

**European Commission**

**National Emission  
Ceilings Directive  
Review**

Proposal

May 2004

Entec UK Limited



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**Report for**

Philip Owen  
Head of Unit  
'Markets' Team  
DG ENV.F.2 (BU-5 00/122)  
B-1049  
Brussels  
Belgium

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**Main Contributors**

Alistair Ritchie  
Alun McIntyre  
Helen ApSimon (Imperial College)  
Katherine Wilson  
Ben Grebot  
Ian Spencer

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**Issued by**

.....  
Alistair Ritchie

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**Approved by**

.....  
Alun McIntyre

---

**Entec UK Limited**

Windsor House  
Gadbrook Business Centre  
Gadbrook Road  
Northwich  
Cheshire  
CW9 7TN  
England  
Tel: +44 (0) 1606 354800  
Fax: +44 (0) 1606 354810

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# European Commission

## National Emission Ceilings Directive Review

Proposal

May 2004

Entec UK Limited



Certificate No. EMS 69090



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# Glossary

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AQEG	Air Quality Expert Group
BAU	Business as usual
CAFE	Clean Air for Europe
CITEPA	Centre Interprofessionnel Technique d'Etudes Pollution Atmospherique
CLE	Current Legislation
Defra	Department for Environment, Food and Rural Affairs
EEA	European Environmental Agency
EPA	Environmental Protection Agency
GIS	Geographic Information Systems
IPPC	Integrated pollution prevention and control
LCP	Large Combustion Plant
MBIs	Market-Based Instruments
NAEI	National Atmospheric Emissions Inventory
NEC	National Emission Ceilings
NH <sub>3</sub>	Ammonia
NO <sub>x</sub>	Oxides of nitrogen
PM	Particulate Matter
PM <sub>10</sub>	Particulate matter of less than 10 µm diameter
SCLF	Sulphur content in liquid fuels
SED	Solvent Emissions Directive
SO <sub>2</sub>	Sulphur dioxide
UNFCCC	United Nations Framework Convention on Climate Change
VOCs	Volatile organic compounds



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# 1. Project Understanding

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## 1.1 Introduction

In its Call for Tenders, the European Commission ('Commission') requests proposals to assist with four tasks associated with the review of the National Emission Ceilings Directive (NEC Directive) - in depth analysis of the NEC national programs; analysis of the feasibility of an emission ceiling for particulate matter (PM); development of an NEC review report and recommendations for further legislation and for the thematic strategy; and stakeholder consultation.

Entec UK Limited ('Entec'), together with Professor Helen ApSimon from Imperial College London, are pleased to respond to the Call for Tenders (hereafter, 'Project Team'). We believe that the Project Team is very well suited to develop a high quality and useful product within the timeframe outlined in the Call for Tenders for the reasons listed below.

- The Project Team has exceptional air emissions policy development and implementation experience in all key policies directly relevant to the Review of the NEC Directive. As such, we understand the policy context for this study, which will be important to ensure that the work is focussed and delivers a useful product to support the NEC Directive review. This experience has been gained widely across the Project Team through a number of detailed and comprehensive studies for the Commission, the UK Department for Environment, Food and Rural Affairs (Defra) and other clients. This will provide valuable insight and information on baseline emissions and measures; additional abatement measures; costs and benefits. This experience is summarised in Table 1.1 and results in a detailed practical and policy-level understanding of:
  - the NEC Directive itself,
  - the Gothenburg Protocol,
  - the Large Combustion Plant Directive (LCP Directive),
  - Auto/Oil EURO standards,
  - Solvents Directive,
  - Stage I Directive,
  - Stage II Petrol Vapour Recovery,
  - Product Directive (VOC in paints),
  - Integrated Pollution Prevention and Control (IPPC) Directive,
  - Sulphur content in liquid fuels (SCLF) Directive,
  - Sulphur content in marine fuels Directive,
  - Standards for motorcycles and mopeds,
  - Legislation on non-road mobile machinery.

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- Entec is familiar with undertaking reviews of key directives and assessments of national plans for the Commission. This includes a major current study on the preparation for the review of the LCP Directive and a study to undertake technical assessments of National Plans from EU25 Member States under the LCP Directive. Through this and our other policy work, we appreciate the importance of the linkages between other projects under the Clean Air for Europe (CAFE) Programme.
  - Entec has extensive experience of working with, and development of, air emission inventories and projections. Notably, within our work for Defra on Cost Curves for Air Pollutants, we interfaced cost curve databases with the UK National Atmospheric Emissions Inventory (NAEI), the UK Integrated Assessment Model and specialist environmental models. Specialist input was provided by Entec to improve the quality and accuracy of the UK NAEI for sulphur dioxide (SO<sub>2</sub>), oxides of nitrogen (NO<sub>x</sub>), volatile organic compounds (VOCs) and particulate matter of less than 10 µm diameter (PM<sub>10</sub>). Furthermore, Entec is experienced in providing data input to models such as the TREMOVE transport emissions model (based on our recent work for the Commission on quantifying European shipping emissions) and the RAINS model (developed by IIASA). Data from the UK cost curves developed by Entec was provided in a format suitable for RAINS, and Entec was responsible for providing support in developing the UK's baseline scenario data.
  - Our associate consultant, Professor Helen ApSimon, brings a long track record in air emissions policy development relevant to the Review of the NEC Directive. Her research in air pollution developed from modelling studies of nuclear accidents and diversified into international issues such as acid rain and air pollution problems in Eastern Europe. Over the last twelve years she has worked extensively for Task Forces under the UN ECE Convention on Long-Range Transboundary Air Pollution, undertaking modelling and assessment of cost-effective strategies to reduce acidification, eutrophication, excess tropospheric ozone and fine particulate concentrations. She also has strong interests in urban air pollution, particularly in London where she chairs the APRIL (Air Pollution Research in London) network. She was a founder member and Chairman, and is now President, of the European Association for the Science of Air Pollution. She has been a member of numerous expert groups and committees, including the Airborne Particles Expert Group, the National Expert Group on Transboundary Air Pollution and the Air Quality Expert Group of Defra. Entec has established a strong working relationship with Helen on a number of recent projects on developing Cost Curves for Air Pollutants for Defra.
  - On the basis of Entec's depth of skills and expertise in the field of local air quality management, delivering high quality assessments on behalf of a number of UK local authorities, Entec was commissioned in 2003 by several UK local authorities to undertake their Updating & Screening Assessments (U&SA). Entec is currently undertaking several reviews and assessments and is working in partnership with UK local authorities in terms of the designation of Air Quality Management Areas and the formulation and implementation of Air Quality Action Plans.
  - Entec has exceptional experience in the field of Cost-Effectiveness Analysis and marginal abatement costs. This is particularly reflected in being awarded the major 3-year research contract by Defra last year in developing 'Cost Curves for Air Pollutants'. This project is to support forthcoming air quality policy development by developing the UK's most

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robust and transparent cost curves for SO<sub>2</sub>, NO<sub>x</sub>, VOCs, PM<sub>10</sub>, and other pollutants, including a large number of business as usual (BAU) and beyond BAU measures for each pollutant against various reference years. Our work has been used in informing the development of the RAINS database. Our capability in this field is supported by a strong technical understanding of the key stationary and mobile emission source sectors, the abatement measures that are currently in place, the potential additional measures, their impact on emissions and their costs.

- We have undertaken a significant number of quantitative Cost-Benefit Analysis studies to support air quality policy development, policy negotiations and Regulatory Impact Assessments. This work utilises quantitative benefit analysis techniques for human health and environmental benefits, linked with specialised air quality modelling approaches and GIS to determine impacts at a 1 km x 1 km resolution. We are experienced in the subsequent valuation of such benefits using a range of approaches. Our team of environmental economists is employed to support this work as appropriate. Examples of some of the policies relevant to the NEC Directive for which we have undertaken Cost-Benefit Analysis studies are shown in Table 1.1.
- Entec is experienced in the evaluation of Market-Based Instruments (MBIs) for NEC pollutants. This includes current work to investigate the feasibility and desirability of MBIs for SO<sub>2</sub> and NO<sub>x</sub> for LCPs across the EU25 in our current Commission study on the Review of the LCP Directive. From this and other work we have a detailed understanding of the proposed Dutch NO<sub>x</sub> trading scheme, NO<sub>x</sub> taxation in Sweden, other regional and national taxes in the EU25, and the NO<sub>x</sub> and SO<sub>2</sub> trading schemes in the US. Furthermore, we recently completed a major project for Defra on the external costs of SO<sub>2</sub> and NO<sub>x</sub> and the scope for MBIs for the UK's industrial sector. Our detailed experience of MBIs includes significant work on the technical and economic development and assessment LCP Directive National Plans for Defra in the UK, our guidance document for the Commission on LCP Directive National Plans, and our subsequent Commission project on the review of those plans from EU25 Member States.
- Through our extensive project work for the Commission and Defra in recent years Entec has built up a wide network of policy, regulatory and industrial contacts across the EU25. This will be a valuable resource in support of this study. This includes current survey work on the Review of the LCP Directive, covering many contacts that would also be relevant to the NEC Directive Review.
- The Project Manager, Alistair Ritchie, is very experienced in successfully managing complex, multi-disciplinary air quality policy development projects for the European Commission and Defra. This will ensure that this challenging project is managed to meet the Commission's quality and timescale needs, by dynamic planning, clear roles and objectives for team members, and close communication with the Commission and within the Project Team. His experience includes management of projects involving detailed air emissions assessments within Geographic Information Systems (GIS) databases; detailed techno-economic evaluations of abatement measures; Cost-Effectiveness Analysis; Cost-Benefit Analysis; and Market-Based Instruments. For example, he managed the Cost Benefit Analysis of the NEC Directive for Defra; he is managing the current Commission studies on the Review of the LCP Directive and the Assessment of National Plans under the LCP Directive; and he is also Project Director for a 3 year Defra research study on Cost Curves for Air Pollutants.

- Entec has consistently and successfully completed projects for European Commission DG Environment and Defra within agreed deadlines and meeting stringent quality requirements. We have demonstrated our ability to be flexible in meeting your specific needs as they develop, which will be important for this project. The ability to resource this diverse project with predominantly in-house staff will enable a high level of control, responsiveness and effectiveness from the project team.
- In dealing with NEC national programmes in other languages and in seeking data from countries where English is not widely spoken the proposed project team has ample language expertise (French, German, Italian, Spanish, Dutch, Finnish, Swedish) to cover most requirements. Where there is a requirement to translate documents into English, we will use Malla Translations, a company experienced in working for the Commission and a company that Entec is currently working with on the assessment of National Plans under the LCP Directive for the Commission.
- Overall, the combined experience of the Project Team uniquely positions us to complete all four major tasks outlined in the Technical Annex.

**Table 1.1 Selected experience of project team relevant to the Review of the NEC Directive**

Policy	Type of Project	Client	Pollutant				
			SO <sub>2</sub>	NO <sub>x</sub>	VOC	NH <sub>3</sub>	PM
NEC Directive	Cost Benefit Analysis	Defra	✓	✓	✓	✓	
Gothenburg Protocol	Cost Benefit Analysis	Defra	✓	✓	✓	✓	
	Compliance Cost Assessment of GP ELVs	Defra	✓	✓	✓	✓	
	Integrated Assessment Modelling	Defra	✓	✓	✓	✓	✓
Large Combustion Plant Directive (LCP Directive)	Review of the LCP Directive	EC	✓	✓			✓
	Assessment of National Plans from Member States under the LCP Directive	EC	✓	✓			✓
	Development of guidance on National Plans under the LCP Directive	EC	✓	✓			✓
	Development of the UK National Plan under the LCP Directive (several studies including assessments of MBIs)	Defra	✓	✓			✓
	Cost Benefit Analysis under the ELV and National Plan approaches (several studies)	Defra	✓	✓			✓
Auto/Oil EURO standards	Development of Revised UK Cost Curves for NO <sub>x</sub> , VOCs, PM and SO <sub>2</sub>	Defra	✓	✓	✓		✓
	Technical policy support on transport in Defra's AEQ Division	Defra	✓	✓	✓	✓	✓
Solvents Directive	Costs and Benefits of reducing vehicle emissions in the EU vehicle refinishing sector	EC			✓		
	Cost Benefit Analysis of Solvent Emissions Directive	Defra			✓		
	Cost Benefit Analysis of application of Solvent Emissions Directive to Dry Cleaning Sector	Defra			✓		
	Development of Revised UK Cost Curve for VOC	Defra			✓		
	Implementation for vehicle refinishing sector, surface cleaning and dry cleaning	Defra			✓		
Stage I Directive	Development of Revised UK Cost Curve for VOC	Defra			✓		
Stage II Petrol Vapour Recovery	Design of Scheme and Cost Benefit Analysis	Defra			✓		
	Development of Revised UK Cost Curve for VOC	Defra			✓		
Product Directive (VOC in paints)	Cost Benefit Analysis	Defra			✓		

Policy	Type of Project	Client	Pollutant				
			SO <sub>2</sub>	NO <sub>x</sub>	VOC	NH <sub>3</sub>	PM
IPPC Directive	Development of Revised UK Cost Curve for VOC	Defra			✓		
	Large number of projects for industry and regulators to implement the IPPC Directive and develop assessments of Best Available Techniques (BAT)	Various	✓	✓	✓	✓	✓
Sulphur content in liquid fuels Directive	Cost Benefit Analysis	Defra	✓				
Sulphur content in marine fuels Directive	Cost Benefit Analysis	Defra	✓				
	Development of Revised UK Cost Curve for SO <sub>2</sub>	Defra	✓				
EU Ship Emissions Strategy	Quantification of emissions from ships in EU sea areas	EC	✓	✓	✓		✓
	Development of Revised UK Cost Curve for SO <sub>2</sub> and NO <sub>x</sub>	Defra	✓	✓			
Standards for motorcycles and mopeds	Development of Revised UK Cost Curve for NO <sub>x</sub> , VOC, PM	Defra		✓	✓		✓
	Technical policy support on transport in Defra's AEQ Division	Defra	✓	✓	✓		✓
Legislation on non-road mobile machinery	Development of Revised UK Cost Curve for NO <sub>x</sub> , VOC and PM	Defra		✓	✓		✓
	Technical policy support on transport in Defra's AEQ Division	Defra	✓	✓	✓		✓
Waste Incineration Directive	Cost Benefit Analysis and investigation into Member States with tighter standards	Defra	✓	✓	✓	✓	✓
4 <sup>th</sup> Air Quality Daughter Directive	Economic evaluation of air quality targets for heavy metals	EC					✓
	Cost Benefit Analysis	Defra					✓
UNECE Heavy Metals and POPs Protocols	Compliance Cost Assessment and Cost Benefit Analysis of the Heavy Metals and POPs Protocols	Defra					✓
National programmes	Investigation of external costs of SO <sub>2</sub> and NO <sub>x</sub> and assessment of Market Based Instruments for SO <sub>2</sub> and NO <sub>x</sub> for the UK industrial sector	Defra	✓	✓			
	Development of agricultural emission projections	Defra				✓	
	Protection of Sites of Special Scientific Interest under the UK Air Quality Strategy	Defra	✓	✓			
	Development of spatially disaggregated cost curves	Defra	✓	✓	✓	✓	✓
	Abatement methods and costs for PAH emissions	DTI					✓
	Abatement methods and costs for lead emissions	DTI					✓

## 1.2 Policy Context

The objectives of the NEC Directive are based in the Commission's communication on a strategy to combat acidification (COM(97)88 final), which sought to set NECs for four pollutants causing acidification and eutrophication and ozone precursors. The NECs pay regard to critical levels and loads, in order to provide fuller protection for the environment and human health against their adverse effects. A key requirement of the Directive, as stated in Article 4, is that by 2010 Member States must limit national annual emissions of SO<sub>2</sub>, NO<sub>x</sub>, VOCs and NH<sub>3</sub> to the ceilings specified for each Member State, presented in Annex I.

The purpose of the NECs is to broadly meet Community-wide interim environmental objectives around the reduction of critical loads of acid depositions and the reduction of ground-level ozone critical levels for human health and vegetation.

Implementation of the NEC Directive requires Member States to develop national programmes for the progressive reduction of the relevant pollutants, in addition to the provision of

information on the likely effect of policy measures on emissions in 2010. The NEC Directive further requires Member States to provide annually updated emission inventories and emissions projections for 2010, which will subsequently be made available to all other Member States.

Articles 9, 10 and 12 of the NEC Directive set out the requirements for a review of the national emissions ceilings to be completed in 2004, incorporating further investigation of costs and benefits of national emissions ceilings. The Commission must report in 2004, 2008 and 2012 to the European Parliament and the Council on progress on the implementation of the ceilings and towards attaining the interim environmental objectives and the long-term objectives set by the Directive.

### **1.3 Objectives of the Study**

The objective of the study, as stated in the Technical Annex, is to provide support to the Commission in the review of the NEC Directive and to analyse in depth some aspects of its implementation.

The main requirements of this support are clearly set out by the four tasks defined within the Technical Annex:

1. In depth analysis of the NEC national programs.
2. Analysis of the feasibility of an emission ceiling for PM and related reporting requirements.
3. Provision of the first draft of the NEC review report and recommendations for further legislation, and for the thematic strategy.
4. Stakeholder consultation including presentation of conclusions in the CAFE Steering Group and relevant working groups, and participation in a special workshop on the NEC reports.

### **1.4 Outline of the Proposal**

This proposal sets out the methodology (Section 2); the project organisation, timing and deliverables (Section 3); the experience of the project team (Section 4); the project costs and timeshare attributed to each of the team members (Section 5); and relevant project experience and quality assurance procedures (Section 6). Curriculum Vitae are presented in Appendix A.

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## 2. Proposed Approach

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### 2.1 Task 1 - In depth analysis of the NEC national programs

#### 2.1.1 Consistency of Member States national programmes reported under the NEC Directive with other submissions

Articles 6, 7 and 8 of the NEC Directive set down the reporting requirements for Member States for their national programmes and emission inventories and projections. Member States were required by the Directive to inform the Commission of their national programmes by 31<sup>st</sup> December 2002. Under Article 5(2), the Directive states that national programmes should include:

*‘..information on adopted and envisaged policies and measures and quantified estimates of the effect of these policies and measures and quantified estimates of the effect of these policies and measures on emissions of the pollutants in 2010. Anticipated significant changes in the geographical distribution of national emissions shall be indicated.’*

To date, 13 Member States have submitted their national programmes with Greece and Ireland yet to provide this information. An initial assessment of these national programmes (excluding those from Belgium and Luxembourg which were submitted after the cut-off date for the study) has been undertaken and a report has been produced by the European Environmental Agency (EEA)<sup>1</sup>. This report highlights the varying levels of information that have been provided in each Member States’ national programmes. Spain, for example, has not provided projections of emissions for 2010 and very few Member States have actually provided all of the information explicitly requested in the Directive. This report, along with our initial assessments of the latest national plans, will inform our work, comparing the consistency of national programmes submitted under the NEC Directive with other submissions as specified in the Technical Annex. These submissions are listed below:

- Air quality plans and programmes reported under the ambient air quality Directives (96/62/EC);
- National programmes for mitigating greenhouse gas emissions reported under the Monitoring Directive and its amendments and implementing provisions;
- Other relevant plans established under European legislation (such as the Large Combustion Plant and VOC plans as foreseen in the respective LCP and VOCs Directives) and under international conventions; and

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<sup>1</sup> EEA (2004): An initial assessment of Member States’ National Programmes and Projections under the National Emissions Ceiling Directive (2001/81/EC). ETC/ACC Technical Paper 2003/8, April 2004. Available at: <http://air-climate.eionet.eu.int/>

- CAFE baseline scenario established as an output of a series of bilateral consultations as lead by IIASA

A matrix for comparison between the submissions listed above and the national programs submitted under the NEC Directive will be initially established to provide a clear understanding of the scope of the various submissions and programmes. An example of how this may be structured is shown below.

**Figure 2.1 Matrix for comparison (illustrative and incomplete)**

	Are specific guidelines provided for format and scope of reporting?	Pollutants included	Sectoral scope	Summary of projections	Assumptions behind projections provided?	Scenarios presented	Information on abatement measures and their potential impacts	Uncertainty
National programmes reported under the NEC Directive								
Air quality plans and programmes reported under the ambient air quality Directives (96/62/EC)								
National programmes for mitigating greenhouse gas emissions reported under the Monitoring Directive and its amendments and implementing provisions								
National plans reported under the LCP Directive (2001/80/EC)								
National plans reported under the VOC Solvents Directive (1999/13/EC)								
CAFE baseline scenario (RAINS Model)								

A more detailed comparison can then be carried out between the national programmes reported under the NEC Directive and each other submission by looking at each in turn. The factors considered in the matrix will be examined in greater detail, particularly where significant differences have been highlighted in the initial comparison.

### Information sources

All of the national programmes submitted to date under the NEC Directive are available on the Commission's website. A large proportion of these plans have not been presented in English and will therefore need translating. As outlined in Section 1, the proposed project team has ample language expertise (French, German, Italian, Spanish, Swedish, Dutch) to cover virtually

all requirements. These language capabilities can be supported by colleagues with additional language skills within Entec's Environment, Health and Safety team. Where the plans are submitted in languages outside our team's skills capacity, these will be translated by Malla Translations, a specialist technical translation company.

We anticipate that data and information on air quality plans and programmes reported under the ambient air quality Directives (96/62/EC) would be made available to Entec for this study.

For national programmes to mitigate greenhouse gas emissions, there is a range of information available from Member States on the EU Monitoring Mechanism<sup>2</sup>. Some of this information is not very detailed and Member States that have signed up to the Kyoto Protocol have provided more information in some cases in their National Communications to the United Nations Framework Convention on Climate Change (UNFCCC)<sup>3</sup>. These will also be used in the project to provide further information on the consistency of the NEC Directive national programmes with greenhouse gas mitigation programmes.

From our work for the Commission providing technical assistance in the evaluation of LCP Directive national plans we have access to all of the plans submitted to date and have already translated those that were not presented in English. Entec have carried out the initial assessment of each of these plans and therefore have a good working knowledge of their content. Entec also have considerable experience relating to VOCs and the Solvent Emissions Directive having carried out projects for the Commission and Defra. We anticipate national emission plans submitted to the Commission under the VOC Solvents Directive would be made available for this study.

IIASA have recently completed the baseline scenarios for the CAFE Programme and these are now available online in the RAINS Model<sup>4</sup>. Entec have considerable experience working with the RAINS model and were involved in the bilaterals between the UK and IIASA for preparation of the CAFE baseline scenario. Projects for Defra producing cost curves for air pollutants and, most recently, the Review of the LCP Directive for the Commission have required Entec to have a good working knowledge of the RAINS model and the information it contains.

### **2.1.2 Inter-comparison of national programmes**

An initial assessment of all national programmes submitted up until 1<sup>st</sup> December 2003 has been produced by the EEA. Since December, two more Member States have submitted their national programmes: Belgium and Luxembourg (Greece and Ireland are yet to submit their information). An initial task would therefore be to undertake a preliminary assessment of these two plans, and any others if they are submitted prior to the start of the project, following a similar method to that employed in the EEA report. These two programmes should be qualitatively assessed on the quality and level of reporting on both projections and policies and measures.

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<sup>2</sup> [http://www.europa.eu.int/comm/environment/docum/0735\\_en.htm](http://www.europa.eu.int/comm/environment/docum/0735_en.htm)

<sup>3</sup> <http://unfccc.int/resource/natcom/nctable.html>

<sup>4</sup> <http://www.iiasa.ac.at/web-apps/tap/RainsWeb/index.html>

Building on this initial assessment and that performed by the EEA, a more detailed inter-comparison of the national programmes will be undertaken. The initial assessment by the EEA includes a qualitative assessment of the quality and level of Member State reporting, and a relatively simple evaluation of current trends, projections and policies and measures.

As far as the available information allows, a detailed cross-comparison will be carried out looking at the proposed measures for each sector and their impact on emissions and costs. This will provide insight into differences between Member States in the way in which they assign specific measures relating to their potential impacts. Where quantitative data regarding emissions reductions from specific measures is available, a cross comparison can be undertaken to look at the variability in estimated impacts between different Member States, e.g. are there significant differences between how each Member State quantifies the impact of a specific measure?

A comparative analysis will be undertaken of potential actions to reduce emissions from the key sectors at different scales (local, national and European) to highlight the relative margin of action of each institutional level from the local up to the European level. Key points to be included in the comparison could include:

- Information on the current state of implementation of measures;
- A matrix detailing who is involved in achieving the requirements of the programmes; what sectors are included; what emissions will be targeted and what reductions are foreseen; what timescales the reductions are expected to be achieved over; procedures for monitoring and control of implementing the programmes.

### 2.1.3 Projections made under national programmes

A critical task in the national programme inter-comparison will be the analysis of each Member States' projections to assess the methodology, quality and comparability of projections used. This task involves a detailed breakdown of each country's projections to build up a profile of the methods, sources, assumptions and abatement measures that lead to these values. Annex III of the NEC Directive states that:

*'Member States shall establish emission inventories and projections using the methodologies agreed upon by the Convention on Long-range Transboundary Air Pollution and are requested to use the joint EMEP/CORINAIR in preparing these inventories and projections.'*

It appears from the EEA initial assessment that, even with the guidance above, the way in which projections have been prepared varies between Member States. IIASA have highlighted, at the third CAFE Stakeholder meeting<sup>5</sup>, the issue of sectoral scope and a lack of consistency in projections for different Member States<sup>6</sup>. They have also noted that for some countries there are important differences between nationally reported emission inventories for 2000. It will therefore be important to assess the sectoral scope of projections for each Member State and highlight how this varies from country to country. The extent to which different Member States have attempted to quantify or present uncertainty, if at all, in their projections will also be

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<sup>5</sup> [http://www.iiasa.ac.at/rains/CAFE\\_files/baseline1-ver3.ppt](http://www.iiasa.ac.at/rains/CAFE_files/baseline1-ver3.ppt)

<sup>6</sup> This is borne out in our own experiences from the IIASA bilaterals

examined, e.g. have they presented more than one scenario, have they attempted to quantify the uncertainty involved?

This analysis will be carried out by comparing the methodologies used by each Member State with those agreed upon by the Convention on Long-range Transboundary Air Pollution and the extent to which the EMEP/CORINAIR emissions handbook has been used. These sources can be regarded as 'best practice' with respect to formulating projections and are referenced in the NEC Directive itself. This assessment would be presented in a matrix, similar to Figure 2.1, to show the extent to which Member States projections meet a series of 'best practice' requirements.

A specific requirement of the Technical Annex is an analysis of the extent to which existing and additional measures to reduce greenhouse gas emissions have been included in Member States' projections. Measures to reduce greenhouse gas emissions will quite often lead to a reduction in emissions of other pollutants as they share common sources. These can impact on emissions directly (e.g. clean technology) or indirectly (e.g. reduced activity/energy usage). Entec will draw on a variety of sources (in particular, information submitted to the UNFCCC relating to policies and measures to reduce greenhouse gas emissions) to create a list of existing and additional measures to reduce greenhouse gas emissions. This list can then be compared to each Member States' projections to assess the extent to which these measures have been included and whether or not their impacts have been quantified. Under the UNFCCC reporting guidelines, Member States should provide at least a 'with measures' estimate of future emissions<sup>7</sup>. They may also provide a 'without measures' projection and a 'with additional measures' projection. Our experience with reviewing National Communications to the UNFCCC suggests that there are significant differences in manner in which this information is presented. For example, many Member States include only a 'with measures' projection and also the categorisation of emissions into different sectors varies amongst Member States.

#### **2.1.4 Administrative and political procedure of adoption in Member States**

We intend to make contact with relevant competent authorities and stakeholders within the Member States that will be able to provide information regarding the administrative and political procedure of adoption of the national programmes in each country. Entec have carried out numerous surveys and stakeholder engagements in the past and have recently undertaken a similar survey of relevant competent authorities within Europe as part of the Review of the Large Combustion Plant Directive for the Commission. Table 2.1 provides a list of some of the key authorities and Environment Ministries within the EU, New Member States and Candidate Countries that were contacted for the LCP Directive contract and who could be contacted during this study. A full list of relevant authorities and stakeholders will be agreed in consultation with the Commission following the award of this contract.

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<sup>7</sup> Including all currently implemented policies.

**Table 2.1 Examples of Key Competent Authorities and Environment Ministries across the EU, New Member States and Candidate Countries.**

Federal Environment Agency (Austria)	Environmental Protection Agency (Ireland)
Umweltbundsamt Vienna (UBAVIE) (Austria)	ANPA (National Environmental Protection Agency) (Italy)
Federal Department of the Environment (Belgium)	Environmental Protection Agency of the Region Liguria (Italy)
Executive Environmental Agency (Bulgaria)	Ministry for the Environment (Italy)
Ministry of Environment & Water (Bulgaria)	Ministry of Environmental Protection and Regional Development (Latvia)
Department of Labour, Ministry of Labour and Social Insurance (Cyprus)	Latvian Environment Agency (Latvia)
Czech Hydrometeorological Institute (Czech Republic)	Ministry of Environment (Lithuania)
Ministry of Environment of the Czech Republic (Czech Republic)	Ministere de l'Environnement (Luxembourg)
Environmental Protection Agency (Denmark)	Central Bureau of Statistics (Netherlands)
Ministry of Environment (Estonia)	Ministry of Environment (Netherlands)
Ministry of the Environment (Finland)	Ministry of Environmental Protection (Poland)
Finnish Environment Institute (Finland)	Dir. Geral do Ambiente (Portugal)
INERIS Institut National de l'Environnement (France)	Ministry of Water, Forest and Environmental Protection (Romania)
European Environmental Bureau (Germany)	Ministry of the Environment (Slovak Republic)
Federal Environmental Agency (UBA) (Germany)	Environmental Agency of the Republic of Slovenia (Slovenia)
Umweltbundesamt (Germany)	Ministerio de Medio Ambiente (Spain)
Ministry of the Environment (Greece)	Swedish Environmental Protection Agency (Sweden)
Energy Information Agency (Hungary)	Ministry of the Environment (Turkey)
IEM Institute for Environmental Management (Hungary)	Department for Environment, Food & Rural Affairs (DEFRA) (UK)
Ministry for Environment and Regional Policy (Hungary)	Environment Agency (UK)

The format of the survey and any questionnaires will be agreed in consultation with the Commission following the award of this contract. Based on the information received, an assessment will be carried out of the acceptability and, if possible, the feasibility of the proposed measures included in the national programmes. The extent of this assessment will be entirely dependent upon the co-operation of the stakeholders and other ministries/agencies concerned. To ensure the success of the survey, we request that the Commission provides Entec with a relevant contact for each Member State and organisation.

We will also request information on the anticipated costs of implementing a Country's national plan and achieving their NEC Directive target. This information will provide a useful contribution to Task 3, in order to meet the requirement of Article 9, paragraph (1) (l) relating to

the ‘*need to avoid excessive costs for any individual member state*’. This is discussed in greater detail in Section 2.3.2.

## **2.1.5 Output – technical report**

### **Analysis of National Programmes**

The outputs of the analyses for Sections 2.1.1-2.1.4 will be presented in this section of the technical report.

### **Proposals for additional essential questions for each Member State**

Following our detailed review of the national programmes submitted under the NEC Directive we will be in a position to highlight any inconsistencies with respect to their conformity to the Directive and their consistency with other plans. The outputs from Sections 2.1.2 and 2.1.3 will include, for each program, a series of essential questions for the Commission to pose to Member States.

EEA’s initial assessment of the NEC Directive national plans has already highlighted several areas for concern (‘gaps in reporting’) which would need clarifying with the Member States concerned. For example:

- it was not always clear whether the projections incorporated the effect of current policies and measures;
- very few Member States provided information on significant changes in the geographical distribution of the pollutants as required under Article 6;
- very few Member States reported on the socio-economic assumptions behind projections even though this is explicitly required in Article 8;
- approximately half of the Member States did not provide any quantification of the impact of policies and measures (in terms of kt) as required in Article 6; and
- the uncertainty involved with emissions projections, although not explicitly required, was only reported to any extent by six Member States.

Our proposals for questions for each Member State will build on the ‘gaps’ identified in the EEA report and include those highlighted in our study. Issues requiring clarification will also be included.

### **Proposals of guidelines to ensure harmonisation**

One of the most important conclusions of the EEA report is that there is an explicit need for a structured reporting process to close the ‘gaps’ in reporting with respect to conformity to the Directive and consistency with other plans. A series of recommendations were outlined for meeting the requirements of the Directive and for ‘Good practice’ (not obligatory). These are summarised below:

Requirements for meeting the Directive

- a BAU and beyond BAU scenario should be reported
- impacts of policies and measures should be quantified

- 
- changes in geographical distribution of pollutants should be reported (if there is no change this should be made clear)
  - socio-economic assumptions and model parameters must be reported

‘Good Practice’

- trends in key sectors should be disaggregated for projections (where possible, consistent with that used in emission inventories)
- uncertainty in emission projections should be reported
- list relevant implementing body for each policy and the type of policy instrument

Entec have already produced a similar guidance document for the Commission, to assist Member States in the preparation of national emission reduction plans for large combustion plants under the LCP Directive. This sets out a series of stages for preparing a national emission reduction plan to meet the requirements of the LCP Directive.

The aim of guidelines for reporting under the NEC Directive will be to improve the quality of reporting in terms of content relating to the requirements of the Directive and to improve the consistency of these plans with those produced by other Member States and those produced under other legislation.

The guidelines that we plan to propose will be based on the requirements of the Directive, the issues identified above and the conclusions of our comparison studies between NEC Directive national programmes and other submissions. The key principles that are applied to greenhouse gas reporting in the UK and which should underpin guidelines for reporting under the NEC Directive are listed below<sup>8</sup>:

- true representation
- completeness
- consistency
- reliability
- transparency

To ensure consistency with existing plans and programmes relating to greenhouse gas emissions we propose to utilise the implementing provisions and reporting requirements of the EU greenhouse gas monitoring mechanism (Decision No 280/2004/EC). Article 3 sets down the reporting requirements for Member States with paragraph 2 most relevant to this task as it includes requirements for assessing future progress. This sets down a series of reporting requirements to be submitted by March 2005 and every two years thereafter. The reporting requirements, relevant to the NEC Directive are set down in Article 3(2).

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<sup>8</sup> Defra (2003): Guidelines for the Measurement and Reporting of Emissions by Direct Participants in the UK Emissions Trading Scheme. June 2003.

The requirements of Decision 280/2004/EC have been deliberately formulated to reflect the reporting obligations and guidelines for the implementation of the UNFCCC and the Kyoto Protocol. These guidelines are available at <http://www.unfccc.int/>.

The guidelines that we will develop will be adapted from the requirements above to match the requirements of the NEC Directive and close any potential 'gaps' identified. As specified in the Technical Annex our proposed guidelines will also address the national adoption procedure to ensure better transparency, acceptance and implementation of the programs. This will be moulded by the outcome of our survey of stakeholders and other ministries/agencies (see Section 2.1.4).

## 2.2 Task 2 – Feasibility of an emission ceiling for particulate matter and related reporting requirements

In addressing the feasibility of an emission ceiling for particulate matter, Entec will employ Helen ApSimon as an associate to undertake a large proportion of the work. Helen is Professor of Air Pollution Studies at Imperial College London, and has worked extensively for Task Forces under the UN ECE Convention on Long-Range Transboundary Air Pollution, undertaking modelling and assessment of cost-effective strategies to reduce acidification, eutrophication, excess tropospheric ozone, and fine particulate concentrations. The assessment would address a number of key issues, identified below.

### *What additional benefit could an emissions ceiling for particulate matter achieve that an air quality limit value could not?*

Under the First Air Quality Directive (1999/30/EC) the EC has already specified limit values for 24 hour and annual average concentrations of PM<sub>10</sub> to be achieved by 1 January 2005, with subsequent tighter limits currently under review within the CAFE (Clean Air for Europe) programme. Concentrations of PM<sub>10</sub> are due to a combination of primary emissions from stationary and mobile sources; secondary particulates formed and accumulated during long-range transport; natural emissions; and some remaining coarser particles. An air quality limit value implicitly takes account of both primary and secondary particulates. However, an emissions ceiling for particulate matter may have to focus on primary particulates due to the complexities inherent within the atmospheric formation of secondary particulates. These issues will be researched and discussed within the technical report.

### *What challenges would there be for assessing compliance against a particulate matter ceiling and how could they be overcome?*

Entec's experience gained through revising the UK cost curve for PM<sub>10</sub> identified a number of sources of uncertainty with regard to emission inventories. For example, particulate emissions from quarries can represent a significant portion of total particulate emissions in a Member State, but they are very difficult to quantify as they are mainly released from fugitive sources that are not amenable to measurement. Emissions estimates could be highly inaccurate if based on emission factors for incomparable sources (e.g. US EPA emission factors are based on emissions from very large quarries in the US that may not be applicable to the EU). A further example is re-suspended dust from roads, which in the UK accounts for a significant proportion of

total emissions reported under the NAEI, but which are highly uncertain and may introduce potential for double-counting.

*To what extent do the current NEC Directive pollutants take into account the net impact of particulate matter due to their coverage of secondary particulate matter pre-cursors (SO<sub>2</sub> and NO<sub>x</sub>)?*

The main precursor emissions (SO<sub>2</sub>, NO<sub>x</sub>, and NH<sub>3</sub>) of the secondary inorganic aerosol (SIA), are already subject to emissions ceilings resulting from the Gothenburg protocol under the Convention on Long Range Transboundary Air Pollution of the UN ECE, and the EC's NEC Directive. Although particulates were not specifically addressed in development of the Gothenburg protocol, their importance was recognised. Independent work undertaken by Imperial College London using the ASAM model in parallel with scenario analysis by IIASA, showed that the proposed emission ceilings to combat acidification, eutrophication and excess tropospheric ozone also provided a cost-effective strategy for reducing exposure to secondary particulates. Since then both secondary and primary particles have become a major focus in work towards review of the Gothenburg protocol in 2005, and in the CAFE programme where transboundary aspects of air pollution are combined with local air quality issues.

*Targeting of individual sources*

A major consideration is that, as reported by many European countries, the main exceedences of the limit values for particle concentrations occur in urban areas, particularly close to busy roads. This emphasises action to control local emissions near hot-spots, and measures to reduce traffic emissions in particular, that is targeting specific sources within the national inventory. Such measures may not be the end-of-pipe technological measures hitherto considered in proposing emission ceilings, but can also include, for example, traffic control measures such as congestion charging in London.

'Planning' solutions, such as congestion charging, can be very effective in reducing ambient concentrations at 'hot-spots', contribute to achieving compliance with the limit value and thereby alleviate detrimental health impacts on the local population. However, at the same time, total *source* emissions may not have been affected, but simply 'managed' in such a way as to reduce the impact on the *receptor*.

Individual countries have been rapidly developing experience in measurement and modelling of particulates in addressing compliance with limit values, as reflected in the UK, for example in the work of Defra's Air Quality Expert Group (AQEG). There have been many advances in development of improved PM<sub>10</sub> and PM<sub>2.5</sub> emission inventories in Europe, in modelling the long-range atmospheric transport of both secondary and primary particles by EMEP with their new Eulerian model, and in considering abatement measures for particulates with derivation of cost curves suitable for use in integrated assessment modelling. This makes it feasible to propose emissions ceilings for primary emissions as well as reviewing those for the SIA precursor emissions, applying models such as RAINS and ASAM.

In completion of this task we shall review progress in Europe as outlined above, including the potential for integrated assessment modelling (e.g. RAINS) to consider the advantages and limitations of continuing and extending the emissions ceiling approach taken for SO<sub>2</sub>, NO<sub>x</sub>, and NH<sub>3</sub> to primary as well as secondary particulates. We shall consider how and whether emission

ceilings could sensibly be targeted on the appropriate sources (e.g. complementing vehicle emission limits in urban areas); and also identify uncertainties in quantifying and auditing the emission reductions from proposed measures and the associated benefits. The outputs from this review will provide clear recommendations for the introduction of an emissions ceiling for particulates, based on an expert analysis of the issue. The technical report will include these recommendations and accompanied analysis of the pros and cons of the introduction of such a ceiling.

## **2.3 Task 3 - NEC review report and recommendations for further legislation and for the thematic strategy**

### **2.3.1 Understanding of the task**

Entec will produce a first draft of the review report as required by the NEC Directive. However, it is understood that the requirements outlined in Article 10, paragraph 5 (a) and (b)<sup>9</sup> of the Directive are not to be included within the scope of the work. Given the range of additional projects commissioned by the EC as well as the UN ECE, in addition to EEA reports and national programs, this task is mainly to gather and summarise the relevant information sources that will contribute to the review of the Directive.

The text of the NEC Directive details the requirements of review reports under Articles 9, 10 and 12. Section 2.3.2 reproduces these requirements and identifies information sources that will be used to address them. An initial review of the data sources has not identified any significant data gaps, beyond those outlined in the tender specification<sup>10</sup>. Methodologies for these ‘gaps’ identified within the tender specification are presented in Section 2.3.3.

### **2.3.2 Information sources to cover the requirements of the review report**

The data sources required to complete this task are largely outputs from other EC contracts. As outlined in Section 3, Entec will seek to agree the process for liaison between EC contractors during the kick-off meeting. Entec is also mindful of the ongoing nature of the CAFE work, and understands that some information sources, notably IIASA baselines and energy projections and AEA cost-benefit analyses, will become available during the course of this project.

The following sections identify the requirements of Articles 9, 10 and 12 in the Directive relating to the work required to complete a first draft of the review report. Information sources are listed alongside relevant Directive requirements and action to be taken by Entec is noted.

#### **Article 9: Reports by the Commission**

Paragraph (1) reads as follows:

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<sup>9</sup> Relating to modifications of the national ceilings and/or for modifications to interim environmental objectives as well as possible further emission reductions with the aim of meeting, preferably by 2020, the long-term objectives of the Directive.

<sup>10</sup> Namely, “a review of the limitations of the regional scope of the NEC Directive as defined in article 2 for what concerns Spain, France and Portugal” and “measures to ensure compliance with the ceilings”.

- (1). In 2004 and 2008 the Commission shall report to the European Parliament and the Council on **progress on the implementation of the national emission ceilings laid down in Annex I** and on the **extent to which the interim environmental objectives set out in Article 5 are likely to be met by 2010** and on the extent to which the long-term objectives set out in Article 1 could be met by 2020. The reports shall include an **economic assessment, including cost-effectiveness, benefits, an assessment of marginal costs and benefits and the socioeconomic impact of the implementation of the national emission ceilings on particular Member States and sectors**. They shall also include a review of the **limitations of the scope of this Directive as defined in Article 2** and an **evaluation of the extent to which further emission reductions might be necessary in order to meet the interim environmental objectives set out in Article 5**.

The text in **bold** denotes requirements of the review report. The information sources for each of these requirements are listed in Table 2.2.

**Table 2.2 Potential information sources and actions relating to Article 9, paragraph (1)**

<b>Requirement</b>	<b>Example Information Sources</b>	<b>Action by Entec</b>
Progress on implementation of the national emission ceilings laid down in Annex I	EEA (2004) An initial assessment of Member States' National Programmes and Projections under the National Emissions Ceiling Directive (2001/81/EC).  Additional analysis from Entec under Task 1	Under Task 1, Entec will conduct additional analysis to build on findings of EEA report and report on progress
Extent to which the interim environmental objectives set out in Article 5 are likely to be met by 2010	Ongoing – IIASA – Service contract for the development of the baseline and policy scenarios and integrated assessment modeling framework for the CAFE programme  Ongoing – IIASA – Service contract for assessment of the effectiveness of European air quality policies and measures  EEA (2004) Air pollution in Europe 1990–2000  EEA (2002) Emissions of atmospheric pollutants in Europe, 1990–99  EEA (2003) Air pollution by ozone in Europe in summer 2003 - Overview of exceedences of EC ozone threshold values during the summer season April–August 2003 and comparisons with previous years. October 2003.  EMEP (2003) Transboundary acidification and eutrophication and ground level ozone in Europe. EMEP Status Report 2003  EMEP/CLRTAP ongoing activities	Entec will collate and review work conducted by IIASA, EEA and EMEP and summarise their findings  If required, Entec can utilise in-house expertise in GIS, in order to summarise data sets provided by external contractors. Entec's GIS team is very experienced, having worked on previous projects for the EC (quantifying ship emissions) and Defra.
Economic assessment, including cost-effectiveness, benefits, an assessment of marginal costs and benefits and the socioeconomic impact of the implementation of the national emission ceilings on particular Member States and sectors	Ongoing – AEAT – Service Contract for carrying out Cost-Benefit Analysis of Air Quality Related Issues, in particular in the Clean Air for Europe (CAFE) Programme  AEAT (1999) Economic Evaluation of a Directive on National Emission Ceilings for Certain Atmospheric Pollutants  IIASA (2000) Cost-effective Control of Acidification and Ground-level Ozone  Systematic Review of Health Aspects of Air Quality in Europe.  Ongoing – IIASA – Service contract for assessment of the effectiveness of European air quality policies and measures	Entec will collate and review work conducted by AEA and IIASA and summarise their findings.  Whilst the requirements are assumed to be covered by other work, Entec has excellent experience in economic assessment, particularly under ongoing 'cost-curves' contract with Defra. This experience will be utilised in the review of the data sources.
Limitations of the scope of this Directive as defined in Article 2	Additional analysis from Entec under Task 1	See Section 2.3.3

Requirement	Example Information Sources	Action by Entec
An evaluation of the extent to which further emission reductions might be necessary in order to meet the interim environmental objectives set out in Article 5	<p>Ongoing – IIASA – Service contract for the development of the baseline and policy scenarios and integrated assessment modelling framework for the Clean Air for Europe (CAFE) programme</p> <p>Ongoing – IIASA – Service contract for assessment of the effectiveness of European air quality policies and measures</p> <p>EMEP (2003) Transboundary acidification and eutrophication and ground level ozone in Europe. EMEP Status Report 2003</p> <p>EMEP/CLRTAP ongoing activities</p>	Entec will collate and review work conducted by IIASA and EMEP and summarise their findings.

Paragraph (1) continues to state that: “*They shall take into account the reports made by Member States pursuant to Article 8(1) and (2), as well as, inter alia*”. The Directive goes on to list 14 separate elements that must be considered. These are listed with potential information sources in Table 2.3

**Table 2.3 Potential information sources and actions relating to Article 9, paragraph (1) (a)-(n)**

Requirement	Example Information Sources	Action by Entec
(a) any new Community legislation which may have been adopted setting emission limits and product standards for relevant sources of emissions;	<p>LCP Directive</p> <p>Sulphur content in liquid fuel (SCLF) Directive</p> <p>Directives on quality of petrol and diesel fuels</p> <p>IPPC legislation on process sources</p> <p>Auto/Oil EURO standards</p> <p>Standards for motorcycles and mopeds</p> <p>Legislation on non-road mobile machinery</p> <p>Stage 1 VOC Directive</p> <p>Carbon Canister Directive</p> <p>Fuel Directive</p> <p>Solvents Directive</p> <p>Product Directive (paints)</p>	<p>These will be taken into account under Task 1.</p> <p>As detailed in Sections 1 and 5, Entec has undertaken a wide range of projects relating to air emissions policy. This experience will be capitalised on through consultation with the technical specialists within the project team (Section 3).</p>
(b) developments of best available techniques in the framework of the exchange of information under Article 16 of Directive 96/61/EC;	<p>As part of the EC review of the LCP Directive, Entec has previously gained data available via Article 16 of the IPPC Directive – Entec would re-contact the EIPPCB to ensure full data coverage</p> <p>BAT Reference Documents</p> <p>Ongoing – project for EC on Emerging Technologies</p> <p>Work by Entec on assessing BAT for LCPs are part of the review of the LCP Directive</p>	Entec will collate and review data obtained from the EIPPCB.
(c) emission reduction objectives for 2008 for emissions of sulphur dioxide and nitrogen oxides	Entec (2004) Preparation of the review relating to the Large Combustion Plant Directive. Interim Report. Report for the European Commission. May 2004.	Entec will collate and review the data available from the various sources and summarise their findings

Requirement	Example Information Sources	Action by Entec
<p>from existing large combustion plants, reported by Member States pursuant to Directive 2001/80/EC of the European Parliament and of the Council of 23 October 2001 on the limitation of emissions of certain pollutants into the air from large combustion plants;</p>	<p>Extensive previous Entec work for the EC and Defra</p> <p>IIASA (1998) Impacts of Revised Emission Limit Values for Large Combustion Plants on EU15 Countries' Emissions in the Year 2010. Report to the European Commission, DG-XI. Contract No. B5-9500/97/000636/MAR/E1. Markus Amann. October 1998.</p> <p>IIASA (2001) Emission reductions from existing large combustion plants resulting from the amendment of the Large Combustion Plant Directive. Report to the European Commission, DG ENV. Contract No. B4-3040/2000/267962/MAR/D3. Janusz Cofala, Markus Amann. January 2001. Available online at: <a href="http://europa.eu.int/comm/environment/pollutants/combustion_report.pdf">http://europa.eu.int/comm/environment/pollutants/combustion_report.pdf</a>.</p>	<p>As Entec is currently commissioned by the EC to contribute to the review of the LCP Directive, we are extremely well placed to utilise the relevant data sources.</p>
<p>(d) emission reductions and reduction commitments by third countries, with particular focus on measures to be taken in the accession candidate countries, and the possibility for further emission reductions in regions in the vicinity of the Community;</p>	<p>UNECE – Reporting of state of environment</p> <p>Reports submitted to the EC</p> <p>Reports collected during previous Entec work, notably, the review of the LCP Directive</p>	<p>Entec will collate and review the data available from the various sources and summarise their findings</p>
<p>(e) any new Community legislation and any international regulations concerning ship and aircraft emissions;</p>	<p><b>SHIPPING</b></p> <p>NERA (2004) Evaluation of the Feasibility of Alternative Market-Based Mechanisms To Promote Low-Emission Shipping In European Union Sea Areas. A Report for the European Commission, Directorate-General Environment. Final Report, March 2004. London.</p> <p>Beicip Franlab (2003) Advice on Marine Fuel: Potential price premium for 0.5%S marine fuel; Particular issues facing fuel producers in different parts of the EU; and Commentary on marine fuels market. Contract Number ENV.C1/SER/2001/0063. Order Slip n° C1/3/2003. European Commission – Directorate General Environment. October 2003</p> <p>Entec UK Ltd (2002) Quantification of emissions from ships associated with ship movements between ports in the European Community. Report for the European Commission. July 2002.</p> <p>EMEP (2001) The influence of ship traffic emissions on the air concentrations of particulate matter. November 2001. Preliminary advice from EMEP for the European Commission</p> <p>Beicip Franlab (2002) Advice on the costs to fuel producers and price premia likely to result from a reduction in the level of sulphur in marine fuels marketed in the EU. Study C.1/01/2002. Contract ENV.C1/SER/2001/0063. April 2002</p> <p>Lloyds (1999) Marine exhaust emissions quantification study. European Commission. December 1999.</p> <p>AEAT (2001) Measures to reduce emissions of VOCs during loading and unloading of ships in the EU. A report for the European Commission. August 2001.</p> <p><b>AIRCRAFT</b></p> <p>EIATNE (2003) Identification and Management of Critical Environmental Impacts from Air Transportation over North Europe. The project was partly financed by the European Commission LIFE-</p>	<p>Entec will collate and review the data available from the various sources and summarise their findings</p> <p>As Entec was commissioned by the EC to conduct the quantification of ship emissions, we have a very good understanding of the legislation and related issues impacting on emissions.</p> <p>Entec will draw on the experience of Malcolm Pratt, who is part of the specialist team and has extensive experience in the aviation field.</p>

Requirement	Example Information Sources	Action by Entec
	<p><u>Environment</u> and partly by the <u>Swedish Civil Aviation Administration</u> (Luftfartsverket)</p> <p>IPCC Aviation and the Global Atmosphere.  <a href="http://www.grida.no/climate/ipcc/aviation/index.htm">http://www.grida.no/climate/ipcc/aviation/index.htm</a></p> <p>ICAO – Annex 16 (Environmental Protection) to the Convention on International Civil Aviation Volume II - Aircraft Engine Emissions</p> <p>ICAO – Report of the Committee on Aviation Environmental Protection, Fifth Meeting, Montreal, 8-17 January 2001 (Doc 9777, CAEP/5)</p> <p>ICAO – QinetiQ Engine Exhaust Emissions Data Bank, published on behalf of ICAO:  <a href="http://www.qinetiq.com/home/markets/Aviation/Aircraft_Engine_Exhaust_Emissions_DataBank.html">http://www.qinetiq.com/home/markets/Aviation/Aircraft_Engine_Exhaust_Emissions_DataBank.html</a></p> <p>ICAO Journals</p>	
(f) the development of transport and any further action to control transport emissions;	<p>IIASA assumptions</p> <p>Further development and application of the REMOVE transport model.</p> <p>Auto-Oil Programme</p> <p>Entec cost curves work</p> <p>Ricardo (first study 2002 to 2003, updated 2003 to 2004) - Carbon to Hydrogen roadmap – commissioned by UK Government Department for Transport and Department of Trade and industry</p> <p>Ricardo (2002 to 2003) - FUIRORE Future Road Vehicle Research – A Roadmap for the Future. Funded by the European Commission under Framework 5</p> <p>Ricardo (2002 to 2003) - Study to Provide Technical and Cost Data Relating to Historic and Future Emissions Technology Required to Meet Emissions Regulations from Euro 0 to Euro 5. Commissioned by CITEPA (Centre Interprofessionnel Technique d'Etudes Pollution Atmospherique) to provide technical input data to support the European RAINS model being developed by IIASA, under the European Commission's CAFE Programme.</p>	<p>Entec will collate and review the data available from the various sources and summarise their findings</p> <p>Entec has significant experience in this area, given previous work on cost curves and specialist technical knowledge of Ben Grebot in the project team.</p>
(g) developments in the field of agriculture, new livestock projections and improvements in emission reduction methods in the agricultural sector;	<p>National projections expected by June 2004</p> <p>Ongoing National Ammonia Reduction Strategies Evaluation System (NARSES) project in the UK. ADAS, commissioned by Defra.</p> <p>Ongoing – CEH – Ammonia monitoring in the UK.</p> <p>Ongoing – IGER - Modelling and measurement of ammonia emissions from ammonia mitigation pilot farms. Project for Defra.</p> <p>Ongoing – CEH – Scoping the use of process modelling for use in the assessment of ammonia mitigation options</p> <p>IGER (2003) Updating the inventory of ammonia emissions from UK agriculture for the years 2000 and 2001. Report for Defra</p> <p>Federal Agricultural Research Centre (2002) In-depth review of the outputs of DEFRA's programme of research on the measurement and control of ammonia emissions from agriculture (1998-2002) IGER (2001) – Cost curve assessment on mitigation options in greenhouse gas emissions from agriculture</p> <p>IGER (2002) Evaluation of ammonia mitigation options. Report for Defra</p>	<p>Entec will collate and review the data available from the various sources and summarise their findings</p> <p>Entec will also draw on the extensive experience of Professor ApSimon in this area.</p>

Requirement	Example Information Sources	Action by Entec
	NERC – Non-agricultural sources of atmospheric ammonia in the UK ADAS (2002) 'Bringing down ammonia emissions'. Report for Defra	
(h) any major changes in the energy supply market within a Member State and new forecasts reflecting the actions taken by Member States to comply with their international obligations in relation to climate change;	CAFE energy baselines. Two draft baseline projections used by IIASA – include PRIMES but also national assumptions. Revised PRIMES projection by June Entec work on impacts on competition in energy markets as part of the review of the LCP Directive. EC (2004). <i>Strategy Paper: Medium Term Vision for the Internal Electricity Market</i> . European Commission DG Energy and Transport Working Paper. EC (2004) DG TREN Draft Working Paper: third benchmarking report on the implementation of the internal electricity and gas market Pope, Ian (2000) The potential for electricity trade in an enlarged EU based on differential environmental standards	Entec will collate and review the data available from the various sources and summarise their findings
(i) assessment of the current and projected exceedences of critical loads and the WHO's guideline values for ground-level ozone;	Ongoing – IIASA – Service contract for the development of the baseline and policy scenarios and integrated assessment modeling framework for the CAFE programme Ongoing – IIASA – Service contract for assessment of the effectiveness of European air quality policies and measures EEA (2004) Air pollution in Europe 1990–2000 EEA (2002) Emissions of atmospheric pollutants in Europe, 1990–99 EMEP (2003) Transboundary acidification and eutrophication and ground level ozone in Europe. EMEP Status Report 2003 EMEP/CLRTAP ongoing activities	Entec will collate and review work conducted by IIASA, EEA and EMEP and summarise their findings.
(j) the possibility of identification of a proposed interim objective for reducing soil eutrophication;	Assumed that this is not included as represents "modification to interim environmental objectives".	Entec will take no action as this is assumed to be outside the project scope.
(k) new technical and scientific data including an assessment of the uncertainties in: (i) national emission inventories; (ii) input reference data; (iii) knowledge of the transboundary transport and deposition of pollutants; (iv) critical loads and levels; (v) the model used; and an assessment of the resulting uncertainty in the national emission ceilings required to meet the interim environmental objectives mentioned in Article 5.	(i) National documentation – e.g. NAEI; Additional analysis from Entec under Task 1 (ii) National documentation – e.g. NAEI; Additional analysis from Entec under Task 1 (iii) EMEP/CLRTAP ongoing activities (iv) EMEP/CLRTAP ongoing activities (v) EMEP/CLRTAP ongoing activities and... Ongoing – AEAT – Service Contract for carrying out Cost-Benefit Analysis of Air Quality Related Issues, in particular in the Clean Air for Europe (CAFE) Programme	Entec will collate and review the data available from the various sources, including a summary of findings from Task 1, and summarise their findings Entec will also draw on the extensive experience of Professor ApSimon in this area.
(l) whether there is a need to avoid excessive costs for any individual Member State;	Information from National Programmes submitted under the NEC Directive Additional analysis from Entec under Task 1	Entec will collate and review the data available from the various sources and summarise their findings. This will be conducted concurrently

Requirement	Example Information Sources	Action by Entec
		with Task 1, as national submissions are reviewed. Policy makers and regulators will also be questioned on this matter as part of the surveys conducted under Task 1.
(m) a comparison of model calculations with observations of acidification, eutrophication and ground-level ozone with a view to improving models;	<p>Ongoing – IIASA – Service contract for the development of the baseline and policy scenarios and integrated assessment modelling framework for the CAFE programme</p> <p>Ongoing – IIASA – Service contract for assessment of the effectiveness of European air quality policies and measures</p> <p>EMEP (2003) Transboundary acidification and eutrophication and ground level ozone in Europe. EMEP Status Report 2003</p> <p>Study to review and critique the RAINS model</p> <p>EMEP/CLRTAP ongoing activities</p>	Entec will collate and review work conducted by IIASA and EMEP and summarise their findings
(n) the possible use, where appropriate, of relevant economic instruments.	<p>Previous Entec work under the review of the LCP Directive has assessed the potential for SO<sub>2</sub>/NO<sub>x</sub> trading. Entec has also carried out similar work under the EC project for the assessment of National Plans for the LCP Directive, as well as work for Defra on market based instruments for SO<sub>2</sub> and NO<sub>x</sub> for industrial sources.</p> <p>Planned EC work on the geographical differentiation of emission trading of NEC Directive pollutants</p> <p>OXERA (2003), 'Analysis of the Interactions and Combinations of Tax and Permit-trading Instruments, with an Application to Climate and Waste Policy', published by the Environment Agency of England and Wales.</p> <p>Ozone Transport Commission (2003), NO<sub>x</sub> Budget Program, 1999-2002 Progress Report</p> <p>National Center for Environmental Economics (2001), The United States Experience with Economic Incentives for Protecting the Environment, EPA-240-R-01-001, January 2001</p> <p>Ellerman, A.D., P.L. Joskow, J-P Montero, R. Schmalensee, and E.M. Bailey (2000), Markets for Clean Air: The U.S. Acid Rain Program, Cambridge University Press</p>	<p>Entec will collate and review the data available from the various sources and summarise their findings.</p> <p>If required, Entec's economist could provide additional support, having wide-ranging experience in this field.</p>

## Article 10: Review

Paragraphs (1-5) read as follows:

- (1). The reports referred to in Article 9 shall take into account the factors listed in Article 9(1). In the light of these factors, of progress towards attaining the emission ceilings by the year 2010, of scientific and technical progress, and of the situation regarding progress towards attaining the interim objectives of this Directive and the long-term objectives of no exceedance of critical loads and levels and of WHO air quality guidelines for ozone, the Commission shall carry out a review of this Directive in preparation for each report.
- (2). In the review to be completed in 2004 an **evaluation will be carried out of the indicative emission ceilings for the Community as a whole set out in Annex II**. The evaluation of these indicative ceilings shall be a factor for consideration during analysis of further cost-effective actions that might be taken in order to reduce emissions of all relevant pollutants, with the aim of attaining the interim environmental objectives set out in Article 5, for the Community as a whole by 2010.

- (3). All reviews shall include a further **investigation of the estimated costs and benefits of national emission ceilings, computed with state-of-the-art models and making use of the best available data** to achieve the least possible uncertainty and taking also into account progress in the enlargement of the European Union, and of the merits of alternative methodologies, in the light of the factors listed in Article 9.
- (4). Without prejudice to Article 18 of Directive 96/61/EC, **with the aim of avoiding distortion of competition, and taking into account the balance between benefits and costs of action**, the Commission shall **examine further the need to develop harmonised Community measures, for the most relevant economic sectors and products contributing to acidification, eutrophication and formation of ground-level ozone**.
- (5). The reports referred to in Article 9 will, if appropriate, be accompanied by proposals for:
- modifications of the national ceilings in Annex I with the aim of meeting the interim environmental objectives of Article 5 and/or for modifications to those interim environmental objectives;
  - possible further emission reductions with the aim of meeting, preferably by 2020, the long-term objectives of this Directive;
  - measures to ensure compliance with the ceilings.**

The text in **bold** denotes requirements of the review report. The information sources for each of these requirements are listed in Table 2.4.

**Table 2.4 Potential information sources and actions relating to Article 10**

Requirement	Information Source	Action by Entec
evaluation will be carried out of the indicative emission ceilings for the Community as a whole set out in Annex II	Ongoing – IIASA – Service contract for the development of the baseline and policy scenarios and integrated assessment modeling framework for the CAFE programme  Ongoing – IIASA – Service contract for assessment of the effectiveness of European air quality policies and measures	Entec will collate and review work conducted by IIASA and summarise their findings.
investigation of the estimated costs and benefits of national emission ceilings, computed with state-of-the-art models and making use of the best available data	Ongoing – AEAT – Service Contract for carrying out Cost-Benefit Analysis of Air Quality Related Issues, in particular in CAFE Programme  Ongoing – IIASA – Service contract for assessment of the effectiveness of European air quality policies and measures  Reports by Member States	Entec will collate and review work conducted by AEA and IIASA and summarise their findings.
with the aim of avoiding distortion of competition, and taking into account the balance between benefits and costs of action ...examine further the need to develop harmonised Community measures, for the most relevant economic sectors and products contributing to acidification, eutrophication and formation of ground-level ozone	EEA (2004) An initial assessment of Member States' National Programmes and Projections under the National Emissions Ceiling Directive (2001/81/EC).  Ongoing – AEAT – Service Contract for carrying out Cost-Benefit Analysis of Air Quality Related Issues, in particular in CAFE Programme  Ongoing – IIASA – Service contract for assessment of the effectiveness of European air quality policies and measures  Entec work on assessing impacts on competition in the EU energy markets as part of the review of the LCP Directive  Additional analysis from Entec under Task 1	Under Task 1, Entec will conduct additional analysis to build on findings of EEA report and report on progress  Entec's current contribution to the EC LCP Directive review has provided valuable experience in understanding the effects of competition

Requirement	Information Source	Action by Entec
measures to ensure compliance with the ceilings	<p>Research Contract – Assessment of the Air Emissions Impact of Emerging Technologies</p> <p>Ongoing – IIASA – Service contract for the development of the baseline and policy scenarios and integrated assessment modeling framework for the CAFE programme</p> <p>Ongoing – IIASA – Service contract for assessment of the effectiveness of European air quality policies and measures</p> <p>Entec cost curves information</p>	See Section 2.3.3

## Article 12: Reports concerning ship and aircraft emission

Paragraphs (1-3) read as follows:

- (1). By the end of 2002 the Commission shall report to the European Parliament and Council on the **extent to which emissions from international maritime traffic contribute to acidification, eutrophication and the formation of ground-level ozone within the Community.**
- (2). By the end of 2004 the Commission shall report to the European Parliament and Council on the **extent to which emissions from aircraft beyond the landing and take-off cycle contribute to acidification, eutrophication and the formation of ground-level ozone within the Community.**
- (3). Each report shall **specify a programme of actions which could be taken at international and Community level as appropriate to reduce emissions from the sector concerned**, as a basis for further consideration by the European Parliament and Council.

The text in **bold** denotes requirements of the review report. The information sources for each of these requirements are listed in Table 2.5.

**Table 2.5 Potential information sources and actions relating to Article 12**

Requirement	Information Source	Action by Entec
extent to which emissions from international maritime traffic contribute to acidification, eutrophication and the formation of ground-level ozone within the Community	<p>New Service Contract on Ship Emissions: Assignment, Abatement and Market-based Instruments – as yet un-awarded, but information will be available in sufficient time to contribute to this project.</p> <p>Entec UK Ltd (2002) Quantification of emissions from ships associated with ship movements between ports in the European Community. Report for the European Commission. July 2002.</p> <p>EMEP (2002) report</p> <p>TREMOVE</p>	Entec will collate and review the data available from the various sources and summarise their findings.
extent to which emissions from aircraft beyond the landing and take-off cycle contribute to acidification, eutrophication and the formation of ground-level ozone within the Community	<p>Entec understands that Eurocontrol will provide the EC with an estimate of emissions from aircraft beyond the landing and take-off cycle for all movements within European air space.</p> <p>However, Entec is not aware of any ongoing contracts to determine the extent to which these emissions contribute to acidification, eutrophication and the formation of ground-level ozone within the Community.</p>	<p>Entec will collate and review the data available from the various sources with regard to emissions from aircraft and summarise their findings.</p> <p>Entec is not in a position to conduct modeling of the impacts of these emissions on environmental objectives. As</p>

Requirement	Information Source	Action by Entec
		such Entec assumes that the Commission will provide this information, or reconsider this review requirement.
specify a programme of actions which could be taken at international and Community level as appropriate to reduce emissions from the sector concerned	See data sources above.	Entec will collate and review the data available from the various sources and summarise their findings.

### 2.3.3 Methodology for additional analysis identified under Task 3

The following sections present Entec's methodology for the 'data gaps' identified by the EC in the Technical Annex.

#### **“A review of the limitations of the regional scope of the NEC Directive as defined in article 2 for what concerns Spain, France and Portugal” (article 9, paragraph 1 of the NEC Directive)**

Entec's current project experience on the review of the LCP Directive will be utilised in the methodology proposed to cover the analysis required in relation to the limitations of regional scope of the LCP Directive.

The current NEC Directive does not apply to the Spanish Canary Islands, French overseas departments or the Portuguese Islands of Madeira and the Azores. This review will investigate what, if any, justification there is to include these regions within the NEC Directive. It will take into consideration:

- Total emissions of NEC Directive pollutants from the three groups of regions as a proportion of their respective national totals, to obtain a perspective on the relative significance of their emissions;
- Identification of additional measures required to reduce emissions of NEC Directive pollutants;
- Potential technical and logistical considerations associated with these measures; and
- Cost-effectiveness of measures, relative to measures required in the nation as a whole

The information required for the analysis will be obtained through a combination of published literature<sup>11</sup> and consultation with the policy makers and regulators in Spain, France and Portugal. Entec has obtained contacts in each of these countries as part of the extensive consultation process, undertaken as part of the ongoing EC project to review of the LCP Directive.

<sup>11</sup> For example: CITEPA publish air emissions for France, including overseas departments ([http://www.citepa.org/emissions/index\\_en.htm](http://www.citepa.org/emissions/index_en.htm))

### **“Measures to ensure compliance with the ceilings” (article 10, paragraph 5 (c) of the NEC Directive)**

Using experience gained from a wide range of cost-benefit assessments for the EC and Defra<sup>12</sup>, Entec will build on research conducted by IIASA and AEAT under the CAFE programme to address this task. The methodology proposed will follow a number of steps, which are listed below.

#### *(i) Identification of Key Emission Source Sectors*

Clearly it is fundamental to identify the key emission source sectors for each pollutant, within each country. In assessing this, Entec will build on research carried out under Task 1, to review the National Programmes. An initial review<sup>13</sup> revealed the following points:

- For the SO<sub>2</sub> ceilings – collectively, the EU15 and the New Member States are projected to comply; however, Belgium, France, the Netherlands and Malta are projected to exceed their national ceilings.
- For NO<sub>x</sub> – the EU15 is projected to exceed the collective ceiling, whereas New Member States are projected to comply. All EU15 Member States, apart from Finland, Greece, Italy, Portugal, and the UK are projected to exceed, whereas all New Member States comply. Austria, Ireland, Luxembourg and Sweden are projected to exceed their national ceilings by greater than 25%.
- For VOCs – collectively, the EU15 and the New Member States are projected to comply; however, Austria, Belgium, Germany, Ireland, Luxembourg, Netherlands, Portugal and Spain are projected to exceed their national ceilings.
- For NH<sub>3</sub> – collectively, the EU15 and the New Member States are projected to comply; however, Belgium, Denmark, Finland, Germany, Ireland, Netherlands, Spain and the UK are projected to exceed their national ceilings.

The likely key sectors include power, road transport, industry and agriculture, but also sectors such as solvent emitting processes, including coating, surface cleaning, etc. Entec has detailed project experience spanning each of sectors, gained by specialist personnel from the project team (See Section 3).

#### *(ii) Establishment of Projected BAU Performance*

In our experience, determining the BAU situation can be one of the most challenging aspects of this type of exercise. This is mainly due to the complexity of BAU policies affecting emissions performance within a sector; the uncertainty associated with how some BAU policies may be complied with and the economic trends affecting the structure and activity rate within a sector. In undertaking this task, recognition will be made of the potential overlaps with various other policy drivers, such as the Solvent Emissions Directive (SED), the LCP Directive, the SCLFD greenhouse gas programmes, etc.

The establishment of a projected BAU situation would include consideration of:

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<sup>12</sup> Particularly notable is experience from the ongoing cost curve project for Defra.

<sup>13</sup> Based on information presented by IIASA at the 3<sup>rd</sup> Stakeholder Consultation on Draft Baseline Scenarios for CAFE, Brussels, April 30, 2004.

- emission reduction measures that are already in place, their efficiency and the percentage of uptake of these measures within a sector;
- additional emission reduction measures required to comply with BAU policies, their efficiency; and the additional percentage of uptake of these within a sector; and
- industry structure and activity rate trends in the sector.

In establishing a baseline for EU15, Entec will review the data collected by IIASA for inclusion within the RAINS model under the Current Legislation (CLE) 'capacity controlled' tables for 2010. Entec is in a strong position for this task as we will draw on our extensive experience in assessing BAU performance from our work for Defra on Cost Curves. Where we feel there is justification, IIASA figures will be updated based on information from in-house team, in addition to consultation with key policy makers and regulators, industry associations, other organisations as appropriate and targeted literature searches.

*(iii) Identification of Additional Techniques to Comply*

As part of work conducted by IIASA and EMEP, identified in Section 2.3.2, compliance with the NEC Directive will be assessed and the requirement for additional techniques identified. The identification of additional techniques will draw on the comparative assessment of National Programmes conducted under Task 1 of this project. The measures identified by individual member states will be supplemented with cost-benefit analyses conducted by both IIASA and AEAT, detailed in Section 2.3.2. This work will be reviewed, in light of Entec experience gleaned from recent policy projects, in order to identify realistic compliance techniques (and their effectiveness and potential uptake) across the diverse range of sectors required.

## 2.3.4 Outputs

### Technical report

Entec will summarise the results of the analyses conducted under Tasks 3 and described here, in Section 2.3.3.

### First draft report

Entec will propose a first draft report as required by the Directive. This will include a synthesis of the main findings of Tasks 1-3, as well as summaries of the findings of ongoing contracts under the CAFE programme. The conclusions from this review report will be presented as recommendations for the Thematic Strategy on Air Pollution.

Issues that may arise include:

- the increasing importance of unregulated sources, such as domestic fuel burning, solvents, agriculture, as measures are identified and applied to industry and transport;
- the potential Community adoption of legal/economic instruments, e.g. SO<sub>2</sub>/NO<sub>x</sub> trading or taxation; and
- the harmonisation of monitoring and implementation processes.

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## 2.4 Task 4 - Stakeholder consultation

The main purposes of the stakeholder consultation will be:

- To present the conclusions of the review of the NEC Directive and ensure understanding of the results
- To generate discussion and ideas
- To record consultation outcomes and integrate these into the work

The consultation will also help to gain support and ownership from the stakeholder group for the review and help people to share experiences and learn from each other. Stakeholders who will be present include representatives of the Member States, the European Parliament, EFTA countries, international organisations, NGOs and business organisations.

The meetings present an opportunity for participative discussions to get feedback and views on the research findings. This could involve a question and answer session or facilitated group discussion. They will be prepared and reported in a professional and transparent manner with technical briefing material provided in advance and feedback on the key outputs issued following the event.

The workshop will explore the main results of the NEC reports with the mixed group of stakeholders. The final format of the workshop will be determined in conjunction with the Commission.

We anticipate that the working language will be English, with interpretation provided by the Commission, if appropriate.



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## 3. Project Organisation, Timing and Deliverables

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### 3.1 Organisation and Steering Group Meetings

This section describes the proposed organisation of the project team and meetings with the Steering Group.

#### 3.1.1 Project Organisation

We would expect to be guided by the Steering Group over the course of the project. Our policy is to have the Project Manager and other senior members of the study team work closely with the client to ensure that the study achieves the client's objectives within the budget that has been established. We would expect the Steering Group to provide guidance on overall study objectives as well as recommendations for specific literature and stakeholder contacts, to supplement the extensive relevant literature and contacts already known to the project team. This interaction would be facilitated by direct liaison with personnel as well as frequent phone calls, progress reports and other means of communication. The key is close interaction to ensure that the study meets the Commission's needs.

The Project Manager will be Alistair Ritchie of Entec. He will be responsible for ensuring that the project meets the Commission's quality and timescale needs. He will also be responsible for project planning, day-to-day communications with the Commission, internal team communications, setting clear roles for the project team members and monitoring performance.

Dr Alun McIntyre of Entec will be the Project Director, and will take overall responsibility for the project.

The Project Team will incorporate a core team of consultants, supported by a further team of specialists. The full Project Team members and their specific roles within the project are defined within Table 3.1:

**Table 3.1 Summary of Main Roles and Team Members with Relevant Expertise**

<b>Team Member</b>	<b>Team role</b>	<b>Role Description</b>
Dr Alun McIntyre	Project Director (Core Team)	Overall responsibility for the project.
Alistair Ritchie	Project Manager (Core Team)	Overall responsibility for quality and performance monitoring, and day to day management of the project. Overall responsibility for Tasks 1, 3 and 4.
Helen ApSimon	Core Team (Associate specialist)	Overall responsibility for Task 2. Provision of specialist guidance and technical guidance throughout project.
Caspar Corden	Core Team	Key input to tasks 1 and 3.
Layla Twigger	Core Team	Key input to tasks 1 and 3.
Mike Soldner	Core Team	Key input to tasks 1 and 3
Katherine Wilson	Core Team	Key input to all tasks.
Ben Grebot	Core Team	Key input to all tasks.
Malcom Pratt	Specialist Support	Key technical support to the core team.
Richard Smyllie	Specialist Support	Specialist with expertise on solvent using industries. Key input to task 1.
Mark Watson	Specialist Support	Key technical support to core team.
Andrew Marsh-Patrick	Specialist Support	Technical support and analysis for Tasks 1 and 3.
Emily Trevorrow	Specialist Support	Key input and support to core team on stakeholder engagement and task 4.
Neil Thurston	Specialist Support	GIS specialist - technical support, information gathering and analysis.
Anna Cohen	Specialist Support	GIS specialist - technical support, information gathering and analysis for.
Sabrina Dann	Specialist Support	Economics support - technical support, information gathering and analysis.
Ian Spencer	Specialist Support	Economics support - technical support, information gathering and analysis.

### 3.1.2 Meetings and Other Interaction with the Steering Group

In complex policy studies of this nature, we appreciate that the policy context and availability of information is constantly evolving and that a flexible, dynamic approach to project planning is required. We emphasise the importance of close interaction with the Steering Group over the course of the project. This interaction would be accomplished through meetings, telephone calls, and frequent progress reports.

With regard to meetings, the Technical Annex various interactions, organised as follows:

- *Kick-off meeting.* This meeting will be held at the start of the contract. This meeting will allow us to:
  - Clarify the study objectives and other initial considerations, with particular regard to any perceived 'data gaps' within Task 3;
  - Obtain any more details related to the Commission's requirements and expectations for the project;
  - Discuss the Commission's specific priorities for the project, in order that resources can be directed to provide most value to the Commission. The project team has sufficient capability and experience to be able to provide this flexibility;
  - Agree the people and organisations to be contacted during the course of the study, including sector representatives and other organisations;
  - Make arrangements for liaison with other CAFE contractors;
  - Discuss arrangements for regular formal and day-to-day contact between the project team and the Commission's Steering Group; and
  - Clarify any outstanding issues regarding this proposal.

Following this meeting, detailed workplans and role descriptions will be developed for each member of the project team in order for the work to be progressed in an effective and timely manner.

- *At least three presentations made by Entec* in the CAFE Steering Group and relevant working groups, in addition to follow-up meetings with Commission representatives.
- *Additional special workshop on the NEC reports* - Entec will attend and participate in the workshop on the 2<sup>nd</sup> September 2004, as specified in the Technical Annex.
- *Meeting to discuss the interim report.* This meeting would provide an opportunity to discuss the interim report and the plans for the subsequent tasks within the project.

To ensure simplicity in lines of communication and efficiency in management of team resources, day-to-day communications between the Project Team and the Commission will be via the Project Manager. Specific technical communications between the Project Team and the Commission will be via the Project manager.

We will endeavour to ensure that all queries addressed to the project team are acknowledged and responded to as quickly as possible. Entec has set procedures for responding to change as part of our quality management system and this will aid us in providing a flexible and responsive approach to any significant issues raised.

We propose that, in addition to the required reports, short progress reports (of the order of 1-2 sides of A4) be provided by the Project Manager on a monthly basis.

### **3.1.3 Review of Information and Contacts**

We will ensure that the confidentiality status of any information provided for the study is reviewed, in accordance with our in-house quality policy. We will ensure that all organisations

contacted are aware of the manner in which the information they provide will be used and ensure that they are given adequate opportunity to clarify what data should and should not be included in any report.

In addition, all information received will be reviewed upon receipt according to Entec's quality guidelines, which are available upon request. It will be of particular importance to review the methodological approach taken in the various literature sources consulted and also the current applicability of the findings (given the range of work being undertaken currently).

## **3.2 Schedule and Deliverables**

This section outlines the schedule and deliverables.

We will make all reasonable endeavours to ensure that we fully meet the requirements for deliverables and timetable. However, we are conscious of our dependence upon a number of external organisations providing the necessary data and information for this review. Through our monthly reporting, and whenever necessary, we will keep you informed of any issues in this area. This will then allow us to seek your guidance and/or assistance as appropriate.

### **3.2.1 Timetable**

The key individuals are available immediately to begin this project. The Technical Annex outlines a rough schedule for the project, with the requirement that:

- an inception report be produced within one month of the kick-off meeting;
- an interim report be delivered 5 months after signature, reflecting progress and findings;
- the draft final report will be completed by 7 months after signature;
- the revised final report must be submitted within one month following submission of the draft final report.

As described in Section 3.1, we have also made provision for submission of short monthly progress reports. As suggested in the Technical Annex, we would commence work immediately following signature of the contract and subsequent kick-off meeting.

A chart detailing the key tasks to be undertaken and the proposed timescales, consistent with the Technical Annex, is provided in Figure 3.1. We will develop a more detailed schedule following the inception report and taking into account any specific additional timescale requirements of the Commission.

Figure 3.1 Chart detailing key tasks and timescales

Month	1	2	3	4	5	6	7	8
Signature of contract	x							
Kick-off meeting	x							
Inception report		x						
Interim report					x			
Draft final report							x	
Final Report								x
Task 1	█							
Task 2	█							
Task 3			█					
Task 4*			█					
Task 4 workshop*			█					
Three presentations								
Follow up meetings								
Monthly progress reports			█	█		█		
*To be agreed								
**Expected to take place within this timeframe (2nd September)								

### 3.2.2 Deliverables

The deliverables are outlined in the Technical Annex. In addition to regular progress reports, we will deliver an inception report, an interim report, a draft final report and a final report.

The Commission's specific needs for each of the reports will be determined in advance through close contact with the Steering Group as discussed earlier.

The technical annex specifies that Tasks 1, 2 and 3 will each produce a technical report. Following clarification with the Commission, these Task reports will be included within the final report as separate sections. Additionally, progress on each of the Tasks will be reported in separate sections within the Interim Report.



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## 4. Project Team Experience

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### 4.1 Introduction

This Section details the extensive relevant experience of the project team. The organisation of the project team including the description of key roles is presented separately in Section 3.1.

### 4.2 Core Team

**Alistair Ritchie (Principal Consultant, Project Manager)** has extensive experience managing, directing and contributing to complex air quality policy development studies for the European Commission, Defra and other key clients. He is a Chartered Chemical Engineer with an MBA, and has specialist expertise in air emissions abatement techniques, techno-economic evaluation, Cost-Benefit Analysis (CBA), Cost-Effectiveness Analysis and market-based instruments.

His experience encompasses a wide range of studies relevant to the Review of the NEC Directive. This includes the project management of Defra CBAs of the NEC Directive, the Gothenburg Protocol, the LCP Directive, the Solvent Emissions Directive, the Sulphur Content in Liquid Fuels Directive, the Sulphur Content in Marine Fuels Directive, the Waste Incineration Directive, the VOC in Paints Directive and several other studies. He is also experienced in the implications of the IPPC Directive through assessments of BAT at a site and sectoral level. He is currently project director for the 3 year Defra research project “Cost Curves for Air Pollutants”, which has developed Revised UK Cost Curves for SO<sub>2</sub>, NO<sub>x</sub>, VOCs and PM.

Alistair is currently managing the European Commission studies on the Review of the LCP Directive and the assessment of National Plans from Member States under the LCP Directive. He previously managed the Commission contract to develop guidance to Member States on LCP Directive National Plans. He has also managed Commission studies on the CBA of reducing VOC emissions from the vehicle refinishing sector, quantifying emissions from ships in EU waters and the economic evaluation of air quality targets for heavy metals.

Alistair is experienced in market-based instruments and recently managed a complex Defra study on external costs of NO<sub>x</sub> and SO<sub>2</sub> emissions from industrial sources and options for economic instruments (trading and taxation). His work on the review of the LCP Directive includes assessing the scope for application of market based instruments in the EU to further reduce SO<sub>2</sub> and NO<sub>x</sub> emissions. Furthermore, Alistair has detailed experience in market-based instruments through several studies related to the development of National Plans under the LCP Directive for the Commission and for Defra.

**Dr Alun McIntyre (Technical Director, Project Director)** is a leading expert in air quality issues for the transport sector and has over 20 years of experience in consultancy and research organisations. The majority of work has been concerned with air quality issues, including both technical, policy and regulatory assessment projects for both government and private sectors.

He was project director for the recently completed study on shipping emissions in EU waters and therefore has a sound overview of the issues important to this study including the apportionment of emissions to different countries. Other relevant recent policy studies include work for DEFRA in the UK on the emission reductions of NO<sub>x</sub> and VOC that would be required to comply with the provisions of both the National Emissions Ceiling Directive (NEC Directive) and the Gothenberg Protocol. Whilst working in Hong Kong, he undertook air quality assessments of two major harbour reclamation schemes: the Kwai Chung container terminal expansion and West Kowloon reclamation. Both of these projects involved an assessment of the effects of emissions from shipping movements in Victoria Harbour and, more specifically, the effects of in-port emissions from container and other ships.

**Helen ApSimon (Associate)** is Professor of Air Pollution Studies at Imperial College London, where her group includes the UK National Focal Centre for Integrated Assessment Modelling. She has 25 years experience in air pollution modelling and analysis, and has worked closely with the Task Force on Integrated Assessment Modelling under the UNECE CLRTAP since 1991. Here she has developed and applied the ASAM model to complement the work of IIASA with the RAINS model. Her research is currently focused on development of integrated policies addressing issues of air quality and health as well as protection of UK ecosystems and transboundary pollution at European and global scales, with new work developing to look at longer term strategies. She has served on various international and national expert groups, including the Air Quality Expert Group of Defra currently addressing fine particles in the UK.

**Caspar Corden (Senior Consultant)** has worked on and/or managed over 40 projects for the UK Governments and Agencies, the European Commission, private companies and trade associations. Caspar has particular expertise in the development and application of techniques for the appraisal of environmental policies and legislation (including cost/risk-benefit analysis, multi-criteria analysis, socio-economic analysis, risk assessment and sustainability appraisal), as well as assessment of the human health and environmental risks associated with chemicals and with dangerous goods transport and storage.

Caspar has worked on a number air quality related projects, including work on the Solvent Emissions Directive in support of the UK's implementation of this Directive and development of national level and spatially disaggregated cost curves for NO<sub>x</sub>, SO<sub>2</sub>, NH<sub>3</sub> and PM<sub>10</sub>. This work, along with an ongoing project for Defra on projecting future emissions of non- CO<sub>2</sub> greenhouse gases involves a detailed understanding of development of emissions inventories and emissions projections.

**Layla Twigger (Senior Consultant)** has worked on a wide range of policy projects for clients including DEFRA, DTI and the European Commission. She is currently working on a large project to update and enhance the utility of the existing UK cost curves for a range of pollutants. To date, these have included NO<sub>x</sub>, VOCs, particulates and SO<sub>2</sub> and have considered emissions from a wide range of sectors, including shipping. She was also involved in feeding data from the UK cost curves into IIASA RAINS database. Layla also recently contributed to a project for Defra which aimed to quantify the environmental impact of industrial air pollution, and assess options for economic instruments. She has also worked on a number of Regulatory Impact Assessments (RIAs) for Defra, including those for the Large Combustion Plant Directive (LCP Directive), Waste Incineration Directive (WID), Sulphur Content of Liquid Fuels Directive (SCLFD), and the UNECE 1998 Aarhus Protocol and the UNEP Stockholm Convention on Persistent Organic Pollutants (POPs). These RIAs included contact with a industry representatives and regulators and assessed the costs and benefits of the proposals, including

carrying out Small Business Litmus Tests. The LCP Directive work involved assessing the costs and benefits of a range of potential compliance and interpretational scenarios.

Layla has also been a key team member of a number of projects for the European Commission. These include current work to review the LCP Directive; a separate project to review National Plans submitted by Member States and Accession States under the LCP Directive; Entec's project on emissions from the shipping sector in EU waters; and a study on the European Heavy Metals "Daughter Directive" under the Air Quality Framework Directive. Layla's experience of emissions from ships was supplemented by a Cost Benefit Analysis study for DEFRA on proposals to reduce the sulphur in marine fuels. Other projects have included a number of additional work packages on the LCP Directive for DEFRA, including the development of a Draft National Plan; and a project for DEFRA which aimed to predict and assess future air quality objectives at SSSIs across the UK.

**Michael Soldner (Consultant)** works within the Entec EHS International and Policy Group. His education in the Environmental Sector has been broad, covering most aspects of the Environmental Consultancy business. He has recently carried out a number of national and international surveys on various legislation regulating emissions from industry. For the European Commission he worked on a guidance document for Member States on the implementation of the LCP Directive. In a related study for DEFRA he investigated the costs and benefits of implementing the LCP Directive both via the Emission Limit Value (ELV) approach or via a National Emission Reduction Strategy (NERS). In a further research study for DEFRA he investigated up-to-date data on air pollution abatement equipment with the aim of revising the UK's cost curves for NO<sub>x</sub> and VOCs. He also carried out a detailed review of the costs of the Gothenburg Protocol (GP) ELV policy options to the petroleum and fertiliser industry and carried out a cost-benefit analysis of implementing the GP in form of the ELV approach and via a NERS. Michael is fluent in English, German, French and Spanish.

**Katherine Wilson (Consultant)** worked within Entec's air quality team for two years, completing air quality impact assessments for a variety of industrial processes. Having taken a year out to complete an M.Sc. in Environmental Technology, she re-joined Entec as part of the policy group in September 2003.

Katherine is currently working on a project for the EC to review the impacts of the LCP Directive on Member States and Accession Countries. During the data-collection phase of the project, Katherine has made contact with a wide range of stakeholders throughout Europe, including policy makers, regulators, industrial trade associations and individual companies. Through consultation with these stakeholders, and using data gained from European databases (e.g. IIASA RAINSWEB, European Pollutant Emissions Register, CoalPower4 Database), Katherine has assimilated detailed operational and emissions data from European LCPs in the dominant sectors.

Katherine has contributed to a number of strategic air quality projects for Defra and the EC. Katherine was a key member of the team commissioned to inform Defra on the abatement measures and costs of meeting policy objectives for air pollutants at Sites of Special Scientific Interest. As part of this project, Katherine identified the national and local strategies currently in place to reduce emissions of SO<sub>2</sub> and NO<sub>x</sub>. She then used a variety of information sources to gather data on further reduction techniques and associated costs and modelled the effects of their implementation. Katherine also contributed to a Regulatory and Environmental Impact Assessment for UK compliance with EC proposals for the Fourth Air Quality Daughter Directive. Both projects involved close liaison with Entec's GIS team, to

produce ambient air quality maps of the UK and assess the potential impacts on human health.

Working for the Scottish Executive, Katherine played a central role in a project to provide detailed information on the potential structure and content of a Scottish Air Emissions Database. She has also been involved with Entec's ongoing 'call-off contract' with Defra to develop 'cost curves' for air pollutants. This work has used the National Atmospheric Emissions Inventory as a basis for predicting the impacts of various abatement techniques on emissions from a variety of source sectors, including the electricity supply industry, petroleum refining and iron and steel works. Recently, Katherine has also been involved with the Carbon Management Pilot Programme for the Carbon Trust, and has reviewed assumptions made within emissions databases for CO<sub>2</sub>.

**Ben Grebot (Assistant Consultant)** has recently joined Entec working in the Environmental Management team with a strong academic and policy background. Ben has joined Entec from the Air and Environmental Quality (AEQ) Division of Defra where he worked as a Policy Advisor on transport-related policy and technology focussing on the impact it has on air quality. This involved developing and assessing the impacts of various policies and programmes including the next round of European vehicle standards and the incentivisation of cleaner fuels, vehicles and technologies. This work required Ben to liaise with a wide range of stakeholders including contractors, the European Commission, other Government departments, local authorities and industry contact groups. He has a good working knowledge of a wide range of transport related policies, programmes and schemes as well as more general air quality issues including European and UK legislation and European programmes and models such as REMOVE and RAINS.

Since joining Entec Ben has been providing specialist input on transport emissions and their abatement measures, under projects for Defra AEQ Division on Cost Curves for Air Pollutants and Defra GA Division on Non- CO<sub>2</sub> Greenhouse Gas Emissions. He is currently working on projects related to the Large Combustion Plant Directive for the European Commission. These include the review of the LCP Directive itself and the assessment of Member State's National Plans submitted to the Commission under the Directive.

### 4.3 Specialist Support

**Malcolm Pratt (Technical Director)** has been with Entec for nearly 30 years. During that time he has conducted and led a wide range of environmental projects in a number of countries. Specific issues that have been addressed include air quality measurement and assessment and predictive modelling, odour and dust nuisance assessment, environmental impact assessment, environmental auditing, accident investigation and contaminated land assessment. He has provided expert evidence on air quality and general environmental impacts at a number of public inquiries in England and Scotland. These planning appeals have examined a wide range of developments including for example, incinerators, nuclear reprocessing plant and industrial premises. He has given evidence in court in connection with environmental nuisance.

Malcolm was project manager of the air quality assessments for Manchester Runway Two and Heathrow Terminal 5 together with a number of related projects including the proposals for M25/T5 Spur Road and improvements to the M4 (junctions 3 to 4b). At the planning inquiries into these developments Malcolm gave air quality evidence for Manchester Airport plc, BAA plc and the Highways Agency. For Manchester Airport he also assisted in the preparation and

edited the air quality section of the Environmental Statement for Runway Two. During these projects Malcolm provided advice on environmental auditing procedures, air quality monitoring and the scope for gaseous emission reductions. Malcolm was project director of a preliminary environmental assessment for a runway extension at Plymouth Airport. He developed pre-construction monitoring requirements to satisfy BAA commitments given during the T5 inquiry and subsequently managed the monitoring programme. Malcolm continues to give advice on air quality issues arising from the T5 decision and the construction of the terminal.

**Richard. J. Smyllie (Principal Consultant)** is a Chartered Chemical Engineer with over 22 years experience in the process industries in process safety, pollution prevention and control and air quality.. He has successfully project managed several projects for DEFRA and the Environment Agency. He project managed a highly regarded study for DEFRA on the compliance cost of the UNECE heavy metals protocol including lead, cadmium and mercury during which he advised the Government in international negotiations on BAT. This involved compiling emissions from various industries as well as emission projections for the heavy metals of concern.. He has project managed a Regulatory and Environmental Impact Assessment for the EC Solvent Emissions Directive for DEFRA which has included follow up work and drafting of 6 LAAPC Guidance Notes. He has undertaken several BAT reviews for the Environment Agency and DEFRA (LAAPC) as well as drafting six IPC Guidance Notes.

He has undertaken several BAT reviews for the Environment Agency and DEFRA which have included:

- Metal carbonyls and inorganic compounds of chromium, magnesium, manganese, nickel and zinc
- Carbonisation processes including coke manufacture, smokeless fuels, carbon black
- Waste recovery process including solvent recovery, oil re-refining, activated carbon regeneration ion exchange resins regeneration.
- Waste Oil Combustion, Refuse Derived Fuels.
- Diisocyanates, Tar and Bitumen Processes and Timber Treatment.
- Metal Coating, Wood Coating and Tar and Bitumen Processes (under LAPC)

He has also had input to the halogens, (titanium dioxide, HF) and phosphorus BAT reviews.

He has drafted six of the EA Chief Inspections Guidance Notes for many of the above processes. He has recently project managed drafting of LAAPC Guidance Notes in Metal Coating, Wood Coating, Vehicle Refinishing, Leather Coating, Oil and Fats, Aircraft Coating and Adhesive Coating processes.

He has recently project managed a feasibility study into reducing VOC emissions from a crude oil storage terminal covering tank doming, and various crude stabilisation options. The study investigated the options for utilising the fuel gas generated as power generation, CHP, hot water and steam generation.

He has also prepared a number of IPC and more recently IPPC applications for authorisation for industrial processes that cover chemicals and plastics manufacture and energy from waste plant. He is an experienced hazop chairman and has undertaken several high profile studies in the oil and gas, pharmaceutical, and water industries. This included the longest LPG pipeline to be

built in the world in India. He gave evidence at the Piper Alpha public enquiry on the causes of extended flaring of the hydrocarbons after the incident.

**Mark Watson (Principal Consultant)** has project managed a number of key policy and research projects. These have included:

- A technical study for UKWIR that examined the feasibility of meeting tighter effluent quality standards at wastewater treatment works. The impact of these tight standards on energy use, greenhouse gas (GHG) emissions and costs was assessed. Performance of the different treatment technologies was compared with respect to effluent quality, energy use, GHG emissions, costs, land use and sludge production. The results of the study should allow the water industry to enter into an informed debate with the regulator regarding effluent quality and climate change issues.
- A technical study for DEFRA involving analysis of the Emission Limit Values (ELVs) in the Gothenburg Protocol. This assessed whether the UK will meet all the requirements of the Protocol under existing policy measures, or if additional measures are needed. The study involved updating emission projections for 2010 for SO<sub>2</sub>, NO<sub>x</sub> and VOCs to determine whether or not existing policy measures will enable the UK to meet the emission ceilings specified in the NEC Directive and the GP. It also explored possible further measures that the UK could implement to meet the ceilings and assessed the associated costs and benefits. This study will support further work to enable the UK to ratify the Gothenburg Protocol (GP) and transpose the National Emission Ceilings Directive (NEC Directive) into national legislation.
- A technical study for DEFRA to characterise and quantify the costs and impact of control measures on current and possible future emissions, and the resulting costs and benefits in support of the development, implementation and monitoring of domestic and international air pollution policies. Initial priorities include:
  - review of policy priorities;
  - improve quality of existing cost curves using best available information on emission sources, techniques and costs;
  - incorporate abatement of multiple pollutants;
  - analyse and quantify uncertainty;
  - investigate options to factor human health and environmental benefits into cost curves;
  - produce spatially disaggregated cost curves; and
  - develop cost curve database and interface with National Atmospheric Emissions Inventory, UK Integrated Assessment Model and specialist environmental models.

Mark has also contributed to a study on the European Heavy Metals “Daughter Directive”, under the Air Quality Framework Directive, which included investigation into emissions from a range of sectors including cement works, non-ferrous metals, incineration and petroleum refineries.

**Andrew Marsh-Patrick (Senior Consultant)** is a Chartered Chemical Engineer with over six years’ industrial and environmental consultancy experience. Andrew previously worked for ICI

at two of their largest UK manufacturing sites prior to joining Entec. Andrew has a masters degree in Chemical Engineering and a MSc in Environmental Decision Making. He recently completed a 6-month study for DEFRA to develop UK costs curves for abatement of dioxin emissions to air. He is a member of the Institution of Occupational Safety & Health and has considerable experience of process plant development, operation and management systems, including environmental reporting and ISO14001.

Andrew was the main researcher and author for a 6-month DEFRA study to develop UK cost curves for abatement of dioxin emissions. This involved review of the key sectors (iron & steel, cremation, cement, non-ferrous metals, waste incineration, etc.) which contribute to dioxin emissions and identification and costing of abatement technologies. Andrew worked closely with stakeholders including the Federation of British Cremation Authorities. His work identified that several amendments were required to the existing national atmospheric emissions inventory (NAEI) for dioxins. Andrew also recently carried out a review of UK emissions projections for SO<sub>2</sub>, NO<sub>x</sub> and VOCs on behalf of DEFRA. This involved quantification of the impacts of the Large Combustion Plant Directive, Solvent Emissions Directive and other existing and planned policy instruments on emissions from the industrial, commercial and domestic sectors. The projections formed part of the government's regulatory impact assessment for the National Emissions Ceiling Directive.

Andrew is currently completing two six-month projects for the Carbon Trust to advise private sector companies on Carbon Management, including GHG emissions baseline assessment, benchmarking and assessment of abatement measures. Andrew undertook technical verification of GHG emissions baselines and monitoring protocols submitted to DEFRA by companies wanting to participate in the UK Emissions Trading Scheme (ETS). He assessed submissions from a variety of sectors including emissions from process operations, transport and buildings. He held discussions with industry bodies on behalf of DEFRA to resolve technical issues such that the protocols could be approved under the rules of the ETS. As part of a DEFRA contract, Andrew collected and analysed data on CO<sub>2</sub> emissions from the oil & gas extraction and petroleum refining industrial sectors across the whole of the UK. He consulted regulators and manufacturers to obtain data on emissions and assess the impact of policy measures. He also reviewed energy saving technologies and made calculations to estimate potential CO<sub>2</sub> emission reductions and associated capital & operating costs.

**Dr Neil Thurston (Senior Consultant)** is a GIS specialist at Entec, with over nine years of experience in spatial mapping and analysis. He is responsible for GIS issues at Entec and advises on MapInfo and ArcView GIS technical skills, GIS development capabilities and Access database linkages for a wide range of environmental projects. In the last few years, Neil has worked on a range of GIS and database development projects for a range of organisations. Examples include: National assessment of the impact of future air quality upon SSSI sites (for DEFRA); Assessment of ship emissions across the European Union area (for European Commission); Development of a customised Access database incorporating a land quality information, hyperlinks to external documents; user-defined queries and reports (for Defence Estates); and management and analysis of large GIS and Access databases to support groundwater and hydroecology projects (for Environment Agency - Anglian Region). Other recent GIS project experience includes: Development of a MapInfo application to assist in the estimation of regional and local patterns of visitors upon open access land (for The Countryside Agency); Assessment of the economic impact of fluvial/coastal flooding in Scotland (for Scottish Executive); Infrastructure project for the enhancement of rural productivity (Asian

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Development Bank/Dept of Agriculture, Philippines); Evaluation of Weak Links in UK flood defences (for Association of British Insurers).

**Emily Trevorrow (Senior Consultant)** is experienced in public consultation and communication on environmental, planning and sustainable development issues. She has provided consultancy to a range of industries and organisations including local and central government, Environment Agency, Countryside Agency, the water industry and the waste industry. Emily's experience in public consultation includes stakeholder engagement; development of education and awareness plans; relating technical information to stakeholders; questionnaire design; and evaluation of existing and potential consultation practices.

She has engaged stakeholders on a variety of subjects including sustainable development; climate change; renewable energy facilities; and waste strategy development. Emily has excellent communication skills, which are essential when working with stakeholders and members of the public. She also has extensive experience in the facilitation, organisation and running of meetings and stakeholder workshops and conferences. Projects Emily has recently been involved in include managing the stakeholder element of the report on Climate Change Impacts in London and a stakeholder involvement programme for the development of a waste strategy for Hampshire County Council, bringing together stakeholders with conflicting views and needs into one forum to identify common goals and ways forward.

**Anna Cohen (Consultant)** has an MSc in GIS and over 7 years experience in the use of GIS for mapping and analysing spatial data. She joined Entec from the Welsh Assembly Government, Agricultural and Rural Affairs Department where she gained 5 years experience mapping and manipulating environmental and agricultural data in GIS. She has experience of using ArcView 3.2, ArcGIS, IDRISI, MapInfo and ERDAS Imagine. As part of her MSc, Anna completed a dissertation specialising in the use of simple interpolation and geostatistical techniques to convert point rain gauge data into continuous rainfall surfaces for use in an integrated hydrological, hydrodynamic water quality and sediment delivery model. Since joining Entec in 2002, Anna has continued to develop her GIS skills using ArcView 3.2, ArcGIS, MapInfo, MS Access and Avenue, the development language for ArcView 3, for both analysis and mapping work. She has used these skills by completing work for a variety of environmental projects including: DEFRA - Quantifying the Environmental Impact of Industrial Air Pollution and Options for Economic Instruments; DEFRA - Cost Curves for Air Pollutants; European Commission - assessment of ship emissions across the European Union; Able UK Ltd - North Killingholme Flood Risk Assessment; North West Regional Assembly - Strategic Views of the River Mersey; Cheshire County Council - Prioritisation of Waste Management Sites; Environment Agency - Water Framework Directive National Characterisation and United Utilities - Strategic Windfarm Opportunities Appraisal.

**Sabrina Dann (Consultant)** joined Entec's corporate social responsibility (CSR) development team after finishing her masters degree at the University of York. Her work ranges across CSR and economic issues, and focuses on the socio-economic impact of corporate behaviour. In addition to the development of Entec's approach to CSR, she has also been involved in a number of complementary projects and proposals. Key inputs have been a wide ranging contribution to an assessment of the environmental, social and economic consequences of climate change in the West Midlands, an assessment of the effects of permit allocation on the National Plan approach to the Large Combustion Plant Directive, and analysis of the economic and regulatory structure of the aluminium and forest products sector to assess the feasibility of decoupling resource use from economic development. She has also been involved in previous planning projects, involving data gathering, calculation and interpretation. Work on these

projects included consultation with local authorities, housing associations, and developers to identify examples of good practice in provision of rural and urban affordable housing. One of the larger projects involved compiling a large data sheet for an Urban Capacity Study of Milton Keynes.

**Ian Spencer (Assistant Consultant)** is an Assistant Consultant qualified at MSc level in Ecological Economics. Ian has practical understanding and experience of natural resource economics, including evaluation of natural resource use, environmental valuation, policy options and appraisal tools such as cost benefit analysis and non-monetary appraisal tools. He has direct experience of evaluating economic instruments for use within the UK and assessing institutional capacity for their delivery. He also has knowledge of international experience in issues such as water pricing, emissions trading and valuation.

Ian also has experience within the European Commission on regional investment programmes in the UK.



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## 5. Relevant project experience and quality assurance procedures

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### 5.1 About Entec

Entec UK Ltd is one of the UK's leading environmental and engineering consultancies. We currently employ over 500 consultants and engineers in the UK, which ensures that Entec has the broadest range of environmental science and engineering skills available in the UK market. This has recently been confirmed by ENDS market analysis of the environmental consultancy industry. Entec aims to deliver high quality assessments that assist in developing sound environmental policy and guidelines by combining skills in a wide range of areas, including climate change.

In addition to working in the UK, we are also very active in the European environmental market, and we have recently won the prestigious European Award for the Environment 2000 in the 'International Partnership for Sustainable Development' category. In addition, our air quality project work for DG Environment is also gaining Entec an increasing profile across Europe and we have contacts and partners in a wide range of industry sectors across the EU.

Entec is a leading advisor to UK Government Departments and overseas clients in the analysis and development of environmental policies. Clients in the public sector include the Department for Environment, Food and Rural Affairs (DEFRA); the Department of Trade and Industry (DTI); the European Commission; the Scottish Executive; the Department of the Environment in Northern Ireland and the Home Office. Combining skills in Cost Benefit Analysis, Policy Interpretation, Environmental Impact and Life Cycle Assessment, Regulatory Impact Assessment, Pollution Prevention & Control, Process Engineering, Cost Assessment, Economic Assessment, Valuation of Externalities, Market-Based Instruments and Sectoral Analysis.

### 5.2 Relevant Entec Project Experience

#### 5.2.1 Air pollutant emission inventories and air quality management plans

##### **Emissions Database Scottish Executive (2001-2002)**

Development of a profile and specification for an atmospheric emissions inventory database for Scotland. Involved reviewing emission databases in other countries (USA, England) and making recommendations for improved connectivity, justification, treatment of uncertainties and accessibility.

##### **Defra - Protection of Sites of Special Scientific Interest under the Air Quality Strategy for England, Scotland, Wales and Northern Ireland (2001 to 2002)**

Entec has undertaken a study to inform Defra on the abatement measures and costs of meeting specific potential policy scenarios for concentrations of NO<sub>x</sub> and SO<sub>2</sub> at Sites of Special Scientific Interest in the UK. This work involved assessments of local, regional and national packages of abatement options associated with transport emissions and emissions from

stationary sources. Outputs from Netcen NO<sub>x</sub> and SO<sub>2</sub> concentration models were utilised, in conjunction with GIS processing techniques, to rank the most cost-effective 'beyond business as usual' measures required to comply with UK air quality objectives.

Following the initial study, Entec was asked to investigate additional policy scenarios and undertook a full benefit analysis. This included the quantification of impacts on health, through application of COMEAP dose-response relationships to 'population weighted mean concentrations' calculated across the UK.

#### **Defra – Non-CO<sub>2</sub> Greenhouse Gas Emissions Projections for the UK (2003 to 2004)**

Entec has been awarded a contract to develop projected emissions of a number of non-carbon dioxide greenhouse gases in the UK. Entec's work will include an assessment of current policy options and their implications for future emissions of methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride, as well as emissions estimates derived up to 2020. Abatement cost curves will be developed for greenhouse gas emissions from each of the major sources. The results will be used to demonstrate UK progress against its legally binding target under the Kyoto Protocol and to help the government identify the most cost-effective mitigation options. Road transport represents one of the key sectors to be considered in this study.

#### **A project team experienced in air quality review and assessment.**

Our staff have undertaken many Phase 1 Review and Assessment projects for local authorities, from the more basic screening methodologies at Stage 1, to detailed dispersion modelling and monitoring at Stage 2 and 3. We are continuing to work with local authorities in terms of providing Stage 4 services and support in relation to the defining of Air Quality Management Areas (AQMAs) and Action Planning, and more recently have completed a number of Updating and Screening Assessments and Detailed Assessments.

#### **Local Authorities - Local Air Quality Management, Updating & Screening Assessments (2003)**

On the basis of Entec's depth of skills and expertise in the field of local air quality management, with a past performance of delivering high quality assessments on behalf of a number of local authorities, Entec was commissioned in 2003 by several local authorities to undertake their Updating & Screening Assessments (U&SA)

The U&SA forms part of the statutory duties surrounding Local Air Quality Management (LAQM) and the on-going process of air quality assessment. The U&SA reviews the pollutants specified under LAQM with regard to guidance issued by Defra in 2003 and the objectives specified in the Air Quality (England) Regulations (2000), the 2002 (amended) objectives and EU Limit Values. Where the U&SA identifies a potential for the AQOs to be exceeded at locations of relevant public exposure, the local authority is required to undertake a Detailed Assessment. The U&SA investigates emissions and concentrations of seven local air pollutants from all emission sources both within and neighbouring each local authority area.

At the current time Entec is continuing to expand into the local authority sector though the provision of further consultancy services. Entec is currently undertaking several Stage 4 review and assessments and is working in partnership with local authorities in terms of the designation of Air Quality Management Areas (AQMAs) and the formulation and implementation of air quality Action Plans.

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**Department for Environment, Food and Rural Affairs (formerly Department of the Environment, Transport and the Regions) – work on the Large Combustion Plant Directive (ongoing)**

Over a number of years, Entec has assisted DEFRA in its investigations of the potential impacts of the Revised Large Combustion Plant Directive (LCP Directive). Projects carried out have included:

- *Consultancy work on the LCP Directive, the National Emissions Ceiling Directive (NEC Directive) and the Gothenburg Protocol (GP) (2003)*. This overall project investigated a number of scenarios and issues associated with the LCP Directive to inform the Government's decision regarding the implementation of this Directive. It also provided support to the implementation of the NEC Directive and GP.
- *Development of Draft National Plan under the new LCP Directive (2002)*. To assist DEFRA in implementation of the new LCP Directive, Entec developed the draft of the UK National Plan. This detailed document had been issued for consultation.
- *Updated Cost Benefit Analysis of the new LCP Directive (2002)*. The recently adopted LCP Directive is subject to considerable scrutiny due to its potential impact on the UK electricity supply industry and other affected sectors. In particular, the choice of implementation options is the subject of a detailed Cost Benefit Analysis that has been undertaken by Entec. This builds on Entec's previous work and updates it, utilising comprehensive plant-by-plant information and evolving techniques in benefit analysis.
- *Development of a Consultation Paper on the implementation of the New LCP Directive including assessment of the National Emission Reduction Plan (National Plan) option for existing plants (2001)*. Following the agreement of the text of the New LCP Directive, Entec developed a Consultation Paper to clearly explain the UK's options for its implementation, their costs and benefits.
- *Secondment and Call-Off Contract to Provide Policy Support on New Large Combustion Plant Directive including development of a Preliminary Paper on the National Plan option for existing plant and a Cost-Benefit Analysis to support a Regulatory and Environmental Impact Assessment (2000 to 2001)*. A key member of Entec staff, Alistair Ritchie, has undertaken a four month secondment to work in the EU and International Branch of DEFRA's Air and Environment Quality Division. The main policy area covered included the Revised LCP Directive. In addition, other policies included the Solvent Emissions Directive, the NEC Directive and GP.
- *Implications of a National Emission Reduction Strategy for Existing Plant under the Revised Large Combustion Plant Directive (2000)*. Entec was requested by DETR to investigate the economic and environmental implications to the UK of a National Emissions Reduction Strategy to inform the Government's future negotiating stance on the Revised LCP Directive. The results of our study were of considerable importance to the UK negotiations in securing an acceptable political agreement.
- *Costs and benefits of implementing the Proposed Amendments to the Large Combustion Plant Directive in the UK (1998 to 1999)*. Entec was commissioned by DETR to develop the Regulatory and Environmental Impact Assessment (REIA) for the Proposed Amendments to the LCP Directive. The work was undertaken as 2 separate projects, considering the application of the Proposed Amendments to *new* and *existing* plant

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(covering coal, oil and gas fired power stations and industrial combustion plant, including gas turbines).

**Department for Environment, Food and Rural Affairs - Development of Draft National Plan under the new Large Combustion Plant Directive (2002)**

To assist DEFRA in implementation of the new Large Combustion Plant Directive (LCP Directive), Entec has developed the draft of the UK National Plan. This detailed document had been issued for consultation. It considers each existing large combustion plant (LCP) in the UK and their relevant operational characteristics within the LCP Directive reference period. Emissions bubbles for SO<sub>2</sub>, NO<sub>x</sub> and dust have been calculated using alternative emission factors and compliance measures to meet the bubbles have been investigated. In addition, the draft National Plan comprises an implementation timetable and a monitoring / reporting mechanism.

**Department for Environment, Food and Rural Affairs - UK Emissions Trading Scheme Pre-Registration Call-Off Contract (2001 to 2002)**

DEFRA awarded Entec an important contract to assist with the implementation of the UK Emissions Trading Scheme. This scheme is of considerable environmental and economic importance to the UK and will further establish the UK at the forefront of meeting global environmental challenges. Our project team of seventeen specialist consultants provided high quality technical advice to DEFRA to help ensure a successful Pre-Registration process. Technical advice was provided across fifteen industry sectors on participant source lists of fuel-related CO<sub>2</sub>, process-related CO<sub>2</sub> and non-CO<sub>2</sub> greenhouse gas emissions and indirect emissions from electricity usage. We also advised on protocols for measurement and reporting of emissions.

**Department for Environment, Food and Rural Affairs - Secondment and Call-Off Contract to Provide Policy Support on Revised Large Combustion Plant Directive and Solvent Emissions Directive (2001 to 2002)**

A key member of Entec staff has undertaken a four month secondment to work in the Transboundary Branch of DEFRA's Air and Environment Quality Division. He was responsible for providing briefing to Ministers, answers to Parliamentary Questions, policy interpretation, technical queries, representation at European Council Environment Working Group meetings and support to the branch head. Policy areas include the Revised Large Combustion Plant Directive (LCP Directive), the Solvent Emissions Directive, the National Emission Ceilings Directive (NEC Directive) and the UNECE Gothenburg (Multi-Pollutant) Protocol. Work included development of a paper on the National Plan implementation option under the Revised LCP Directive, with consideration given to the application of economic instruments. His initial secondment has been followed by a Call-Off Contract to advise on the technical feasibility, costs and environmental benefits of potential compromise positions for the Revised LCP Directive; to develop the Cost-Benefit Analysis of the final text and to provide advice on development of the National Plan implementation option.

**The Carbon Trust - Carbon Management Pilot Programme**

Entec was selected by four UK companies to carry out four separate Carbon Management Pilot Programme (CMPP) studies, which are all funded by The Carbon Trust.

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Carbon Management is about mitigating an organisation's contribution to Climate Change and reducing its greenhouse gas (GHG) emissions. Entec's work helped the companies to recognise the associated risks and opportunities and that the businesses adapt accordingly.

There are several key drivers for carbon management, including:

- UK climate change policy
- EU emissions trading scheme
- Competitive position
- Reputation / brand image
- Cost savings.

One of the four contracts was for Kronospan, a company for which Energy is such a significant proportion of manufacturing costs, that finding ways to reduce these costs is crucial to maintaining or enhancing competitive position. Kronospan is likely to be a direct participant in the EU emissions trading scheme because there is more than 20 MW of power generation capacity on-site. There is likely to be significant indirect impact of the EU ETS as analysts are projecting increases in UK wholesale electricity prices of 20 - 50%. This would have a significant business impact on Kronospan.

The projects involved progression of the following four steps:

- Step 1: Evaluate Business Case;
- Step 2: Develop Strategic Objectives;
- Step 3: Identify Opportunities;
- Step 4: Develop an Implementation Plan.

Supporting activities to progress these steps included:

- Undertaking a value at stake assessment, taking into consideration the potential impacts of the EU ETS;
- Development of strategic objectives for the organisation;
- Calculating carbon emissions baselines for the organisation under different scenarios (UK CCLA or EU ETS);
- Identification and assessment of carbon mitigation measures that could be implemented within the organisation;
- Developing a model to allow assessment of the impact of various carbon mitigation measures, including illustration of the effectiveness of measures in marginal abatement cost curves;
- Development of a prioritised implementation plan for uptake of the measures.

Entec identified a number of opportunities that could be implemented to reduce the carbon emission baselines, both relevant to the UK CCLA and the EU ETS and also identified some key change management aspects that would facilitate ongoing carbon management of the site.

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**Environment Agency - Regulatory Guidance Notes for Combustion Processes and Development of a Combustion Process Action Plan (1999 - 2000)**

Entec assisted the Environment Agency with the updating of the Process Guidance Notes for Combustion Processes. Our work involved the preparation of updated text on best available techniques for combustion processes covered by 7 existing Guidance Notes (including coal, oil and gas fired boilers, gas turbines, gasification processes, waste combustion and other processes); the development of information on the costs of SO<sub>2</sub>, NO<sub>x</sub> and particulate abatement techniques and an economic assessment of the power generation industry. A separate aspect of our study involved an assessment of compliance of combustion processes with existing Process Guidance Notes. We were then commissioned by the Agency to develop an Action Plan for combustion processes targeted at Pollution Inspectors, the Agency's Power Industry Sector Group and the Technical Guidance Branch.

**European Commission - Quantification of emissions from ships associated with ship movements between ports in the European Community (2001 to 2002)**

As increasingly stringent controls are placed on land based emission sources, there is mounting pressure to bring ship emissions more closely within air quality policy across the European Community. Research has demonstrated that ship emissions can make a significant contribution to air pollution problems in the European Community and, in particular, are major sources of acid gas emissions. In order to assess the potential for Community measures to reduce these emissions, a key objective of this study was to undertake a detailed quantification of intra-community ship emissions of SO<sub>2</sub>, NO<sub>x</sub>, hydrocarbons and CO<sub>2</sub>. The study has developed disaggregated emissions data, primarily to differentiate between those emissions associated with vessels making stops at Community / accession country ports and those emissions associated with ships which make no stops at all. Further objectives included the undertaking of a market survey of marine distillates with 0.2% sulphur content and an investigation into the feasibility of ships storing and using multiple grades of marine distillates. Our findings from this study have recently been published on the EC website.

**Department for Environment, Food and Rural Affairs - Cost Curves for Air Pollutants - Cost Curves for SO<sub>2</sub> (2000 and 2010 baselines)**

As part of Entec's three year research contract to characterise and quantify the costs and impact of control measures on current and possible future emissions, this project required analysis of the costs and potential emission reductions of business as usual (BAU) and beyond BAU abatement options for sulphur dioxide emissions from a range of emission sources in the UK. The sources were selected where they contribute over 1% of total UK emissions, in order to focus effort on the sectors where most impact could be achieved. Sources included power stations, ships, petroleum refineries, iron and steel works and other industrial sites. The output was a revised cost curve for SO<sub>2</sub> for the UK with a baseline of the year 2000. Projected 2010 emissions were also considered and a similar revised cost curve with a baseline of the year 2010 was also provided.

**Department for Environment, Food and Rural Affairs - Cost Curves for Air Pollutants - Cost Curves for NO<sub>x</sub> (2000 and 2010 baselines)**

As part of Entec's three year research contract to characterise and quantify the costs and impact of control measures on current and possible future emissions, this project required analysis of the costs and potential emission reductions of business as usual (BAU) and beyond BAU abatement options for NO<sub>x</sub> emissions from a range of emission sources in the UK. The sources were selected where they contribute over 1% of total UK emissions, in order to focus effort on

the sectors where most impact could be achieved. Sources included power stations, ships and road transport, and certain industrial sites. The output was a revised cost curve for NO<sub>x</sub> for the UK with a baseline of the year 2000. Projected 2010 emissions were also considered and a similar revised cost curve with a baseline of the year 2010 was also provided.

#### **Department for Environment, Food and Rural Affairs – Revised PM<sub>10</sub> Cost Curve (2003 to 2004)**

Analysis of business as usual (BAU) and beyond BAU abatement options for particulate matter emissions from road transport, as part of Entec's contract to revise the UK PM<sub>10</sub> Cost Curve. This work involved detailed investigations into road transport emission and activity trends up to 2025 and consultation with a range of official sources of data. The revised cost curve took into account data recently developed by Ricardo for CITEPA (to support IIASA's RAINS WEB model) on technical measures to reduce air emissions from road transport. Work has been updated to be consistent with IIASA's requirements for the RAINS WEB model, following attendance of the Technical Bilateral with IIASA for baseline modelling. Cost curves were developed for reference emissions in both 2000 and 2010.

#### **Department for Environment, Food and Rural Affairs – Revised VOC Cost Curve (2002 to 2003, and 2004)**

A similar study was undertaken by Entec to investigate abatement options for NO<sub>x</sub> emissions from road transport, as part of Entec's contract to revise the UK VOC Cost Curve.

### **5.2.2 The use of models to predict emissions and air quality and the effects of air pollution**

#### **Defra - Regulatory and Environmental Impact Assessment (REIA) for the European Commission's Proposals for the 4<sup>th</sup> Daughter Directive (2001 to 2002)**

The EC are developing proposals for the 4<sup>th</sup> Daughter Directive (4DD) made under the framework set out in Directive 96/62/EC on ambient air quality assessment and management. The 4DD will set ambient air quality limit values for arsenic, cadmium, nickel and polycyclic aromatic hydrocarbons (PAHs) and long term objectives for arsenic and PAH. Entec prepared the REIA for 4DD, thereby providing the Government and devolved administrations with a quantified assessment of the incremental costs and environmental benefits of implementing 4DD in the UK.

The work required the close co-operation of Entec's air quality and GIS teams, in utilising Netcen model outputs and assessing the air quality impacts of implementing 'beyond business as usual' measures. The project also considered impacts on health, through application of COMEAP dose-response relationships to 'population weighted mean concentrations' in areas that exceeded the proposed limit values.

#### **Department for Environment, Food and Rural Affairs - Development of emission projections and Cost Benefit Analysis for the UK meeting the ceilings under the National Emission Ceilings Directive and Gothenburg Protocol (2002)**

In order to support the UK implementation of the National Emission Ceilings Directive (NEC Directive) and the Gothenburg Protocol, Entec developed detailed and up-to-date 2010 projections of emissions of three pollutants covered by these policies. Following this, the project team explored the possible measures the UK may need to implement to meet the ceilings and the costs and benefits of these.

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**European Commission - Assessment of ship emissions across the European Union (2002 – 2003)**

In 2001 and 2002, Entec was employed by the European Commission to assess ship emissions across the European Union area. As part of this project, Entec evaluated different scenarios of SO<sub>2</sub>, CO<sub>2</sub>, NO<sub>x</sub>, PM and HC emissions using a variety of GIS based techniques. This process required the manipulation of large databases of ship movement data; development of GIS codes to assess spatial distribution of air quality emissions; spatial modelling of ship routes and the production of final map and analysis reports for the client. The results of this study are now published via the internet.

**Environment Agency - East Midlands Regional Air Quality Report (2002)**

Project to assist in the delivery of the first regional air quality report to be produced on behalf of the Environment Agency. The report investigated air pollution trends in the East Midlands region, through the use of monitoring and modelling studies with results presented by GIS mapping. Data from 40 local authorities were included and all Air Quality Management Areas were mapped using ArcView GIS and the reasons for their declaration and the methods by which these conclusions reached were discussed. The consultation of the draft document with 60+ organisations was carefully managed and comments received were incorporated into a final report.

**Department of the Environment, Food & Rural Affairs – Industrial Sector CO<sub>2</sub> Emissions**

Entec has been commissioned to carry out this important project for the Global Atmosphere Division of DEFRA. The project involves development of an existing tool to model energy use and the resulting CO<sub>2</sub> emissions from 19 industrial sectors (including oil & gas, iron & steel, cement manufacture and paper production) up to 2020. The effect on energy demand and CO<sub>2</sub> emissions of implementing all cost effective and all technically feasible energy efficient technologies within the sectors will be investigated from a business as usual starting point. In addition, the effect of the various climate change policies (i.e. emissions trading, climate change levy and negotiated agreements and capital allowances for CHP development) will be modelled to establish their influence on energy use and CO<sub>2</sub> emissions. The effect of fuel price sensitivities will also be examined together with the overall effect the policies may have on industrial output. The results of the work will feed into the UK's reporting obligations to the UN Framework Convention on Climate Change and the EU Monitoring Mechanism.

**Department for Environment, Food and Rural Affairs - Verification of Monitoring Protocols for the UK Emissions Trading Scheme**

Entec undertook technical verification of GHG emissions baselines and monitoring protocols submitted to DEFRA by companies wanting to participate in the UK Emissions Trading Scheme. In particular, DEFRA asked Entec to review submissions that included process emissions, i.e. those that did not arise from the combustion of a fossil fuel, in addition to fuel related emissions. Guidance on monitoring protocols for process emissions was less well developed than for fuel use. Entec reviewed the submissions to assess the robustness of the emissions baselines and the monitoring protocols and compared them against any against existing guidelines, e.g. IPCC, DEFRA. We provided advice on uncertainty analysis, materiality and emissions factors in a variety of industry sectors including oil & gas extraction and processing, cement production, HFC manufacture, coal mining, food & drink and chemicals manufacture. Entec held discussions with industry bodies on behalf of DEFRA to resolve technical issues such that the protocols could be approved under the rules of the ETS.

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**Department for Environment, Food and Rural Affairs – Quantifying the environmental impact of industrial pollution control and options for economic instruments (2003)**

This project, which has recently been completed by Entec supported by OXERA:

- analysed the environmental costs of industrial air pollution, to be focussed on emissions of oxides of sulphur (SO<sub>x</sub>) and oxides of nitrogen (NO<sub>x</sub>);
- determined the extent to which these are tackled by existing policies; and
- set out whether there is a case for using further policy measures to tackle these.

Included in this work was consideration of the potential role of possible policy options, including the option of a tax or other economic instruments such as trading permit schemes and the role which these could play in the context of existing regulation.

See also projects in Section 6.2.3 and 6.2.4

**5.2.3 Cost and benefit aspects of air pollution measures to reduce pollutant emissions**

Entec has exceptional experience in the field of Cost-Effectiveness Analysis and Cost-Benefit Analysis. This is particularly reflected in being awarded the major 3-year research contract by Defra last year in developing ‘Cost Curves for Air Pollutants’. This project is to support forthcoming air quality policy negotiations by developing the UK’s most robust and transparent cost curves for key air pollutants; spatially disaggregated cost curves and, in the future, multi-pollutant cost curves.

We have undertaken a significant number of quantitative Cost-Benefit Analysis studies to support negotiations and Regulatory Impact Assessments relating to air quality. This work utilises quantitative benefit analysis techniques for human health and environmental benefits, linked with specialised air quality modelling approaches and GIS. Our team of environmental economists is employed to support this work as appropriate.

**Department for Environment, Food and Rural Affairs - Updated Cost Benefit Analysis of new Large Combustion Plant Directive (2002)**

The recently adopted LCP Directive is subject to considerable scrutiny due to its potential impact on the UK electricity supply industry and other affected sectors. In particular, the choice of implementation options is the subject of a detailed Cost Benefit Analysis that has been undertaken by Entec. This builds on Entec’s previous work and updates it, utilising comprehensive plant-by-plant information and evolving techniques in benefit analysis.

**Department of the Environment, Transport and the Regions - Costs and benefits of implementing the Proposed Amendments to the Large Combustion Plant Directive in the UK (1998 to 1999)**

Entec was commissioned by DETR to develop the Regulatory and Environmental Impact Assessment (REIA) for the Proposed Amendments to the Large Combustion Plant (LCP) Directive. The work was undertaken as 2 separate projects, considering the application of the Proposed Amendments to *new* and *existing* plant (covering coal, oil and gas fired power stations and industrial combustion plant, including gas turbines). Our work involved predicting the future costs and benefits of implementing the Proposed Amendments for LCPs in the UK. The main requirements relate to emission limit values for SO<sub>2</sub>, NO<sub>x</sub> and particulate emissions. A

quantified benefit analysis addressed benefits to human health (mortality and morbidity effects), ecosystems (reductions in critical load exceedences), buildings and crops.

Our work assisted the DETR in their on-going negotiations by presenting the costs and benefits of 24 alternative policy scenarios. These considered the impacts of alternative emission limit values, different compliance deadlines (up to 2010) and derogations. The study included the use of the latest emission projections to 2010 considering various economic scenarios; power generation projections from the National Grid and fuel mix projections. The scope of work also included an assessment of the impacts on electricity prices; on employment; and the potential impact if off-shore gas turbines were to be included within the scope of the Directive.

**Scottish Executive & Department of the Environment in Northern Ireland - Costs and benefits of transposing European Directive 1999/32/EC on the Sulphur Content of Certain Liquid Fuels into legislation in Scotland and Northern Ireland (1999 to 2000)**

Following our work for DETR we have been commissioned to undertake similar studies to develop REIAs for transposing the Sulphur Content of Certain Liquid Fuels (SCLF) Directive into legislation in Scotland and Northern Ireland.

**Department of the Environment, Transport and Regions - Calculation of the UK Costs of Complying with the Proposed UNECE Protocols on Heavy Metals and Persistent Organic Pollutants (1998)**

We completed this compliance cost assessment which covered a very wide range of industrial processes and products. The main air emissions of interest included lead, cadmium, mercury, dioxins, PAHs and hexachlorobenzene. Our work, which was performed in accordance with the Regulatory Appraisal Guide, was to support the regulatory appraisal of the Protocols to be presented to Parliament.

**European Commission - Cost Benefit Analysis of Reducing VOC Emissions in the EU Vehicle Refinishing Sector (1999 - 2000)**

Entec assisted the European Commission in investigating the costs and benefits of a product based approach for reducing VOC emissions from the EU vehicle refinishing sector. This study involved a market assessment into the current and projected profile of vehicle refinishing in each Member State; a technical and cost assessment of alternative coatings; an economic assessment of the impact on the vehicle refinishing sector and other affected sectors and the quantification of environmental benefits in terms of reduced VOC emissions and ozone concentrations.

**Department of the Environment - Compliance Cost Assessment of Techniques to Reduce UK Emissions of Heavy Metals (1996)**

Entec has carried out an extensive investigation into the costs of particulate and gaseous abatement techniques for atmospheric emissions of lead, cadmium and mercury for the DoE. For each significant UK sector we compared BAT in UK and Europe; investigated emissions for the sector and evaluated emission reduction techniques to meet existing and potential future commitments. The capital and operating costs of over 200 emission reduction techniques were assessed with overall costs for each sector presented on a £/tonne pollutant abated basis. Our work was to support government negotiations concerning the UNECE Convention on Long Range Transboundary Air Pollution.

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**Department of Trade and Industry - A Comprehensive Assessment of the Costs of Polycyclic Aromatic Hydrocarbon (PAH) Abatement in the Vicinity of Industrial Sites (2000)**

Entec has undertaken a research project on behalf of DTI to comprehensively assess the costs of PAH abatement at industrial sites. Sectors of interest include coke ovens, sinter plants, aluminium production, tar and bitumen processes, carbonisation, wood impregnation and industrial combustion. A key objective was to construct combined abatement cost curves for PAHs in the UK transport and non-transport sectors. This project was a first step towards determining whether and at what level any new Air Quality Strategy (AQS) objectives for PAHs should be set.

**Department of Trade and Industry - A Comprehensive Assessment of the Costs of Lead Abatement in the Vicinity of Industrial Sites (2000)**

Entec has undertaken a research project on behalf of DTI to comprehensively assess the costs of lead abatement at industrial sites. The work was to inform the UK Air Quality Strategy (AQS) review process and the Interdepartmental Group on Costs and Benefits. The AQS objective for lead is  $0.5\mu\text{g}/\text{m}^3$  (annual mean) to be met by the end of 2004 and there is a more stringent objective of  $0.25\mu\text{g}/\text{m}^3$  (annual mean) to be met by the end of 2008. This project involved the construction of abatement cost curves for lead emissions for non-transport sources and sectors in the UK.

**Department of the Environment, Transport and the Regions / Department of Trade and Industry - Implications of a National Emission Reduction Strategy for Existing Plant under the Revised Large Combustion Plant Directive (2000)**

Entec was requested by DETR to investigate the economic and environmental implications to the UK of a National Emissions Reduction Strategy to inform the Government's future negotiating stance on the Revised Large Combustion Plant (LCP) Directive. The inclusion of existing plant in the LCP Directive has become a high profile issue at a European level and the UK has played a leading part in the negotiations so far. Our study considered a number of baseline scenarios for emissions of  $\text{SO}_2$ ,  $\text{NO}_x$  and particulates and a number of potential compliance deadlines and emissions reduction targets. The results of our study were of considerable importance to the UK negotiations in securing an acceptable political agreement.

**Department for Environment, Food and Rural Affairs - Cost Curves for Air Pollutants (2002 to 2005)**

Entec has been awarded a three year research contract to characterise and quantify the costs and impact of control measures on current and possible future emissions, and the resulting costs and benefits in support of the development, implementation and monitoring of domestic and international air pollution policies. Project tasks will evolve and emerge over the time period, with initial priorities including:

- review of policy priorities;
- improve quality of existing cost curves using best available information on emission sources, techniques and costs;
- incorporate abatement of multiple pollutants;
- analyse and quantify uncertainty;
- investigate options to factor human health and environmental benefits into cost curves;

- produce spatially disaggregated cost curves; and
- develop cost curve database and interface with National Atmospheric Emissions Inventory, UK Integrated Assessment Model and specialist environmental models.

The work comprises a series of Work Packages that, within the first year, include:

- development of a revised UK cost curve for NO<sub>x</sub>,
- development of a revised UK cost curve for VOC,
- development of a revised UK cost curve for dioxins, and
- development of spatially disaggregated cost curves for SO<sub>2</sub>, NO<sub>x</sub>, NH<sub>3</sub> and particulates.

#### **Department for Environment, Food and Rural Affairs - Cost Curves for Air Pollutants - Cost Curves for SO<sub>2</sub> (2000 and 2010 baselines)**

As part of Entec's three year research contract to characterise and quantify the costs and impact of control measures on current and possible future emissions, this project required analysis of the costs and potential emission reductions of business as usual (BAU) and beyond BAU abatement options for sulphur dioxide emissions from a range of emission sources in the UK. The sources were selected where they contribute over 1% of total UK emissions, in order to focus effort on the sectors where most impact could be achieved. Sources included power stations, ships, petroleum refineries, iron and steel works and other industrial sites. The output was a revised cost curve for SO<sub>2</sub> for the UK with a baseline of the year 2000. Projected 2010 emissions were also considered and a similar revised cost curve with a baseline of the year 2010 was also provided.

#### **Department for Environment, Food and Rural Affairs - Cost Curves for Air Pollutants - Cost Curves for NO<sub>x</sub> (2000 and 2010 baselines)**

As part of Entec's three year research contract to characterise and quantify the costs and impact of control measures on current and possible future emissions, this project required analysis of the costs and potential emission reductions of business as usual (BAU) and beyond BAU abatement options for NO<sub>x</sub> emissions from a range of emission sources in the UK. The sources were selected where they contribute over 1% of total UK emissions, in order to focus effort on the sectors where most impact could be achieved. Sources included power stations, ships and road transport, and certain industrial sites. The output was a revised cost curve for NO<sub>x</sub> for the UK with a baseline of the year 2000. Projected 2010 emissions were also considered and a similar revised cost curve with a baseline of the year 2010 was also provided.

#### **Department for Environment, Food and Rural Affairs – Revised PM<sub>10</sub> Cost Curve (2003 to 2004)**

Analysis of business as usual (BAU) and beyond BAU abatement options for particulate matter emissions from road transport, as part of Entec's contract to revise the UK PM<sub>10</sub> Cost Curve. This work involved detailed investigations into road transport emission and activity trends up to 2025 and consultation with a range of official sources of data. The revised cost curve took into account data recently developed by Ricardo for CITEPA (to support IASA's RAINS WEB model) on technical measures to reduce air emissions from road transport. Work has been updated to be consistent with IASA's requirements for the RAINS WEB model, following attendance of the Technical Bilateral with IASA for baseline modelling. Cost curves were developed for reference emissions in both 2000 and 2010.

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**Department for Environment, Food and Rural Affairs – Revised VOC Cost Curve (2002 to 2003, and 2004)**

A similar study was undertaken by Entec to investigate abatement options for NO<sub>x</sub> emissions from road transport, as part of Entec's contract to revise the UK VOC Cost Curve.

**Department for Environment, Food and Rural Affairs, Air and Environment Quality Division – Advice on road transport policy development (2003 to 2004)**

A key member of the Entec team was involved in a wide range of policy development work during a 6 month period in Defra's AEQ Division. Work included:

- Involvement in formulating Defra's position on the next round of Euro standards for new vehicles and negotiations between other Government departments (DfT, DTI, Treasury). This involved developing a series of scenarios so that Defra's contractors could model the air quality impacts and analysing the outputs of their modelling.
- Management of a working group to address issues surrounding Water Diesel Emulsion (WDE) and how to go about incentivising the fuel.
- Involvement in negotiations between DfT, Defra and Customs and Excise regarding the current status and future of the Reduced Pollution Certificate (RPC) scheme.

Research into a wide range of technical and non-technical measures for reducing air emissions from road transport.

**Department for Environment, Food and Rural Affairs - Determination of UK Costs of Complying with the UNECE Gothenburg Protocol (2001 to 2002)**

Entec has undertaken a study to assess the direct costs to industry of the UNECE Gothenburg Protocol. This Protocol aims to abate acidification, eutrophication and ground level ozone by setting national emission ceilings on SO<sub>2</sub>, NO<sub>x</sub>, VOCs and ammonia as well as industry specific emission limit values. Our study assessed the cost impacts of emission limit values for nitric acid production, storage and distribution of petrol and stationary engines. Owing to the potential implications of applying the emission limit values, we investigated the alternative implementation approach via a UK National Plan for NO<sub>x</sub> and VOCs. This quantified the cost benefits and implementation issues associated with this approach, that might be implemented with economic instruments. Practical suggestions for amendments to the text of the Protocol were also proposed, to address key concerns associated with the emission limit value approach.

**Department for Environment, Food and Rural Affairs - Ratification of Persistent Organic Pollutants (POPs) Protocol and Convention (2002)**

Both the UNECE POPs Protocol and the UNEP POPs Convention aim to reduce any discharges, emissions and losses of POPs, in order to protect both human health and the environment. To support the UK's ratification of the POPs Protocol and Convention, Entec has undertaken a thorough investigation to assess, as accurately as possible, the likely costs and benefits of transposing the Protocol and Convention into domestic legislation. This has involved extensive primary research involving consultation with trade associations, regulatory bodies and other parties. Our work has led to the preparation of draft Explanatory Memoranda and draft Regulatory Impact Assessments for each policy.

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**European Commission - Quantification of emissions from ships associated with ship movements between ports in the European Community (2001 to 2002)**

As increasingly stringent controls are placed on land based emission sources, there is mounting pressure to bring ship emissions more closely within air quality policy across the European Community. Research has demonstrated that ship emissions can make a significant contribution to air pollution problems in the European Community and, in particular, are major sources of acid gas emissions. In order to assess the potential for Community measures to reduce these emissions, a key objective of this study was to undertake a detailed quantification of intra-community ship emissions of SO<sub>2</sub>, NO<sub>x</sub>, hydrocarbons and CO<sub>2</sub>. The study has developed disaggregated emissions data, primarily to differentiate between those emissions associated with vessels making stops at Community / accession country ports and those emissions associated with ships which make no stops at all. Further objectives included the undertaking of a market survey of marine distillates with 0.2% sulphur content and an investigation into the feasibility of ships storing and using multiple grades of marine distillates. Our findings from this study have recently been published on the EC website.

**European Commission - Economic Evaluation of Air Quality Targets for Heavy Metals (2000)**

Entec was awarded a major contract to carry out an economic evaluation of ambient air quality standards for heavy metals. Our work assisted the European Commission in setting the level and timing of limit values for cadmium, arsenic and nickel for all 15 EU Member States and 6 Accession Countries (Czech Republic, Poland, Hungary, Slovenia, Estonia and Cyprus). This challenging project involved determining the least cost package of measures to achieve a series of alternative limit values and the consequent environmental benefits (to human health and ecosystems).

See also projects in Sections 6.2.2 and 6.2.4.

**5.2.4 Good knowledge of relevant Directives concerning air quality and emissions****European Commission - Cost Benefit Analysis of Reducing VOC Emissions in the EU Vehicle Refinishing Sector (1999 - 2000)**

Entec assisted the European Commission in investigating the costs and benefits of a product based approach for reducing VOC emissions from the EU vehicle refinishing sector. This study involved a market assessment into the current and projected profile of vehicle refinishing in each Member State; a technical and cost assessment of alternative coatings; an economic assessment of the impact on the vehicle refinishing sector and other affected sectors and the quantification of environmental benefits in terms of reduced VOC emissions and ozone concentrations.

**Department for Environment, Food and Rural Affairs - Solvent Emissions Directive update**

In 1999, Entec prepared a Regulatory and Environment Impact Assessment for the Solvent Emissions Directive (SED). DEFRA is now planning to introduce the requirements of the Directive for the dry cleaning sector under the Local Authority Pollution Prevention and Control (LAPPC) regime. This will introduce requirements for dry cleaners that are additional to the requirements of the Directive alone.

The project involved two parts: a Regulatory and Environmental Impact Assessment for the dry cleaning sector (Task 1) and an examination of the implications of the SED requirements in relation to fugitive emissions (Task 2).

For Task 1, emissions to air from the dry cleaning sector were estimated and the costs of implementing the Directive were estimated for individual companies and the dry cleaning sector as a whole. Human health and environmental benefits were estimated and valued in monetary terms. The study was conducted in accordance with Government Guidance on Regulatory Impact Assessments and Competition Assessments.

In relation to fugitive emissions (Task 2), an examination was made of the additional requirements introduced by the Directive into a number of the affected activities. Information was provided on the costs of compliance in relation to fugitive emissions.

#### **Department for Environment, Food and Rural Affairs - Solvent Emissions Directive consultancy**

Following on from Entec's previous work for Defra on implementation of the Solvent Emissions Directive, two Entec consultants attended a meeting with Defra and a further cross-governmental meeting to discuss how the SED should be implemented based on Defra's consultation paper.

#### **Department of the Environment, Transport and the Regions - Costs and benefits of transposing European Directive 1999/32/EC on the Sulphur Content of Certain Liquid Fuels into legislation in England and Wales (1999)**

Entec has undertaken the REIA of transposing the Sulphur Content of Certain Liquid Fuels (SCLF) Directive into legislation in England and Wales. Cost impacts have been investigated for oil refineries and a wide range of oil consumers including power stations (including coal fired), iron & steel works, manufacturing industry, residential and institutional boiler plant, agricultural and marine sources. The study has developed projections for fuel consumptions and emissions for each year from 1999 to 2010, using a combination of the latest estimates from DTI on fuel consumption projections up to 2010 (considering various economic growth and fuel price scenarios), the Digest of UK Energy Statistics and the latest detailed emissions inventory data. A quantified benefit analysis addressed benefits to human health (mortality and morbidity effects), ecosystems (reductions in critical load exceedences), buildings and crops.

#### **Department for Environment, Food and Rural Affairs - Determination of UK Costs of Complying with the UNECE Gothenburg Protocol (2001 to 2002)**

Entec has undertaken a study to assess the direct costs to industry of the UNECE Gothenburg Protocol. This Protocol aims to abate acidification, eutrophication and ground level ozone by setting national emission ceilings on SO<sub>2</sub>, NO<sub>x</sub>, VOCs and ammonia as well as industry specific emission limit values. Our study assessed the cost impacts of emission limit values for nitric acid production, storage and distribution of petrol and stationary engines.

Owing to the potential implications of applying the emission limit values, we investigated the alternative implementation approach via a UK National Plan for NO<sub>x</sub> and VOCs. This quantified the cost benefits and implementation issues associated with this approach, that might be implemented with economic instruments. Practical suggestions for amendments to the text of the Protocol were also proposed, to address key concerns associated with the emission limit value approach.

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**Department for Environment, Food and Rural Affairs - Consultancy work on the Large Combustion Plant Directive, the National Emission Ceilings Directive and the Gothenburg Protocol (2003).**

This overall project has investigated a number of scenarios and issues associated with the Large Combustion Plant Directive (LCP Directive) to inform the Government's decision regarding the implementation of this Directive. It also provides support to the implementation of the National Emission Ceilings Directive (NEC Directive) and the Gothenburg Protocol (GP).

Entec has developed emissions data for each 'existing' plant under the LCP Directive for a full range of scenarios and determined the effect of these scenarios on costs and benefits. The implications for complying with the NEC Directive under different scenarios has been investigated as well as the potential incomplete take up of a National Plan and the burning of waste in LCPs. We have critically commented on alternative allocation mechanisms under a National Plan as well as developed an updated National Plan for the UK. Other tasks included developing information on unabated power stations in Europe and investigating a National Emission Reduction Strategy for NO<sub>x</sub> to implement the GP.

**European Commission – Review of the Large Combustion Plant Directive (2003 to 2004)**

This project is to inform the European Commission's review of the Large Combustion Plant Directive in 2004. The main tasks being undertaken include:

- Collection of information on emissions; air quality limit values and targets; Best Available Techniques (BAT) for power plants; national emission reduction plans; implementation of the Directive in the Candidate Countries; fuel use in power plants; and comparison of EU and US approaches to reducing emissions from large combustion plants, including economic instruments; and
- Presentation of findings on a range of issues, including the feasibility of tightening emission limit values (ELVs) under the LCP Directive; cost-effectiveness of further reductions; justification for including ELVs for heavy metals and size-differentiated particles; justification for inclusion of offshore gas turbines; effects of differences between Community environmental standards; improvements to monitoring and compliance; and the feasibility of national or regional emission trading.

The scope of the study will include current Member States and Candidate Countries and will include attendance at meetings of key stakeholders and national experts.

**European Commission - Development of a guidance document to assist Member States in the preparation of national emission reduction plans for large combustion plants (2002)**

The European Parliament and the Council Directive adopted a new Directive (2001/80/EC) to limit the emissions of certain pollutants into the air from large combustion plants whose rated thermal input is equal to or greater than 50MWth, referred to as the new Large Combustion Plant Directive (LCP Directive). Among its provisions the new LCP Directive requires that existing plants comply with emission limit values (ELVs) for sulphur dioxide (SO<sub>2</sub>), nitrogen oxides (NO<sub>x</sub>) and dust or alternatively are subject to a national emission reduction plan (National Plan) which shall reduce the total annual emission of these pollutants to the levels that would have been achieved by applying the ELVs. Under this project Entec developed a Guidance Document to assist any Member State that chooses the option of a National Plan for existing plants to prepare such a plan. The Guidance Document includes an overview of the requirements for existing plants and a worked example with a presentation of a National Plan for a hypothetical Member State.

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**Department of the Environment, Transport and the Regions - Costs and benefits of implementing the Proposed Waste Incineration Directive in the UK and investigation into the position of other Member States (1998 to 1999)**

Entec has recently completed 3 projects for DETR to develop the REIA of the Proposed Waste Incineration Directive (WID) and to provide information to assist them in their negotiations. The Proposed WID covers a wide range of waste incineration (municipal, clinical, sewage sludge, chemical and general waste incineration processes and various waste combustion processes) and co-incineration processes (esp. cement kilns) and imposes limitations on emissions to air, water and land. We performed a thorough investigation to assess the future costs and benefits of implementing the Proposed WID in all the UK sectors affected. Costs were developed for typical businesses and for sectors as a whole, with Small Business Litmus Tests performed as necessary. Forecast emissions reductions were investigated for SO<sub>2</sub>, NO<sub>x</sub>, particulates, dioxins, heavy metals, HCl and HF. The quantified benefit analysis addressed human health and environmental effects.

Our work included assessing the impact of aligning the Hazardous Waste Incineration Directive to meet all the requirements of the Proposed WID and the impact of potentially tighter requirements. This involved an assessment of incineration and co-incineration processes and waste management policies in Denmark, Sweden, Netherlands, Germany and Austria.

See also projects in Sections 6.2.2 and 6.2.3.

**5.2.5 Stakeholder Consultation****The Impacts of Climate Change on London, *Greater London Authority***

Entec managed this project to identify the threats and opportunities to London presented by climate change. The study was the first for a major urban area and used the UK Climate Impact Programme's latest scenarios of climate change. Stakeholder engagement was pivotal to the study and was successfully achieved through several workshops involving a broad range of stakeholders representing London's environmental, social and economic interests in relation to climate change. This has provided an excellent start to the process of engaging decision-makers effectively in climate change impacts and adaptations.

**The Impacts of Climate Change in the East Midlands, *East Midlands Sustainable Development Roundtable***

Entec was commissioned to carry out a study into the potential effects of climate change on economic, social and environmental processes in the East Midlands. The study included stakeholder consultation whereby stakeholders were consulted on key issues for the region in terms of climate change so that they can be addressed in the future meeting stakeholder needs.

**Best Practice Review of Waste Minimisation Initiatives in Industry, *Environment Agency***

Stakeholder consultation is a vital part of the project, in which Entec is working with the Environment Agency to review and assess UK waste minimisation projects and identify and promote best practice and the development of public policy in this area. Representatives from business and governmental organisations were invited to take part in a workshop to discuss findings and generate further ideas, and Entec continues to work together with key stakeholders to explore ideas for future strategy.

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### **High Level Stakeholder Consultation on Options to Expand the Capacity in the Rail Network, *Strategic Rail Authority***

The Strategic Rail Authority commissioned Entec to complete a high level consultation with a range of statutory consultees and representatives from business, environmental groups and the transport sector to examine strategic options to extend existing rail network capacity. The consultation process assisted the development of a business case to determine whether the strategic options were sufficiently robust to receive further scrutiny and assessment.

### **Consultation and Guidance on the use of Contaminant Transport Modelling within the Environment Agency, *Environment Agency***

Entec carried out an internal survey as part of a project to develop guidance documents on contaminant transport modelling for the Environment Agency. A questionnaire was distributed to collect factual data and identify key relevant personnel within each of the Area and Regional offices. Facilitated workshops were then held at each of the regional offices to identify issues and concerns regarding the current use of contaminant transport and groundwater risk assessment modelling within the Agency, agree requirements for best practice guidance and discuss future strategy. The process provided a clear indication of what was required by the intended users of the guidance documents and their ideas for future development.

### **Stakeholder Consultation of Waste Management Strategy - Technical review of waste management options, *Swindon and Wiltshire Councils***

Entec undertook a review of the main waste to energy technologies available world-wide, focusing on technological aspects of the various options, environmental impacts and economic aspects. Following publication of the documents, Entec staff acted as facilitators during a Local Waste Forum debate on options for waste management in the area. The documents were also used as the basis for a presentation to waste forum members on the status of Energy from Waste technology.

### **The Relationship between Community Strategies and Local Development Frameworks, *Office of the Deputy Prime Minister***

The Office of the Deputy Prime Minister commissioned Entec to produce good practice guidance on strategies for local planning and development. A review of existing strategies and Local Authorities culminated in four regional workshops, in which local government representatives explored difficulties experienced by stakeholders and the potential for improving these relationships.

### **Development of Social and Economic Sustainability Indicators for the Water Sector, *UK Water Industry Research (UKWIR)***

Entec assisted UKWIR with the development of a set of water industry social and economic sustainability indicators. A key element of the project was to ensure that the industry's stakeholders were involved in the process of identifying the scope of topics and the way that they are considered. To achieve this workshops were held with a wide number of organisations and multi-stakeholder working groups set up to investigate key issues in more detail.

### **Evaluation of Environment Development Fund, *Countryside Commission for Wales***

Entec carried out a qualitative evaluation of the Environment Development Fund for the Countryside Council for Wales. A workshop brought together representatives involved in running the Fund to identify areas for potential improvement and to help gauge its impact.

Telephone interviews and a questionnaire were used to communicate with people involved in individual projects either as applicants or as beneficiaries.

### **5.3 Quality assurance procedures**

The services we provide are focused on meeting our Customer's requirements in terms of time, cost and quality. To meet these standards of service we place prime importance on the continuous development and delivery of the very best in quality practices to achieve the complete satisfaction of our Customers. To assist in meeting this aim Entec is registered to the international standard BS EN ISO 9001:1994.

In addition, Entec has recently been awarded ISO 14001, the international standard for environmental management systems (EMS).



