2,823	2,940	2,990	3,049
Total	117,182	115,005	113,574	113,133	112,697	111,355	106,793	104,201	102,574	101,509	

¹² Inventory 2001 – 2005 and projection 2006 – 2010.

Annex 3 Assumptions for 2010 Projections

SO₂	With Measures	With Additional Measures.
Power sector	<ul style="list-style-type: none"> Assumes 13% renewables (Directive 2001/77/EC) by 2010. Under LCP:NERP, Moneypoint, reduces SO₂ in 2010 by about 89% compared to 2005 - 80% from FGD and remainder from reduced run time. Assume 2005 emission factors for peat. 99/32/EC 0.1% gasoil 	<ul style="list-style-type: none"> Assumes 18% renewables in 2010 – 30% by 2020. Wind component is 14% of total generation in 2010..
Residential sector	<ul style="list-style-type: none"> 0.45% assumed for post 2005 coal as per SFTG agreement Pet coke sulphur levels assumed 2.7% as per SFTG agreement falling to 2% in 2008. Gasoil sulphur content 1600 ppm falling to 1000 ppm (0.1% S) from 2008 as per 99/32/EC. 	
Commercial	<ul style="list-style-type: none"> Gasoil sulphur content 1600 ppm falling to 1000 ppm (0.1% S) from 2008 as per 99/32/EC. 0.45% assumed for coal as per SFTG agreement HFO at 1% S as per 99/32/EC. 	
Industrial	<ul style="list-style-type: none"> Gasoil sulphur content 1000 ppm (0.1% S) gasoil from 2008 as per 99/32/EC. Mix of HFO at 1% and 0.7%. For non ferrous metals (single installation) boiler is gas fired (new CHP plant) but calciner remains oil fired. 	
Road Transport	<ul style="list-style-type: none"> Sulphur free (10 ppm) fuels from 2009 Projections based on uptake of Euro standards as per legislative requirements using COPERT III model. 	
Other Mobile	<ul style="list-style-type: none"> Assumes sulphur content for rail fuel at 50 ppm as for road fuel, not required legislatively but same storage is used for road/rail bunkers. Nav fuel/gas oil at 1% as per 99/32/EC. 	<p><i>Potential further additional measures – not quantified.</i></p> <ul style="list-style-type: none"> Rail/road fuel may move to sulphur free diesel Ag gasoil move to 10ppm or as for road fuel
Agriculture	<ul style="list-style-type: none"> Agricultural diesel at 1000 ppm 	<p><i>Potential further additional measures – not quantified.</i></p> <ul style="list-style-type: none"> Ag assumed at 10ppm as for road fuel

NO_x	With Measures	With Additional Measures.
Power Sector	<ul style="list-style-type: none"> 13% renewables (Directive 2001/77/EC) by 2010 –wind generation accounts for 11% of total generation. Under LCP NERP, Moneypoint, reduces emissions in 2010 by about 79% compared to 2005. 70% results from SCR and the remainder from reduced run time.’ 	<ul style="list-style-type: none"> Assumes 18% renewables in 2010 (linear increase to 30% by 2020). Wind component is 14% of total generation..
Residential sector	<ul style="list-style-type: none"> All emission factors as for 2005 inventory. 	
Commercial sector	<ul style="list-style-type: none"> All emission factors as for 2005 inventory.. 	
Industry sector	<ul style="list-style-type: none"> Non ferrous metals sector converts to gas fired CHP. LCP NERP applies to some installations. Assume BAT in the cement sector at 800 mg/m³ 	<ul style="list-style-type: none"> Assume BAT as 500 mg/m³ for cement sector.
Road Transport	<ul style="list-style-type: none"> Projections based on uptake of Euro standards as per legislative requirements using Copert III model 	<i>Potential further additional measures – not quantified.</i> <ul style="list-style-type: none"> Examine viability of retrofit scheme for HDVs and captive fleets.
Other Mobile	<ul style="list-style-type: none"> Rail and navigation held at 2005 values. 	

VOCs	With Measures	With Additional Measures.
Power Sector	<ul style="list-style-type: none"> 13% renewables (Directive 2001/77/EC) by 2010 –wind generation accounts for 11% of total generation.’ 	<ul style="list-style-type: none"> Assumes 18% renewables in 2010 (linear increase to 30% by 2020). Wind component is 14% of total generation..
Residential sector	<ul style="list-style-type: none"> All emission factors as for 2005 inventory. 	
Commercial, industry & residential	<ul style="list-style-type: none"> All emission factors as for 2005 inventory.. Assume emissions for NFR 3 remain as for 2005 until 2010. 	
Road Transport	<ul style="list-style-type: none"> Projections based on uptake of Euro standards as per legislative requirements using Copert III model 	<i>Potential further additional measures – not quantified.</i> <ul style="list-style-type: none"> Installation of vapour recovery a petrol filling stations..
Other Mobile	<ul style="list-style-type: none"> Rail and navigation held at 2005 values. 	

NH₃	With Measures	With Additional Measures.
Agriculture	<ul style="list-style-type: none"> Low Nitrogen Application techniques grant aided at 40%. 	
Road Transport	<ul style="list-style-type: none"> Projections based on uptake of Euro standards as per legislative requirements using Copert III model 	