Energy Efficiency in Environmental Permits

FINAL REPORT

IMPEL
NETWORK

European Union Network for the Implementation
and Enforcement of Environmental Law

S Y K E

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FOREWORD

The European Union Network for the Implementation and Enforcement of Environmental Law is an informal network of the environmental authorities of EU Member States and future Member States (before Candidate Countries). The European Commission is also a member of IMPEL and shares the chairmanship of management meetings. The network is commonly known as the IMPEL Network.

The expertise and experience of the participants within IMPEL make the network uniquely qualified to work on certain of the technical and regulatory aspects of EU environmental legislation. The network's objective is to create the necessary impetus in the European Community to make progress on ensuring a more effective application of environmental legislation. It promotes the exchange of information and experience and the development of greater consistency of approach in the implementation, application and enforcement of environmental legislation, with special emphasis on Community environmental legislation. It provides a framework for policy makers, environmental inspectors and enforcement officers to exchange ideas, and encourages the development of enforcement structures and best practices.

Information on the IMPEL Network is also available through its web site at
http://europa.eu.int/comm/environment/impel

This report is the result of a project within the IMPEL Network. The content does not necessarily represent the view of national administrations or the Commission. The report was adopted on the 13th December 2002 during the 20th IMPEL Meeting in Copenhagen.

EXECUTIVE SUMMARY

The IMPEL project, on consideration of energy efficiency in environmental permits in implementing the IPPC directive, began in early 2001. The general principle of efficient use of energy is stated in Article 3 of the European Council directive 96/61/EC on Integrated Pollution Prevention and Control (IPPC), which mostly concerns large industrial installations. This principle is new for environmental permitting, and the Member States have some problems with implementing it. The project consisted of a survey, studies of relevant documents and a seminar.

The main objectives of the project were:

- to investigate different opinions on how energy efficiency can be regulated in IPPC permits;
- to make a study on how energy efficiency is dealt with in the existing documents, the BREFs and voluntary environmental management schemes;
- to examine how voluntary environmental management schemes and energy saving agreements can be linked to the legal obligations in environmental permitting;
- to study the co-operation between environmental and energy administrations in the implementation of the IPPC directive; and
- to study the role of the authorities in the assessment of energy efficiency in applications and environmental permitting of large installations.

In this project the following good practices were found in relation to the main objectives:

- It is good practice to create practical guidelines to clarify and define energy efficiency. Overall guidance on energy efficiency is not possible, but the solution could be found in sector-wise guidance and, in general, energy should be looked at on a case by case basis. Good practical solutions such as benchmarking, pinch technology and energy balance checking were mentioned.
- In order to create good permit applications prior information exchange between the operator and the authorities is good practice. Also, application forms where the information requirements concerning energy efficiency are listed should be available on the Internet.
- No good practice for establishing binding permit conditions could be identified. However, the final report gives some concrete examples of more or less binding permit conditions. The permit condition or the text in the descriptive part could also be linked to voluntary energy saving agreements.
- It is good practice for environmental authorities to use the BREFs which contain a considerable amount of information on energy. The most specific information is available on energy consumption. There is less data on energy saving and energy recovery techniques.
- In inspections of energy efficiency good practice is self monitoring under the precondition that the inspector can influence the monitoring practices of the operator. Because of the lack of energy knowledge among the permit authorities and inspectors, there is a need for more co-operation between the energy and environmental authorities.
- The energy audit report should be available on site for environmental inspectors and the summary of audit findings should be submitted as a part of any annual environmental report.
- Co-operation between energy and environmental authorities on energy efficiency issues is good practice and should be developed. Each authority has special knowledge that the others may need or could use in their work.
- It is good practice to have transparency in environmental permitting concerning energy efficiency, so that the Aarhus Convention really is implemented in the same way in different countries. Transparency in all voluntary measures is also good practice.

- The environmental management systems provide a good tool for managing energy issues. The policy and targets set by the company should not be transferred as such to the permit. This could negatively affect the companies' interest in setting targets and even in using environmental management systems. There should also be clear and attractive incentives for the companies to join the management systems.
- It is in itself good practice when voluntary energy saving agreements are made for most of the industries in a country, which should lead to energy savings and the efficient use of energy. Concrete measures are already included in the agreements and should be followed up.
- As the environmental authorities in general do not have enough knowledge of energy efficiency it is good practice to provide general training for environmental authorities and to raise the level of knowledge. It is also good practice to create fact sheets which contain information on energy efficiency as a tool for environmental permitting, supplementing the BREFs and any national BAT guidance. Good practice is that the environmental authorities are provided with information from the voluntary energy audits made by energy experts.

Proposals for further work:

- There are few concrete examples of permit conditions concerning energy efficiency from the participating countries. This issue should be followed up after some years when a significant share of all large industries have had their new permits granted.
- General guidelines of what can be considered as confidential in the permit procedure especially on energy issues should be developed.
- Sector specific BREFs with more information on energy efficiency issues, a horizontal energy efficiency BREF and a cross-media BREF where the emissions are linked also to the need of energy should be developed.
- The link between the permit and voluntary measures should be clarified.
- The understanding of the link between the permit and the future greenhouse gas emissions trading scheme should be improved.
- There is also a need for guidelines on the inspection procedure to be used in the auditing of energy efficiency.

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1 INTRODUCTION

Energy is central to social and economic wellbeing, but its production and consumption put considerable pressures on the environment in emissions to the atmosphere and biosphere. These may lead to dangerous changes in the global climate, damaging natural ecosystems, tarnishing the built environment and harming human health.

In the industrial sector, these emissions may arise from the combustion of fuels to generate heat or power or through the direct use of energy within a production process. In both cases there are potentials for energy saving, increased production of heat and power and reductions in environmental emissions. The European Union's (EU) target under the Kyoto Climate Change Protocol for cutting greenhouse emissions is 8 % below the 1990 levels by the 2008–2012 period. EU's emissions of greenhouse gases fell by 3.5 % between 1990 and 2000, but without additional counter-measures they are likely to rise back to around the 1990 level by the year 2010.

The IMPEL project on consideration of energy efficiency in environmental permits in implementing the IPPC directive began in early 2001. The general principle of efficient use of energy is stated in Article 3 of the European Council directive 96/61/EC on Integrated Pollution Prevention and Control (IPPC) which mostly concerns large industrial installations. This principle is new for environmental permitting and the Member States have some problems with implementing it. Article 6 of the directive has stipulations on the requirements of an application which the applicant must be aware of and Article 9 deals with the duties of the permit authorities concerning BAT and energy efficiency.

The main objectives of the project in the terms of reference were:

- to investigate different opinions on how energy efficiency can be regulated in IPPC permits
- to make a study on how energy efficiency is dealt with in the existing documents, the BREFs and voluntary environmental management schemes
- to examine how voluntary environmental management schemes and energy saving agreements can be linked to the legal obligations in environmental permitting
- to study the co-operation between environmental and energy administrations in the implementation of the IPPC directive and
- to study the role of the authorities in the assessment of energy efficiency in applications and environmental permitting of large installations.

This project investigated how energy efficiency was regulated in IPPC permits, how the BREF documents have been used or can be used in permitting and how the voluntary energy saving agreements and voluntary environmental management schemes have been used or can be used in consideration of energy efficiency. The overall objective was to find out what is good practice in determination of energy efficiency for industrial operations and how to state it as a permit condition if, for example using the BREFs, voluntary environmental management systems or energy saving systems.

A three-step process was used to get the necessary information. First a draft questionnaire was drawn up and discussed in a meeting of members in the advisory committee. In the advisory committee were members from Austria, Finland, Germany, the Netherlands, and Sweden and the IMPEL co-ordinator. The finalised questionnaire was then sent out to the Member States and future Member States. The replies to the questionnaire were analysed. The second step was to hold a seminar to get more in-depth information, where the most problematic questions were discussed, key difficulties identified and good practices for different situations were agreed on. The seminar

was held in Helsinki on 6–8 February 2002. The third step was to examine eight BREF documents and make studies on technical possibilities to use energy efficiently and on options for emissions trading in the European Union.

The questionnaire covered specific topics from the IPPC directive and its implementation in the countries. In particular the contents of Articles 3(d), 6(1), 9(1), 9(8) and 15(1) were looked at. The questionnaire also covered other topics such as competent authorities, voluntary environmental management systems, energy saving agreements, energy taxes and emissions trading. The aim of the questionnaire was to clarify the similarities and differences between the countries in implementation of the IPPC directive and in the practices of the authorities permitting IPPC installations. The following countries replied to this questionnaire: Austria, Denmark, Finland, France, Germany, Ireland, Italy, Lithuania, the Netherlands, Poland, Portugal, Sweden and the United Kingdom. The compilation of the answers to the questionnaire is presented in Annex I of this report.

The seminar themes were the legal base for energy efficiency, consideration of energy efficiency in environmental permitting, energy issues in environmental management schemes and energy saving agreements and emissions trading. In the seminar, key difficulties in the handling of energy issues in environmental permitting were discussed and possible solutions to the problems were suggested and finally good practices for the consideration of energy efficiency in environmental permitting of large installations were agreed on. The chairmen of the seminar were Mr Antero Honkasalo, Environment Counsellor, Ministry of the Environment and Mr Alec Estlander, Division Manager, Finnish Environment Institute. The seminar agenda and the list of participants are presented in Annex II of this report. The seminar report was sent out to the participants for comments in February 2002 and their comments have been incorporated into the seminar report and in the final report.

The project was led by the Finnish Environment Institute. The project team consisted of the project leader, Ms Marianne Lindström, Project Manager, Finnish Environment Institute, and six experts. The experts were: Ms Elise Sahivirta, Legal Scientist, Ms Jaana Pennanen, Mr Mikko Attila, Ms Terhi Ihalainen, Environmental Scientists; and Mr Davide Secci and Mr Thomas Kohl, students of engineering. All the experts were employees of the Finnish Environment Institute.

The Finnish advisory team consisted of Ms Sirpa Salo-Asikainen, Environment Counsellor, Ministry of the Environment; Mr Pentti Puhakka, Senior Adviser, Ministry of Trade and Industry; Mr Jouni Punnonen, Energy Counsellor, Finnish Association for Industry and Employees; Ms Emelie Enckell, Chief of the Environmental Protection Division, Uusimaa Regional Environment Centre and Mr Kai Nykänen, Senior Adviser, the Pohjanmaa Regional Environment Centre.

The Advisory Committee for the project comprised Mr Otto-Werner Schaubschläger, Austria; Ms Sirpa Salo-Asikainen, Finland; Ms Emelie Enckell, Finland; Mr Tapio Kovanen, Finland; Mr Pentti Puhakka, Finland; Mr Jouni Punnonen, Finland; Mr Ulrich Buntrock, Germany; Mr Frans Bruinsma, The Netherlands; Mr Erik Nyström, Sweden and Mr Terence Shears, the United Kingdom.

Ms Marianne Lindström, Ms Elise Sahivirta, Mr Mikko Attila and Ms Jaana Pennanen drafted this report. Ms Terhi Ihalainen made a study on emissions trading in the European Union (Annex V), Mr Davide Secci, from Switzerland, made a study on the BREFs (Chapter 5) and Mr Thomas Kohl, from Germany, did a study on technical possibilities for energy efficiency (Annex IV). The first draft report was sent out for comments in October 2002 to the participants in this project.

We are grateful to all those who participated in this project by taking part in the advisory committee work, by answering the questionnaire, by taking part in the seminar and by providing us with examples of permit conditions, existing guidelines and comments on the draft report.

2 LEGAL BACKGROUND

2.1 General background

The European Union has been active in the field of combating climate change in various ways that cannot all be listed here. But just to name a few steps towards protecting the climate and prevent climate change we can point out, for example Council Decision 91/565/EEC, where the Council adopted the SAVE programme (Specific Actions for Vigorous Energy Programme) that aimed at promoting energy efficiency in the Community. Council directive 93/76/EEC aimed to limit carbon dioxide (CO_2) emissions by improving energy efficiency (the SAVE directive). The demand for efficient use of energy is a general principle within Council directive 96/61/EC on Integrated Prevention and Control (henceforth the IPPC directive). The European Union is also a party to international treaties in the field of climate protection. The United Nations Framework Convention on Climate Change dates from the year 1992 and the Kyoto protocol was signed in 1997. The European Union ratified the Kyoto protocol in summer 2002.

The European Union's Sixth Environment Action Programme also stated that: "In addition, special attention will be paid to four priority areas for action… Tackling climate change: Objective – to stabilise the atmospheric concentrations of greenhouse gases at a level that will not cause unnatural variations of the earth's climate. The scientific consensus is that climate change is happening and that human activity is causing the increases in concentrations of greenhouse gases that are the cause of the problem. The key priority for the Sixth Programme will be the ratification and implementation of the Kyoto Protocol (see above) to cut greenhouse gas emissions by 8 % over 1990 levels by 2008–12. This must be considered as a first step to the long-term target of a 70 % cut." (COM/2001/0031 final, 3).

The legal and administrative "command and control" regulation approach has been the traditional way to guide environmental protection in the European Union. The same approach is adopted also in the IPPC directive (Backes and Betlem 1999, 120). As a method "command and control" by legislation is still in a dominating position as an environmental policy tool, but in addition environmental issues are included in various other policies, and to stop climate change the methods go beyond legislation by using trading schemes and voluntary measures. Market based voluntary methods emphasise less control by authorities and the operators' obligation to "play by the rules". In these cases the minimum requirements are fixed through the permitting system that is supplemented by voluntary methods. Some of the Member States have chosen market-based measures, such as energy saving agreements, EMAS and ISO 14001, in addition to "command and control" regulation to implement the directives articles concerning energy efficiency. The problem within energy efficiency regulation is that various methods have little, if any, connection with each other. The control system of energy efficiency is basically sector-oriented.

FIGURE 1. The present ways to control energy efficiency.

2.2 Implementation of the IPPC directive

The IPPC directive was adopted by the European Council on 24 September 1996, was published on 10 October 1996, and entered into force on 30 October 1996. The Member States had until 30 October 1999 to take appropriate implementing measures. The requirements to apply its authorisation requirements to new plants must be given effect no later than three years after the directive entered into force, the deadline was 30 October 1999. Many of the Member States failed to meet that deadline. Some of the directive's provisions have to be applied to existing plants as of that date, whereas the rest will have to be applied within eight years thereafter (Article 5), the deadline is 30 October 2007. Of the future Member States, Poland and Lithuania took part in the project and they had not implemented the IPPC by the time of the questionnaire, summer 2001. In Poland the IPPC was already transposed into national law, but the laws came in force after the questionnaire was answered. With the future Member States the implementation schedule of the IPPC directive is the same as for the present Member States, except for certain existing installations that have been granted an additional transition period. Altogether the implementation into the national legal systems did not, according to the answers to the questionnaire, cause any problems but the implementation in practice has proved to be more difficult than anticipated (Annex I, Table 1).

The implementation of the IPPC directive required at least some legislative measures in all of the Member States; some adopted totally new laws and in some Member States only minor changes of legislation were needed. The implementation level differed in the Member States because of the legislative starting points: for example in Sweden and France the integrated approach was already adopted in legislation, whereas in Germany the federal state legislative system and constitutional issues have made the implementation process difficult. The implementation has been done technically by amendments to different sector laws as in Austria or by a larger codifications as in Finland. The actual implementation situation in the Member States varies also because of the transition period lasting until 2007. For example, in Finland the installations under the Environmental Protection Act that implemented the IPPC directive are due for permitting at different times. The first wave is due at the end of 2003 and the second by the end of 2004, so all of the now approximately 630 Finnish IPPC installations will comply with the IPPC by the end of 2007. In the questionnaire some countries have described the situation at the time they completed the questionnaire, some after full implementation, and in that respect the questionnaire does not show a real picture of the implementation situation in summer 2001 when all the answers were given (Annex I, Tables 1 and 2).

The IPPC directive creates a requirement for industrial facilities, which fall under its scope of coverage to be made subject to authorisation through permitting. The Articles covering energy efficiency that are under this projects agenda are:

> **Article 3:"** General principles governing the basic obligations of the operator Member States shall take the necessary measures to provide that the competent authorities ensure that installations are operated in such a way that:…(d) energy is used efficiently; …"For the purposes of compliance with this Article, it shall be sufficient if Member States ensure that the competent authorities take account of the general principles set out in this Article when they determine the conditions of the permit.
> **Article 6**:" Applications for permits 1. Member States shall take the necessary measures to ensure that an application to the competent authority for a permit includes a description of - the installation and its activities, - the raw and auxiliary materials, other substances and the energy used in or generated by the installation, - the sources of emissions from the installation, - the conditions of the site of the installation, - the nature and quantities of foreseeable emissions from the installation into each medium as well as identification of significant effects of the emissions on the environment, - the proposed technology and other techniques for preventing or, where this not possible, reducing emissions from the installation, - where necessary, measures for the prevention and recovery of waste generated by the installation, - further measures planned to comply with the general principles of the basic obligations of the operator as provided for in Article 3, - measures planned to monitor emissions into the environment. An application for a permit shall also include a non-technical summary of the details referred to in the above indents.
> **Article 9**:" Conditions of the permit 1. Member States shall ensure that the permit includes all measures necessary for compliance with the requirements of Articles 3 and 10 for the granting of permits in order to achieve a high level of protection for the environment as a whole by means of protection of the air, water and land.
> (8.) Without prejudice to the obligation to implement a permit procedure pursuant to this Directive, Member States may prescribe certain requirements for certain categories of installations in general binding rules instead of including them in individual permit conditions, provided that an integrated approach and an equivalent high level of environmental protection as a whole are ensured.
> **Article 15**:" Access to information and public participation in the permit procedure 1. Without prejudice to Council Directive 90/313/EEC of 7 June 1990 on the freedom of access to information on the environment (14), Member States shall take the necessary measures to ensure that applications for permits for new installations or for substantial changes are made available for an appropriate period of time to the public, to enable it to comment on them before the competent authority reaches its decision. That decision, including at least a copy of the permit, and any subsequent updates, must be made available to the public. 2. The results of monitoring of releases as required under the permit conditions referred to in Article 9 and held by the competent authority must be made available to the public. 3. An inventory of the principal emissions and sources responsible shall be published every three years by the Commission on the basis of the data supplied by the Member States. The Commission shall establish the format and particulars needed for the transmission of information in accordance with the procedure laid down in Article 19. In accordance with the same procedure, the Commission may propose measures to ensure intercomparability and complementarity between data concerning the inventory of emissions referred to in the first subparagraph and data from other registers and sources of data on emissions. 4. Paragraphs 1, 2 and 3 shall apply subject to the restrictions laid down in Article 3 (2) and (3) of Directive 90/313/EEC.

Transposing the energy efficiency requirements and the articles of the directive (Articles 3 (d), 6(1), 9(1, 8) and 15 concerning access to information and public participation in the permit procedure) into legislation were not seen as problematic. Some Member States, for example, Austria and Portugal had adopted the exact wording of the directive and some had more detailed national prescriptions. On the other hand, the practical implementation of this kind of a basic obligation such as Article 3(d), was seen as very problematic. The main reasons for problems that were stated were in connection with the lack of an explicit definition of energy efficiency, with a lack of experience in the field of practical implementation of energy efficiency and with the lack of guidance, for example, in BREFs. In general, the wordings of the IPPC directive concerning energy efficiency were considered to be very open.

In Finland the national legislation has in practice been specified by using commonly acceptable non-binding guidance, created by several stakeholders. Altogether the common opinion of the

countries within the project was that the whole concept of energy efficiency was vague and as such difficult to implement in practice. With the concept of energy efficiency in permitting, it has to be asked whether the problem lies in flexible norms themselves or in the lack of national guidance or in the lack of experience or perhaps in all three. In any event regulation with exact wordings is not always possible and in some cases not even reasonable. The most effective way to reach equity in interpretations would be in common negotiations through which reasonable interpretations could be reached (Annex I, Tables 2, 3 and 7).

In most countries energy efficiency also applies to installations not falling under the IPPC directive. These installations, to which the energy efficiency requirement applies, are estimated to cover about 65–85 % of the total industrial energy use. These figures are rough estimations and not all countries could give any percentage figure. But those that could answer the question (total 8 countries) estimated the figure to be large, if not accurate. The incentive to require energy efficiency might yet come also from different demands than those caused by the implementation of the IPPC directive, for example from the taxation of energy or from grants for energy saving projects. The United Kingdom and Ireland said in their replies that the requirement for energy efficiency only applies to IPPC installations. In Finland the obligation to use energy efficiently is applied to at least IPPC plants, but there are no legal obstacles to prevent it being applied also to other installations. Altogether in most of the Member States the requirement for energy efficiency applies widely to all sectors of industry that use energy. (Annex I, Tables 10–13).

The IPPC directive is to be applied to all installations covered by the directive by 31 October 2007. In many countries there is a transition period for existing installations to comply with the demands of the renewed legislation. This applies also to the demands of BAT of which energy efficiency is also a part (see Section 4.5 and Chapter 5 of this report).

> Article 2 of the IPPC directive defines BAT: "Best available techniques shall mean the most effective and advanced stage in the development of activities and their methods of operation which indicate the practical suitability of particular techniques for providing in principle the basis for emission limit values designed to prevent and, where that is not practicable, generally to reduce emissions and the impact on the environment as a whole" And by defining BAT in accordance to the Annex IV of the directive, the following must be taken into consideration "The consumption and nature of raw materials (including water) used in the process and their energy efficiency."

Costs efficiency plays a role in permitting existing and new installations – as is pointed out in the Portuguese answer “for existing installations, cost and advantages for new legal requirements regarding energy efficiency demands will have to be balanced in order to avoid shutdowns”. In many cases the transition periods are not organised according to the requirements for energy efficiency, but instead as a general transition period to implement an integrated permitting procedure for all the installations falling under the scope of either the Annex I of the IPPC directive or under wider national arrangements. (Annex I, Tables 11 and 12)

2.3 Definition of efficient energy use

From the answers to the questionnaire, the wordings of the IPPC directive concerning energy efficiency issues were considered to be very open and there was a recognised need for definitions in order to clarify the practical implementation of the requirements for energy efficiency. The seminar, organised in Helsinki, also discussed whether there would be a need for guidance in defining energy efficiency and what kind of guidance would be needed. It was also pointed out, that the definition on search was a practical definition, not a legal one.

Article 9(8) gives the Member States an opportunity to use general binding rules (GBR) in implementation of the IPPC directive. The GBRs are not generally used in clarifying energy efficiency, but there are some branch general binding rules, for example in France, that include at least some consideration of energy efficiency, like clarification of energy consumption and justification of energy choice. Only France has actually used GBRs with some consideration on energy efficiency. However, France pointed out that general binding rules should here be understood as binding guidance (Annex I, Table 15). Also, other countries are considering the possibility of using GBRs in the future. The general binding rules are, or would all be considered as, minimum requirements: there would still be a possibility to impose case by case stricter requirements. (Annex I, Table 16. For more about the GBRs, see Section 4.1 and The Application of… 2000).

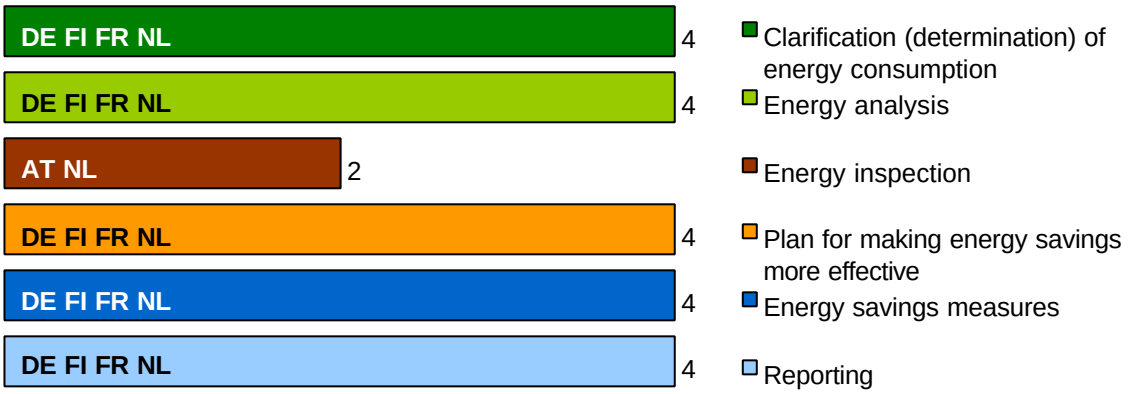

FIGURE 2 (Annex I, Table 15). If there would be General Binding Rules for energy efficiency, the main contents of the rules would, according to the replies, consist of the above mentioned parts.

There are some definitions of energy efficiency in use in the Member States' legislation. The definitions are mostly at a general level but for instance in Germany there is a branch wide definition but only for waste incineration (Annex I, Table 8). Instead, most of the countries provided both general and branch-wide guidance on defining energy efficiency in the form of reports, technical information sheets or guidebooks produced by several stakeholders (Annex I, Table 9).

In the discussions at the Helsinki seminar it was pointed out that there are several approaches available to define energy efficiency about which there was no general consensus. It was also pointed out that reducing energy use is not always the most efficient approach from the environmental point of view, given that reducing energy might mean even more emissions. In defining what is "useful" energy and what is not it could be said that, for example, it is useful energy to reduce emissions up to a certain point. There was also a discussion about energy losses which are quite easy to check. Yet the participants agreed that overall guidance on energy efficiency is not possible, the solution could be based on sector-wise guidance and, in general, efficiency should be looked at on a case by case basis. There was no approach that was found to be superior to the others. The participants of the seminar agreed that several approaches are good and can be used in parallel. Of the approaches benchmarking and balance checking were discussed and seen as useful tools (see Chapter 6). There is a need to determine energy balance, inputs and outputs, but it is very difficult to verify this information. It was also agreed at the seminar that there is a need for horizontal BREFs (that is the one on generic energy efficiency techniques and the one on economic and cross-media issues.)

3 THE AUTHORITIES AND ORGANISATIONS

3.1 The competent authorities and organisations

This section deals with the national competent authorities and other organisations that are responsible for energy and environmental issues and that grant, change and supervise environmental permits. Most of the participating Member States and also the future Member States (Lithuania and Poland) have different authorities responsible for national energy policy and environmental issues. The most common situation is that the ministry or department of economics or finance or trade or industry or enterprise is responsible for energy policy on the national level and the ministry or department of environment or agriculture or forestry or housing is responsible for environmental issues.

Competent authorities and organisations concerning energy issues

The common situation is as described above. The responsibility can also be shared between ministries and authorities as in Sweden, where it is shared between the Ministry of the Environment, the Ministry of Industry and the Swedish National Energy Administration. In France, the Ministry of Economy, Finance and Industry is responsible for the definition of national policy of energy and the Ministry of Spatial Planning and the Environment is responsible for the definition of national policy on the rational use of energy. The only exceptions are Ireland and Sweden, where two ministries or departments are co-operating in the field of energy policy and the rest of the ministries are also responsible for environmental issues. (Annex I, Tables 17–18)

Competent authorities and organisations concerning environmental issues and guidance on energy efficiency

In nearly all of the participating countries the ministry or department of the environment has the main responsibility for environmental issues. The Netherlands has joint responsibility between two ministries – the Ministry of Economic Affairs and the Ministry of Housing, Spatial Planning and the Environment. In Sweden the Environmental Protection Agency is the competent authority, but also all other authorities must take environmental aspects into consideration as appropriate. The actual situation on the consideration of environmental aspects also by other authorities is presumably similar in many other participating countries, but there is no clear evidence of this in the replies to the questionnaire. (Annex I, Table 18)

In most of the countries competence for giving guidance on energy efficiency in permits is given to the same ministry which is responsible for environmental issues or to the national environmental protection agency (EPA). In Germany, in matters where the ministry does not give the guidance, the "Länder" can themselves give guidance. The Portuguese competent authorities are the Environmental and Land Planning Ministry in co-ordination with the General Directorate of Energy. In Sweden the permit authorities, that is the environmental courts, and the county administrative boards, are not bound by the guidance given by the EPA. (Annex I, Table 19)

Competent authorities for issuing permits including energy efficiency

The IPPC directive does not stipulate how many permit granting authorities a Member State has to have, but it stipulates that the permit has to be fully co-ordinated in cases of several competent authorities. In Article 2 of the directive the concept of a "competent authority" is defined:

> "Competent authority shall mean the authority or authorities or bodies responsible under the legal provisions of the Member States for carrying out the obligations arising from this Directive".

The Member States thus have the opportunity to organise the question of competent authorities according to national interests as long as the co-ordination between different authorities is fully organised.

Most of the participating countries (for example Austria, Denmark, Finland, Italy, the Netherlands and Sweden) have a system where several authorities are issuing environmental permits depending on the geographical location, size or environmental impacts of the installation. Major installations are permitted by a ministry, environmental protection agency or an environmental court and the smaller ones by a regional or local authority. (Annex I, Table 20)

Another system to organise permitting (e.g. Portugal) is that only one authority grants permits. A variation of this is the German system, which is based on regional level authorities, depending on the organisation of the system in the various "Länder". (Annex I, Table 20)

Competent authorities for monitoring compliance and enforcement with energy use and energy efficiency conditions

Many of the participating Member States (e.g. Denmark, Germany, Ireland, Italy, the Netherlands, Portugal and the United Kingdom) and also Lithuania have the same competent authorities for monitoring and enforcement of energy use and energy efficiency conditions as for permitting. In addition to these, the Finnish Ministry of Trade and Industry is also involved in this issue concerning the voluntary agreements. (Annex I, Tables 21–22)

If a voluntary energy saving agreement is made between an authority and a company, the competent authority for monitoring on the national level is, in Denmark the Danish Energy Agency, and, in Finland, the Energy Information Centre for Energy Efficiency and Renewable Energy Sources (Motiva). However, these two authorities are responsible only for the voluntary agreements. For other cases in Denmark, the authorities are the same as for permitting. In Finland the regional environment centres are always responsible for monitoring the permit conditions. However, the monitoring in Finland and Sweden is mainly in the form of self-monitoring by the companies. In Sweden the county administrative boards carry out the monitoring of compliance of all types of conditions in permits for almost all IPPC installations. (Annex I, Table 21)

In France the national level authorities are the Ministry of the Environment and the Ministry of Industry and, on the regional level, "Direction Régionale de l'Industrie de la Recherche et de l'Environnement", which operates under the responsibility of the same representative that issues the permits. The competent authorities who enforce energy use and efficiency are the same as for monitoring. (Annex I, Tables 21–22)

3.2 Co-operation between authorities and organisations

Article 7 of the IPPC directive states, that

> Integrated approach to issuing permits:
>
> "Member States shall take the measures necessary to ensure that the conditions of, and procedure for the grant of, the permit are fully co-ordinated where more than one competent authority is involved, in order to guarantee an effective integrated approach by all authorities competent for this procedure."

While the assumption was that there might be some problems in co-operation, this was not generally seen as problematic. There is a great deal of co-operation between the authorities, and even the countries where there is no co-operation, do not see any problems arising from the division of authorisation. Each authority has special knowledge that the others may need or could use in their work. Especially in this case the development of co-operation would be highly recommended since energy efficiency is not a very clear and simple concept.

All of the Member States have several organisations involved in issues concerning energy efficiency. There are mainly ministries (environment, industry or economics), environmental protection agencies, energy centres and branch organisations, which cover the field of energy efficiency. Different energy efficiency agencies and non-governmental organisations also participate in many countries. (Annex I, Table 23)

According to the replies to the questionnaire, seven countries (Austria, Finland, France, Ireland, Italy, Sweden and the United Kingdom) have co-operation between different authorities and organisations concerning implementation and guidance in the permit procedure. The co-operation is mainly in the form of consultations, working groups and seminars between the different actors. In the Netherlands there is in general no co-operation on individual permit procedures and in Portugal there might be co-operation in this field in the future. (Annex I, Table 24)

Half of the participating countries replied that there is co-operation between environmental authorities, energy authorities and other organisations in the monitoring and enforcement of energy use and efficiency in the permit procedure. In Italy it is only information exchanges and in the Netherlands the authorities are informed by the national agency for energy and the environment (Novem) if companies do not perform adequately. Authorities will then start a procedure to enforce or adapt the permit. (Annex I, Tables 25–26)

Where non-regulatory energy efficiency schemes are used in the United Kingdom, as part of the permit requirements for the IPPC, these are monitored by the government. Where the conditions of non-regulatory energy efficiency schemes are not met by a permit-holder to the satisfaction of the government, the regulating authorities are notified and enforcement action may result. Finnish authorities and the Confederation of Finnish Industry and Employers had a common steering group when drafting a guidebook for energy efficiency in environmental permits and they also participated in drafting the permit application form for assessing energy efficiency (Annex III). In France the local representatives of the energy authority and the environment authority are under the same regional direction of research, industry and environment (DRIRE). (Annex I, Tables 25–26)

4 ENERGY EFFICIENCY IN THE PERMIT PROCEDURE

4.1 Guidance for the applicant

In the replies to the questionnaire concerning energy efficiency in environmental permitting it was apparent that one of the main problems is lack of specific guidance at different levels of the permitting procedure.

The Article 9(8) of the IPPC directive allows Member States to use General Binding Rules (GBRs) in place of certain aspects of installation specific permits, as long as the integrated approach is maintained and an equivalent high level of environmental protection is ensured. The need for ensuring an equivalent high level of environmental protection means that GBRs cannot be used where the local environment is particularly sensitive. In such a case only individual BAT determinations can be used. Thus, GBRs are appropriate where emissions do not lead to local problems or where interactions with individual media are predictable. The following criteria should apply before consideration is given to the development of a GBR:

- A GBR must cover a sufficient number of installations of that category to make development of the GBR cost-effective.
- The current status of technology and techniques in the category must not be fast moving, as GBRs cannot be updated frequently.
- Installations must have a relatively uniform impact on the environment.
- The sector should be covered by a well organised trade association to ensure agreement on the details of the GBR.
- GBRs must be amenable to inclusion in a statutory document.

GBRs will need to be reviewed whenever significant changes take place either in the techniques used by the category of installation or in the understanding of the environmental impacts of its operation. GBRs might pose some problems for stakeholder participation, particularly during public consultations on permit applications, as the condition to be applied cannot be varied (IMPEL report: General Binding Rules, 2001).

Some Member States such as Denmark, Finland, France and the United Kingdom have guidance concerning energy efficiency but usually no quantified objectives have been set. In Denmark some sector energy analysis and some horizontal guidelines (e.g. on ventilation, heating, compressors and electric light) exist. The Danish Energy Agency provided the guidelines (Annex I, Tables 27 and 28).

In Finland the Ministry of Trade and Industry together with the Finnish Environmental Institute ordered from Energia-Ekono Ltd a study on energy efficiency in environmental permits and energy saving agreements. This study was the first in Finland that was aiming at implementation of the IPPC directive's requirement on energy efficiency (Energy Efficiency… 1999). In the study a method was developed based on the calculation of an energy efficiency index. This method was tested in different installations and seemed to work best in the pulp and paper industry.

Thereafter, the Finnish Ministry of the Environment ordered from Electrowatt-Ekono Ltd a study on consideration of energy efficiency specifically in the environmental permit procedure (Siitonen et al. 2001). The steering group for this study included members from the Ministry of the Environment, the Ministry of Trade and Industry and the Confederation of Finnish Industry and Employers. The report concludes that an energy assessment always must contain numerical information as well as a verbal description. Information should be presented in such a format that total energy con-

sumption and also energy distribution between different units are shown. The effects of environmental investments on energy use should also be specified. Changes in energy efficiency can also be described with a plant or sector specific index value if such an index has been defined. This report also contained a proposal for an application form for assessment of energy efficiency as attachment to the environmental permit application form. Yearly reports and reports made under energy saving agreements are used when reporting to the environmental authorities on permit compliance. The Finnish application form has no official status but it is generally used in practice (Annex III).

In France there are some considerations on energy efficiency in the guidance for the applications. The French environmental law states that the Ministry of the Environment can impose general rules. The documents from the ADEME (Agency for the Environment and Energy) provide sector-wise information about energy efficiency and energy efficient technology. The sectors are: Glass Industry, Combustion Plants, Cement Industry, Paper Industry and Incineration Plants. In France there are also several ministry decisions on different industrial sectors in which energy management is incorporated:

1) Ministry Decision on the Glass Industry: The plant manager must take all necessary measures in the design and the management of the plant to limit energy consumption. He must make available to the environment inspector the reasons for the choice of energy sources as well as information about the energy efficiency of the installation.
2) Ministry Decision on the Paper Industry: The plant manager must take all necessary measures in design and management of the plant to reduce air pollution at the source, in particular by optimising energy efficiency.
3) Ministry Decision in relation to Use and Consumption of Water, to Air Emissions of any kind from Classified Installations: The plant manager takes all necessary measures in design and management of the plant to reduce air pollution at the source, in particular by optimising energy consumption.
4) Ministry Decision on Incineration Plants of Industrial Waste: The plant must be designed and managed so that calorific energy produced by waste combustion can be recycled and of value. The percentage of energy of value is defined as the ratio of valuable energy and energy produced at the output of the boiler. Caloric or electric energy produced by the plant is said to be of value when it is actually consumed or sold to a third person.

France also has draft ministry decisions on boilers with capacity grater than 20 MWh and on co-incineration and incineration plants of non-dangerous substances. The French guidance is binding but it does not provide quantified objectives. Additionally, information on voluntary energy saving agreements and emission reduction are made available to the local representatives of the environmental authorities.

The application form in Portugal has to be used when the operator applies for a permit. Furthermore, in Portugal the General Directorate of Energy and the Centre for Energy Conservation have developed several sector initiatives providing guidance on energy auditing (textiles, ceramics, dairies, and wood and cork). Portugal also has definitions on minimum efficiency requirements for hot water boilers and definitions on energy consumption optimums for the following industrial sectors: food and drinks, textiles, wood and cork, pulp and paper, chemistry and cement, ceramics and glass.

In the Netherlands, in general, energy measures are implemented based on the environmental law. Implementation depends on the category of the installation and whether a company has joined a voluntary reduction agreement.

a) For the highest energy consumers, >0,5 PJ/a, benchmarking is used. The companies are compared with the world's best performing installations. If their performance is less than the best, they have to draw up an improvement plan and the measures will be implemented in the permit. About 200 companies have joined this scheme and have started the comparison.
b) For other major energy consumers, mainly industrial, that covers together about 90 % of total energy consumption of industry, there is the voluntary agreement, MJA.
c) Non MJA-companies are requested to apply for a permit review and the permit authority will decide on the measures. Guidelines for this process and possible measures are made available by means of technical information sheets by Novem (National Agency for Energy and the Environment). The selection depends largely on the payback period of the required investment, which usually is 4 years.
d) AMVB installations have general binding rules. They are mainly smaller installations such as offices, restaurants, shops and glasshouses and they are exempted from the permit requirement.

The Netherlands has the following regulations in use for those companies which have not joined a voluntary saving agreement (referring to point c above). Those are divided further into two categories in terms of annual energy use. The following regulations, considered as GBRs, are valid for bigger companies (Circular… 1999, 25–28, unofficial translation):

Regulation 1: Performance of energy saving study
Performance term of energy saving study…[indicate]. (Part of the) installation at which the study is aimed…[describe].

The results of this study are laid down in a report, containing at least the following information:

1. Description of the object;
2. Description of the survey of the energy balance of the object as a whole, and an assignment of at least 90 % of the total energy consumption to individual installations and (parts of) processes;
3. A survey of the possible energy saving techniques and/or measures, aimed at the installations and (parts of) processes, that, according to the energy balance, make the largest contribution to the total consumption;
4. For each energy saving measure the following information:
   - annual energy saving
   - (additional) investment costs
   - expected economical lifespan
   - annual saving of energy costs, based on energy tariffs as they apply to the company at the time of the study
   - estimation of possible additional costs or benefits other than energy saving
   - payback time, based on (additional) investment costs and benefits;
5. A survey of possible organising and good housekeeping measures, which lead to energy saving.

Regulation 2: Drawing up a company energy plan
On the basis of the report a company energy plan is being drawn up, according to the format prescribed in the circular "Energy in the environmental permit". Measures with a payback time of up to and including five years will be included in the plan. Phasing over a certain period of time is allowed here. If one of these measures will not be carried out, this will be motivated.

Regulation 3: Producing study report and company energy plan for approval
Timetable of delivering the study report and company energy plan to the competent authority for approval…[indicate].

Regulation 4: Carrying out company energy plan
The company holder carries out the company energy plan within the terms set in the plan.

Additionally there are measuring and registration, instruction and maintenance regulations and a reporting obligation.

In Italy no guidance for applicants is available at the moment. The environment agency is studying a possible approach to energy efficiency evaluation in the industry through the use of pinch technology.

Germany has no general binding rules because of the political goal to meet the CO_2-reduction regarding the Kyoto protocol by voluntary agreements. Germany has used GBRs for steel mills and waste incineration plants already before the IPPC directive came into force. In Germany there are guidelines for energy management in companies, including pinch technology for improvement of energy efficiency and practical guidelines for the improvement of rational energy use in the industry. Also, VDI's (Association of German Engineers) guidelines can be used as a source of information from a non-governmental organisation.

Sweden is considering the use of general binding rules.

In the United Kingdom there is a draft Horizontal Guidance Note on Integrated Pollution Prevention and Control and Energy Efficiency (Horizontal Guidance Note IPPC H2). There are also sector guidance notes for each industrial sector with information for the applicants. Where the European Union has issued a BREF document for a sector, the information it contains is taken into account in the Sector Guidance Note. The purpose of this draft horizontal guidance note is to provide supplementary information to assist applicants in responding to the energy efficiency requirements described in the IPPC Sector Guidance Notes. All installations under the scope of the IPPC Directive shall provide the authorities with the following information:

- energy consumed or generated and the direct or indirect carbon dioxide emissions;
- energy management provisions;
- proposed measures for the improvement of energy efficiency in operating and maintenance procedures, control of excessive heating and cooling losses and building services;
- provision of an energy efficiency plan that identifies energy efficiency techniques that are applicable to the operation of the activities.

The applicants use this guidance but may ultimately negotiate actual conditions with the competent authority. The environmental impact of carbon dioxide emissions is global and indirect in effect and there is no universally acceptable methodology that assesses this impact in terms of emissions concentrations. Therefore, in the United Kingdom, the determination of BAT for energy efficiency by setting standards based on emission limit values (ELVs) is not considered appropriate. Instead they are replaced by equivalent technical measures as determined by appraisal of the appropriate balance between costs of the techniques and the environmental benefits they deliver.

All installations in the United Kingdom under the scope of the IPPC Directive must also meet additional energy efficiency requirements either:

- through participation in a Climate Change Agreement or Direct Participant Agreement in the Emissions Trading Scheme; or
- through compliance with further permit-specific requirements as determined with the regulator.

Lithuania has a plan to develop GBRs for appropriate branches of industry and the requirements of energy efficiency would be included in the rules.

Poland has no general binding rules but is preparing application forms.

4.2 Application documents

Most of the participating countries in this project required the following information from the operator in the application documents: total energy balance, energy production, energy consumption, assessment of energy efficiency, energy saving plan and description of energy use. Earlier saving measures and the amount of energy used for environmental protection measures were not always required. (Annex I, Table 29)

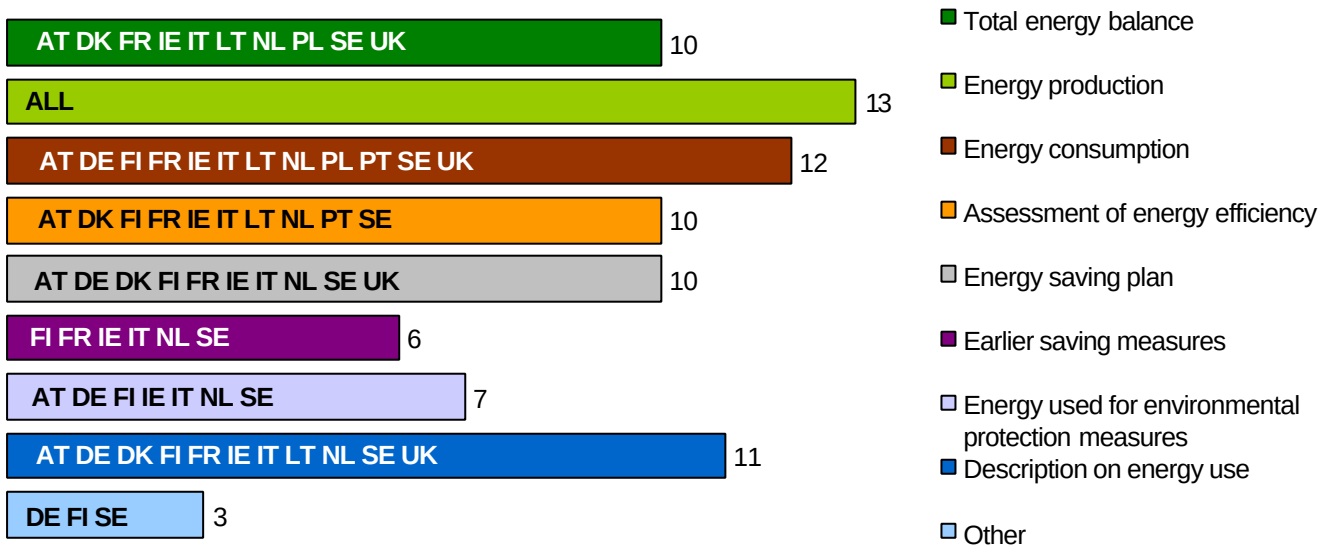

FIGURE 3 (Annex I, Table 29). Information concerning energy required in the application.

4.2.1 Required energy information in the application

Austria requires data on substances used or produced and on energy. Certain discretion is left to the authorities. The following information is important:

- total energy balance
- energy production
- energy consumption
- assessment of energy efficiency
- energy saving plan

- energy used for environmental protection measures and
- description on energy use except data on earlier saving measures.

In Germany all the above mentioned requirements are needed in an application and in addition to these, a declaration of the delivering of usable heat to third parties, if not used in the company itself. The possibilities to achieve high usable energetic ratios and optimisation, energy recovery and insulation measures are required. The effects of energy saving measures are required. Usually no information on voluntary energy saving agreements is required. Application documents for existing installations have to be sent only in the case of planned substantial changes, because Germany does not require new applications for all IPPC installations when implementing the IPPC directive. Germany has guidelines for energy management in companies and guidelines for the applicant on pinch technology for the improvement of energy efficiency. Additionally, Germany wanted the information to be concrete and detailed enough.

In Italy no guidance is available for the applicants at the moment. Some studies have been made (ANPA, ENEA), but most of the guidance will be based on negotiations between applicant and competent authority. Requirements to use energy efficiently are set in permit conditions, but there are not details on how to evaluate the efficient use of energy.

In the Netherlands there are AMVB's General Binding Rules. Larger companies are also advised by Novem. IPPC installations must in their applications provide the following information:

- annual energy saving
- annual saving of energy costs
- company energy plan
- registration of energy use
- reporting obligations that should contain, for example, deviations with respect to the company energy plan.

4.2.2 Other required information

The question of monitoring the effects of measures for energy saving was not quite clear for all the countries. Germany, Ireland, Italy and the Netherlands said that the effects should be monitored. Poland has proposed methods for monitoring technological processes, including measurement and registration of concentration or levels of substances and energy released to the environment. In France there is monitoring of the effects of measures for rational use of energy and investments contributing to rational use of energy. In Lithuania companies are preparing waste reduction plans and in these plans energy saving issues are also described in detail. (Annex I, Table 30)

Most of the participating countries were of the opinion that the information from the voluntary systems can be used in the application documents or in the assessment of an application or as background material. Denmark said that it could be used to verify current effort and status. Germany said that the information has to be concrete and detailed and has to be a declared part of the application document. Ireland uses the information in the application assessment and to set a benchmark against which the company will achieve various objectives and targets. In the Netherlands the energy plans made as part of the agreements are part of the application. In the United Kingdom voluntary energy saving agreements may be used to meet part of the requirements for the IPPC Directive. In addition, each installation has to meet a set of basic energy requirements as a minimum. Italy, Portugal and Sweden said that any relevant information could be used regardless of source. In Sweden the question of how to reduce fossil fuel use is also of interest. (Annex I, Table 31)

Most of the countries saw no differences in the requirements for new or existing installations. However, France said that existing installations must provide a report on past years. In this report there should be an assessment of the effects of the plant on health and the environment during past years, an account of investments to prevent or reduce pollution during past years and the amount of discharges to water or air emissions during the past year. In Germany the application documents for existing installations have to be sent in only if substantial changes are planned and they refer to the parts of the installations where changes are planned. After that there are negotiations between the authority and the operator if some additional documents are required. In Ireland new licences are issued with energy conditions. IPPC installations have to be reviewed once the IPPC directive is introduced in Irish law. (Annex I, Table 32)

4.2.3 Application forms

Finland has a general application form and additionally a form specifically for energy issues with guidance for the operators to fill in when applying for an environmental permit. A group with members from the Finnish environmental authorities and the Confederation of Finnish Industry and Employers developed this form for energy issues. Operators must include on the form (Annex III) information concerning the following:

- total energy balance
- energy production
- energy consumption
- assessment of energy efficiency
- energy saving plan
- energy used for environmental protection measures
- description on energy use
- earlier and planned saving measures and
- planned environmental investments.

The application form and guidance can be downloaded from the Internet. Annex III to this report contains the form.

In Portugal there is an application form for the operator to fill in to apply for an environmental permit. The application form also has some questions regarding energy consumption and energy efficiency, among many other questions related to the installation's activities and emissions (e.g. the quantification of CO_2 emissions). It is not a specific form for energy issues. The form is available on the Internet.

4.3 Permit consideration

4.3.1 Energy efficiency measures in permit consideration

The following guiding principles according to Article 3 of the IPPC Directive must be taken into account by the competent authority when granting a permit:

- appropriate preventive measures are put in place using BAT or other techniques;
- no significant pollution is caused;
- waste is minimised, reused or recycled before being disposed;
- **energy is used efficiently;**
- accidents and incidents with environmental effects are minimised; and
- remediation and restoration measures are in place following cessation of activity.

The IMPEL Workshop on Integrated Permitting in Dublin 2000 also had some key conclusions.

- The permits should be precise and unambiguous.
- The application may or may not be part of the permit.
- All permits should require monitoring by the permitted facility and the regulator should also carry out some monitoring.
- All permits must meet national legislation.
- EMS may or may not be appropriate for all operators.
- Individual environmental media should be addressed under separate headings in the permit.
- The BREF documents will be useful but should be used as guidance only.
- An integrated permit should be all embracing and cover all environmental media.

The environmental authorities take into consideration specific energy saving matters such as choice of fuel, use of electricity, use of heat, process optimisation, index for energy efficiency, use of waste energy, previous measures for energy savings, planned measures for energy savings and planned measures for environmental investments.

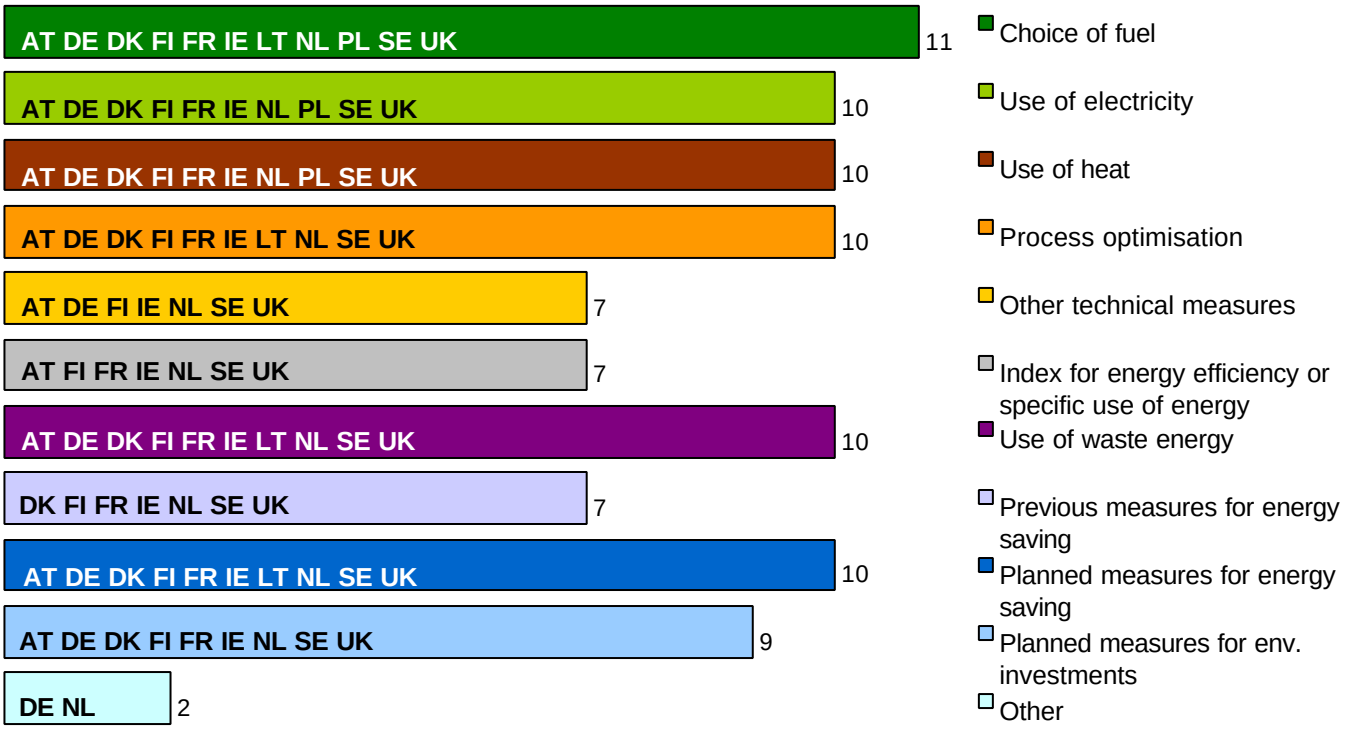

FIGURE 4 (Annex I, Table 34). Specific energy saving matters in permitting.

At the time the questionnaire was sent out there were not many examples of permit conditions including the consideration of energy efficiency. Ireland will carry out a thorough energy audit that will identify all opportunities for energy use reduction and energy efficiency. All the energy specific items are evaluated in the Objectives and Targets by the Irish EPA and in the Annual Environment Report submitted by the licensee to the EPA. In Denmark consideration will be given to co-generation of heat and power if applicable.

In Portugal the operator is required to monitor energy production and usage, and promote an annual self-assessment of energy efficiency (Annex I, Tables 33 and 34). In Portugal the use of waste energy, previous measures for energy savings, planned measures for energy savings and planned measures for environmental investments are also considered when providing grants for industry within several financing programmes.

In their replies most countries said that changes in energy efficiency also could affect the permit and at least lead to a reconsideration of a permit condition. Only Portugal and Finland answered that this is not the case. The requirements for energy efficiency could be incorporated into the permit in different ways; as a binding permit condition, as a general consideration within other permit conditions or as a general consideration in the general part of the permit. All these ways are used equally among the Member States. The most used permit condition is the obligation to improve the energy efficiency. Most of the countries find the BREFs useful when assessing energy efficiency although the data in the BREFs could be improved. A horizontal BREF could also be useful as it might clarify different aspects of energy efficiency.

4.3.2 Other items under consideration when evaluating energy efficiency

In their permits some countries often use references to voluntary energy saving agreements (Finland, the Netherlands and the United Kingdom) or voluntary environmental management schemes (Finland and the Netherlands). Denmark, France, Germany and Lithuania also use references to the application. In Germany permit conditions will be necessary if the operator has to fix other or additional measures than those described in the application documents. In other cases the energy efficiency measures are usually determined by reference to the application documents. (Annex I, Table 33)

Other items that the authority takes into consideration when evaluating energy efficiency could be for example the use of non fossil fuels, transportation, water consumption, air pollution abatement and waste management. The use of non fossil fuels is always taken into consideration whilst transportation is seldom taken into account - only Sweden and the Netherlands consider it. In Sweden energy used in producing raw material or chemicals used might be considered. Sweden also considers issuing permits with permit conditions including specific energy consumption. Water consumption, air pollution abatement and noise abatement are always taken into consideration in the permit procedure because the minimisation of all pollutants is important. (Annex I, Table 35)

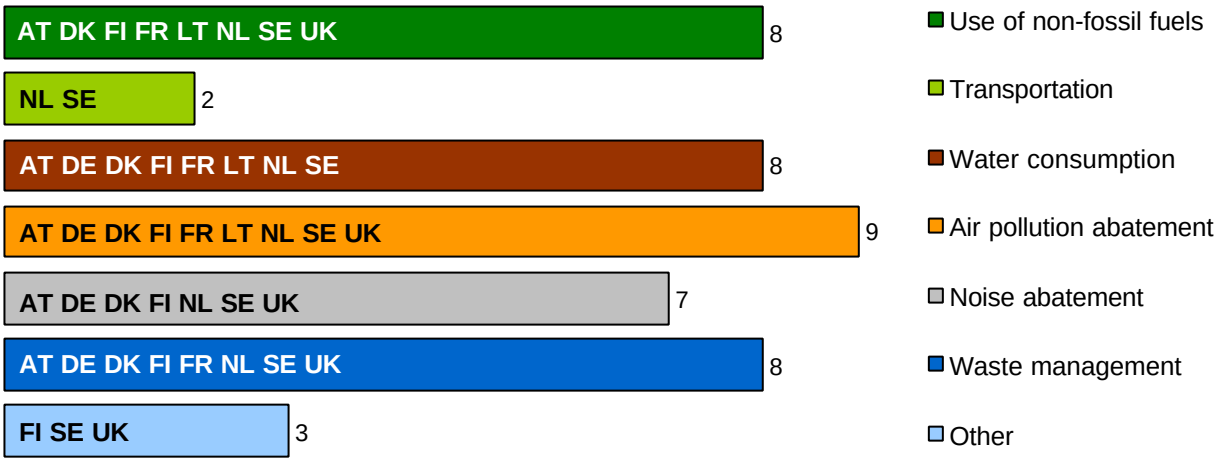

FIGURE 5 (Annex I, Table 35). Other items when evaluating energy efficiency in permitting

Most of the countries have no guidelines on how the choice of fuel shall be handled within the permit consideration. In Germany fuel and emissions from the use of it should also be taken into consideration. Ireland has a BATNEEC Guidance note for each sector. This note supplies information on, for example, what type of fuel should be used. In the Netherlands there are no general guidelines, but minimal CO_2 effects and other emissions such as SO_2 and NO_x are normally considered. (Annex I, Table 36)

Finland said that the cross-evaluation of the effects of the reduction of emissions and wastes in comparison with energy efficiency might be of importance in the permit procedure. The Netherlands and the United Kingdom have some non-binding guidelines for how to deal with co-generation of heat and power in the permit procedure. In the Netherlands the use of residual heat is encouraged and in the United Kingdom, CHP is considered as one of the techniques to improve the efficiency of energy conversion and use. (Annex I, Table 37)

4.4 Permit conditions

4.4.1 Energy efficiency in permitting in practice

In the seminar discussion it was pointed out that the requirement for energy efficiency is as important as the permit conditions on emissions. There are not yet many examples of permits containing consideration of energy efficiency. In general, the countries do not have guidance for the consideration of energy efficiency in the permitting procedure, except for Ireland, the Netherlands and the United Kingdom. Finland, Germany, the Netherlands, Poland, Sweden and the United Kingdom could foresee the requirement for energy efficiency as a binding permit condition.

Most of the countries considered the following items as important when evaluating energy efficiency in the permit procedure (Annex I, Table 34):

- choice of fuel;
- use of electricity;
- use of heat;

- process optimisation;
- other technical measures;
- index for energy efficiency or specific use of energy;
- use of waste energy;
- previous measures for energy savings;
- planned measures for environmental investment and, if applicable and
- possible co-generation of power and heat is important.

In Germany there are usually references to the application. However, permit conditions will be required if the authority has to fix other or additional measures than those described in the application documents. If applicable, co-generation of power and heat is also taken into consideration in permitting.

In Finland there is a permitting guidance under development in which the issue will be addressed. Additionally, also in the Finnish environmental permits there could be references to the application. In cases where the installation has joined the energy saving agreement no further energy efficiency conditions are set in the permits.

In France there are "Provisions about rational use of energy in classified installations for environmental protection regulations". In the ministry decision on the glass industry it is a requirement that the plant manager must take all necessary measures in the design and the management of the plant to limit energy consumption. He must make available for the environment inspector the reasons explaining the choice of energy sources as well as information about the energy efficiency of the installations. In the ministry decision on the paper industry it is required that the plant manager must take all necessary measures in design and management of the plant to reduce air pollution at the source, in particular by optimising energy efficiency.

In France the efficient use of energy in a plant is mainly studied when designing the plant together with the impact study, at the decennial assessment of the permit or during energy audits on a voluntary basis. France has a Decree on the Periodic Control of Installations consuming Energy in which the following terms are defined: boiler, nominal power and characteristic yield. Periodic control comprises:

- calculation of the yield characteristic of the boilers;
- control of the existence and the correct operation of the control and measuring apparatus;
- checking of the good condition of the installations intended for the distribution of thermal energy;
- checking of the quality of the combustion and the correct operation of the boilers; and
- checking of the boiler manual.

The periodic controls are carried out at the expense of the owner of the thermal installation.

In Ireland the current permits often have a condition that requires the activity to carry out a thorough energy audit that will identify all opportunities for energy use reduction and energy efficiency. The Netherlands thought that benchmarking is a good way forward, at least for the most environmentally aware companies. In the United Kingdom an energy efficiency implementation plan should be attached to the permit. The most difficult question is whether the authorities can set limit values for energy efficiency. The general opinion was that there could be no restrictions on energy consumption as such and that it is difficult to have binding conditions. The linkages between the permits and the voluntary energy saving schemes were seen as useful. The checking of energy use could be done through annual monitoring.

In Lithuania there are requirements for energy use and references to the application in the permits. In Poland the permit must specify, in particular, the type and quantity of consumed energy, materials, raw materials and fuels, the sources of origination, of substances, and energy releases to the environment.

Portugal has limited experiences so far with permitting IPPC installations. The use of waste energy, previous measures for energy savings, planned measures for energy savings and planned measures for environmental investments are also considered when providing grants to industry within several financing programmes with the objective to improve energy efficiency.

4.4.2 Some examples of permit conditions

For Finland two types of permit conditions can be mentioned:

For an IPPC chemical plant in Finland:
In the operation and planning of the installation the most efficient use of energy and continuous improvement of energy efficiency shall be taken into consideration. The operator shall before 31 December 2003 present to the environmental authority an assessment of the present energy efficiency of the installation, the plan for monitoring the efficiency and consideration of it in the operation as well as the goals for the future. The authority will check the report and do an assessment of the improvement of energy efficiency and the necessity of the measures for monitoring.

For a small metal plant in Finland:
The results of the energy inspection and analysis and the plan for more efficient energy production and use must be sent for acceptance to the environmental authority before 1 June 2001. In the improvement plan there must be at least goals for improvement and the costs of the measures and a timetable for the measures.

In France the permit for a boiler (68.2 MW) has, for example the following permit conditions. The most significant conditions with respect to the effective use of energy are mentioned, but are in unofficially translation into English.

Each generator must be provided with the following apparatuses:
- a recording vacuum gauge;
- an indicator of the temperature of combustion gases on the outlet side of the generator;
- a temperature sensor of the fluid at the entry and exit of each boiler room;
- a device indicating the thermal parameters of the coolant to the entry and the outlet side of each generator;
- an apparatus measuring continuously the index of blackening;
- a device indicating either the flow of fuel or flow of the coolant; and
- an automatic analyser of combustion gas giving at least the content of carbon dioxide or any equivalent indication.

The condition on management states that a manual on heating must be held and that it shall contain at least information on
- general conditions of the use of heat;
- results of controls of the combustion and the operation of the apparatuses and of modifications to combustion and controls; and
- yearly fuel consumption.

The operator shall take all measures to ensure, for example:

- a periodicity determined for the cleaning of the heat-transferring surfaces
- an effective heat insulation of elements of generators, appliances as well as of transport or distribution pipes.

In France the minimum boiler yield should be between 85 and 90 % based on the fuel used in the boiler when the boiler yield is defined as $R = 100 – (Pf + Pa + Pr)/Pin$

- Pf is the loss of energy through the fumes
- Pa is the loss of energy in the ashes
- Pr is the energy lost through convection and radiation
- Pin is the input of energy expressed as low heating value

In Germany there could be a condition such as the applicants documents are declared an integrated part of the permit. That means that the applicant is legally bound to each detail in that document. The document must show concrete, detailed and specific energy efficiency.

In Ireland the permit template has a condition that requires the activity to carry out a thorough energy audit that will identify all opportunities for energy use reduction and energy efficiency. This information is submitted to the agency in an annual environmental report (AER).

The Irish wording for a permit condition is as follows:
"The licensee shall carry out an audit of the energy efficiency of the site within one year of the date of grant of this licence. The licensee shall consult with the Agency on the nature and extent of the audit and shall develop an audit programme to the satisfaction of the Agency. The audit programme shall be submitted to the Agency in writing at least one month before the audit is to be carried out. A copy of the audit shall be available on-site for inspection by authorised persons of the Agency and a summary of the audit findings shall be submitted as part of Annual Environmental Report. The energy efficiency audit shall be repeated at intervals as required by the Agency.

The audit shall identify all opportunities for energy use reduction and efficiency and the recommendations of the audit will be incorporated into the Schedule of Environmental Objectives and Targets under Condition 2.2 above."

In Portugal the operator has to monitor the energy consumption and send the results to the authority. He has also to evaluate energy efficiency and is required to develop actions aiming to obtain maximum energy efficiency. Usually the requirement for energy efficiency is incorporated as a general consideration in the descriptive part of the permit. In future when the BREF documents for energy intensive installations have values for energy consumption the requirement for energy efficiency may be incorporated into the permit as a binding permit condition.

Examples from two **Swedish** Environmental Court Decisions and three statements of the Swedish EPA:

Swedish example I:
"The company shall in co-operation with the supervising authority and the Swedish Environment Protection Agency conduct the following investigations and illustrate the impact on cost and environment of the considered measures:

1. As regards energy conservation:
   Possibilities to

a) Reduce consumption of energy in the installation through savings
b) Further use of low-heat energy for district heating purposes
c) Substituting hydrogen gas or steam bought from the neighbouring pulp mill for oil

2. As regards transportation:
   Possibilities to reduce environmental impact from transportation by changing over to railway transportation, (and introducing) requirements when contracting transportation etc.

The investigations together with proposals for measures and final conditions shall be presented to the environment court before 1st of January 2004."

Swedish example II:
"The company shall elaborate a long term plan for conservation of energy and present it to the regional state authority by 30th of September 2002 at the latest"

In the following three statements issued by the Swedish EPA to environment courts:
Note that the courts have not yet given their rulings on the proposals. The decisions are expected by the end of 2002.

Swedish EPA statement I:
For one permit application for a pulp mill the Swedish EPA has proposed the following conditions:

1. Before the end of 2005 production of electricity and of low pressure steam shall have increased on the whole as described in annex A point 7.1 in the company's application dated 16th of March 2001, "increased dryness of black liquor". The measure should thus aim at increasing production of electricity by about 5 700 MWh/year and of low pressure steam by about 48 000 t/year.
2. Before the end of 2005 the consumption of heat energy in the evaporation plant shall be reduced on the whole as described in the additional information from the company dated 28th of November 2005 under point 15, "Ecocyclic mill". The measure should thus aim at reducing the total energy consumption in evaporation and stripper to about 4 GJ/t bleached pulp.
3. Before the end of 2005 the energy consumption in the drying machine shall be reduced as a whole as described in the company's additional information dated 28th of November 2005 under point 8, "Drying machine, dryness". The measure should thus aim at reaching a net steam consumption in the drying machine of about 2.1 GJ/tonne."

Swedish EPA statement II:
In another case the Swedish EPA has proposed that the following investigations be carried out:
"The company shall investigate different possibilities for and consequences of

1. Taking measures, which at the production levels applied for, reduce the consumption of electricity by about 20 % compared to what is stated in the application.
2. Taking measures which increase production of electric energy with the purpose of being 50 respectively 75 % self sufficient with electricity at the production levels applied for."

The Swedish EPA moreover proposed the following final conditions:

1. Before the end of 2005 the capacity of the auxiliary boiler when fuelling bark is to be increased as described in the court's file annex 61 under point C.5 or in another equivalent manner, which the supervising authority deems as promoting a sustainable development in an equivalent or better way.
2. Before the end of 2005 the existing flash drier is to be replaced by a modern drying machine.

3. Before the end of 2007 the use of oil in the limekiln is to be replaced with bark powder or gasified bark.

Swedish EPA statement III:
In a third ongoing case the applicant has accepted the following condition for an investigation on energy efficiency to be carried out together with the supervising authority during one year:

"The report (to the court) from the investigation shall comprise an account of the energy efficiency development at the installation, a comparison with the development at other known similar activities in Sweden, a comparison with the BAT document that has been elaborated within the EU, an account of the potential for further measures at the installation and proposals for conditions for energy conservation"

The United Kingdom has been considering a legal instrument by which Regulators can incorporate negotiated agreements and trading agreements into IPPC permits. Although as yet not finalised, draft permit conditions may include the following requirements:

- annual reporting of energy consumption, direct and indirect carbon dioxide emissions;
- compliance with a set of basic energy efficiency requirements;
- the holding of a current negotiated agreement or trading agreement validated by the relevant government ministry; and
- if no such agreement is held, compliance with site-specific energy efficiency measures.

4.5 Best Available Technique (BAT) in the permit procedure

A Best Available Techniques Reference document (BREF) is the product of an exchange of information carried out in the European IPPC Bureau with a dedicated Technical Working Group (TWG) constituted for the purpose. In total there are 32 industrial sectors for which these BREFs have to be established. Eight of them have already been adopted by the European Commission and four finalised BREFs are awaiting adoption at the moment (November 2002). A TWG for a horizontal energy efficiency BREF is planned to be established in 2003.

The term "best available techniques" is defined in Article 2(11) of the IPPC directive as follows:

> "The most effective and advanced stage in the development of activities and their methods of operation which indicate the practical suitability of particular techniques for providing in principle the basis for emission limit values designed to prevent and, where that is not practicable, generally to reduce emissions and the impact on the environment as a whole."

Article 2(11) goes on to clarify further the definition of the words "techniques", "available" and "best". The contents of the BREFs are presented in more detail in Chapter 5 "Best available technique reference documents and energy efficiency". This chapter is based on the replies to the questionnaire.

A very clear perception concerning the usefulness of the BREFs when assessing energy efficiency is that very few of them contain specific enough data. However, BREFs for the cement and lime, chlor-alkali, non-ferrous metals and pulp and paper industries were mentioned as useful examples. In general BREFs can be useful for the authority as guidance documents representing the minimum demands, but they should be improved in terms of energy efficiency. Nearly all of the participating countries indicated that the sector-specific BREFs should contain more information on energy effi-

cient techniques and energy consumption, for example kWh/t per produced unit at best performing installations. (Annex I, Tables 43 and 47)

Seven out of ten countries wish better information about a consistent basis for energy reporting and also consideration of trade-offs between energy use and other environmental impacts. There were other suggestions too on ways to improve the BREFs, for example, energy aspects should be dealt with more comprehensively way mainly in sector-specific BREFs and a horizontal BREF should only contain general principles and techniques (Austria). Portugal suggested clarification of the use of different methods for assessing the energy efficiency in specific situations or alternatively its consideration in the monitoring BREF. Sweden would like to see more data on energy production possibilities at the installations and on the possibility to use excessive heat, for example, for district heating perhaps after heat-pumps. (Annex I, Table 47)

It seems that there has been to systematic comparison and evaluation of possible differences between the BREFs on concerning energy efficiency in new and existing installations. The general opinion is that there should be no major differences because the data in the BREFs are based on well-performing existing installations and reflect the BAT for the sector. Portugal refers to the cement and lime industry BREF, where the heat balance value associated with BAT is only valid for new plants and major upgrades. Existing installations use the parameters given in the BREFs as targets (Lithuania). The United Kingdom points out that it seems to be more relevant to list energy efficiency parameters and other related issues for different technology types and then to consider which technology would be chosen for the new installation. (Annex I, Table 44)

None of the participants in this project, except Lithuania, consider the energy efficiency data as sufficient in the BREFs, neither for new nor existing installations. There just is not enough data, nor is the information specific enough. The BREFs are only guidance documents, which should be taken into account (Sweden). Portugal's proposal is that the content of the BREFs could be made more readable and uniform. All the values indicated should be clearly presented as benchmarks to the sector and, if possible, specified for each process. Especially for new installations there should always be an energy efficiency value attainable with the suggested BATs. (Annex I, Table 45)

As mentioned above, there are several problems with the use of BREFs concerning energy efficiency. Additional comments on this issue are, that the BREFs suffer from a lack of comparable data (Finland), because industry tends to keep energy data secret (Sweden). It should also be noted that some techniques, for example emission reduction processes, often increase energy consumption (France, Germany and Portugal). The BREFs could also deal more in detail with the integration of energy efficiency and the reduction of greenhouse gases (the Netherlands). Two countries, Denmark and Portugal, would like to see all of the BREFs revised due to the lack of different energy efficiency issues. The specific BREFs proposed for revision are cement and lime (Austria and Portugal), pulp and paper (Austria) and glass (Portugal). (Annex I, Tables 46 and 48)

A new horizontal BREF on energy efficiency techniques would be useful according to the replies from eight countries. It should clarify the different aspects of energy efficiency and give some examples on national guidance (Finland). Many of the countries also criticise a possible horizontal BREF because most of the problems are too much sector related or technology specific to be treated properly at a horizontal level (Austria, France, Germany and Sweden). Such a document could give good guidance on principles and definitions for the authorities (Germany), but the experience from horizontal BREFs so far is not very encouraging in terms of usefulness (Sweden). The United Kingdom has already produced this sort of national guidance. (Annex I, Table 49)

Other international BAT-related documents – recommendations of the Paris Commission (PARCOM) and Helsinki Commission (HELCOM) and Nordic BAT documents – are in use in only three countries participating in this project: Finland, France and Lithuania use at least one of these documents when evaluating BAT for energy efficiency. Finland suggests in its reply that the Nordic BAT documents and communication between the countries could be used more than at present. There are national sector-wise evaluation of BAT including energy efficiency in the Netherlands and Germany. In the Netherlands there are technical information sheets concerning energy measures for those branches or installations, which are not participating in the benchmarking or long term (MJA) agreements. Germany has binding guidelines only for specific industries, for example steel mills. Italy is at present working on developing sector-wise guidelines and Portugal will soon start working on evaluating the adequacy of the BATs to industry. Finland has already published an expert report on BATs in large combustion plants. (Annex I, Tables 50 and 51)

5 BEST AVAILABLE TECHNIQUE REFERENCE DOCUMENTS AND ENERGY EFFICIENCY

The goal of this chapter is to present the most important information and aspects concerning energy efficiency found within the Best Available Techniques Reference Documents (BREF). There are 32 industrial sectors for which these BREFs have to be established until 2004/2005. Until now (November 2002), only eight BREFs have been adopted. Consequently, all the information and data within this summary are based on only these eight documents. Nevertheless, a general tendency can be recognised because of the diversity of the analysed industrial sectors. These BREFs include the following industries:

- cement and lime industry, March 2000 (mentioned in this chapter as BREF 1)
- iron and steel production, March 2000 (BREF 2)
- non-ferrous metals industry, May 2000 (BREF 3)
- pulp and paper industry, July 2000 (BREF 4)
- chlor-alkali manufacturing industries, October 2000 (BREF 5)
- ferrous metals processing industry, October 2000 (BREF 6)
- glass manufacturing industries, October 2000 (BREF 7)
- cooling systems, November 2000 (BREF 8).

First there is a description of some general aspects concerning energy (5.1–5.4). A detailed summary for each industrial sector can be found in Sections 5.5–5.12. The table in Section 5.14 shows the most important aspects concerning energy efficiency. Within the summaries there is a basic structure that is applied also in the table. The main focus has been put on the energy related aspects found in the BREFs for each industrial process in the different sectors. Other criteria include the importance of energy, the most important techniques or processes concerning energy, and energy saving and energy recovery techniques, the availability of data, individual aspects, and future recommendations.

It should be noted that all the information and descriptions from the BREFs and obviously also from this report are incomplete and, therefore, are given for information purposes only. The information has no legal value and does not in any way alter or prejudice the actual provisions of the IPPC directive.

5.1 General findings

For energy consumption, energy recovery and energy savings the amount of information found in the BREFs is considerable. There are some fluctuations between the different documents, but this depends mainly on the importance of energy use within the individual industrial sectors. In almost every BREF, energy use and emissions to air belong to the main environmental issues. In some cases the main focus is on air pollution abatement and little information on energy is available.

Sector-specific BREFs give technical information and data on emissions and consumption levels to be used when assessing energy efficiency. In some sector-specific BREFs the energy data is very detailed and well structured. There is even guidance and a description on how to calculate the relative conservation of energy (BREF 8, Annex II, 161–177). On the other hand, there are BREFs where it is rather complex to collect and organise the information, so that it is difficult for the reader to keep track of it.

Application of energy efficient methods is not always unambiguous. In some processes the techniques applied require certain arrangements or in some cases the demands set for the raw materials also give some restrictions. Possibilities for application of energy efficient methods depends greatly on the possibilities given by the individual industrial sectors and the processes applied.

Use of emissions abatement techniques increases energy consumption. A balance between the level of emission reduction and energy savings has to be considered case by case. This is important e. g. for the ferrous and non-ferrous metals industries, where many emission abatement techniques are highly energy intensive.

5.2 Importance of energy

Almost every industrial sector is considered to be a high consumer of energy. In extreme cases energy is a major input, accounting for 50 % of total production costs. However, the level of description of energy efficiency varies between each sector. This does not mean that all industries which consume a lot of energy, are necessarily energy inefficient. For example, the pulp and paper industry is a large consumer of energy, but it has made a lot of progress during the last few years in implementing new economical technologies and energy saving techniques. In some cases, where a combined heat and power plant (CHP) has been installed, it may even produce more electrical energy than actually needed. Another good example is the integrated pulp and paper mills where a great part of the energy is recovered from the liquid residue (black liquor).

It should be noted that almost every industrial sector is really interested in reducing its energy consumption. Energy causes high production costs, so it is a very important financial aspect which has to be considered by the companies.

5.3 Energy consumption

Energy consumption is described extensively and consumption data are given for almost every industrial sector. In a few sectors, data are available even for several single processes. There is much more information about consumption levels than about recovery or savings quantities. Some industries use both heat energy and electrical power. Others are either using electrical energy or heat energy. Heat is usually generated in burners, boilers, kilns or furnaces using different kinds of fuels. The related processes are burning, melting and heating. They are used mainly in the glass, ferrous metals, iron and steel industries. The unit is given in MJ/t of product or GJ/t of product.

Electrical energy is needed in the chlor-alkali sector, as well as in several other processes in different industrial sectors. The unit is kWh/t of product or ACkWh/t of product.

5.4 Energy savings and recovery techniques

The information regarding energy saving or energy recovery techniques varies from limited to excellent. This subject is handled in many different ways, probably related to the importance of the individual sector. In some documents energy saving methods are hardly mentioned.

For the pulp and paper sector, as well as for the ferrous metals processing sector, the availability of information concerning energy savings is largely considered excellent (BREF 4, 271–292; BREF 6,

111ff). The energy data are well structured and many aspects, such as the applicability of the measure or technique, the highest level of environmental performance achieved and the economic benefits, are described accurately.

Generally, the level of description of savings and recovery techniques and especially the associated energy values are insufficient and incomplete. This problem is also seen when analysing the recommendations for the future in each BREF.

5.5 Cement and lime industry

Importance of energy efficiency

The cement and lime industry is an energy intensive industry with energy typically accounting for 30–50 % of production costs (that is excluding capital costs). The key environmental issues associated with cement and lime production are air pollution and the use of energy.

Most important processes/technologies related to energy efficiency

The clinker-burning process (for cement), or the lime-burning process, is the main source of emissions and is also the principal user of energy. The primary use of energy in cement manufacturing is as fuel for the kiln. The major users of electricity are the mills and the exhaust fans, which together account for more than 80 % of electrical energy use. On average, energy costs – in the form of fuel and electricity – represent 50 % of total production cost involved in producing a tonne of cement. Electrical energy represents approximately 20 % of this overall energy requirement.

The theoretical energy use for the burning process (chemical reactions) is about 1 700 to 1 800 MJ/t clinker. The actual fuel energy use for different kiln systems is about 3 000 to 6 000 MJ/t clinker.

The electricity demand is about 90–130 kWh/t cement (BREF 1, 23). The heat and electrical power use for calcining of limestone by lime kiln depends on the given kiln type, on the quality of the stone used and on the degree of conversion of calcium carbonate to calcium oxide.

The heat of dissociation of calcium limestone is 3 200 MJ/t. The net heat use per tonne of quicklime varies considerably with kiln design. Rotary kilns generally require more heat than shaft kilns. The heat use tends to increase as the degree of burning increases.

The use of electricity varies from a low range of 5–15 kWh/t of lime for mixed-feed shaft kilns, to 20–40 kWh/t for the more advanced designs of shaft kiln and for rotary kilns (BREF 1, 80).

Energy recovery or energy saving techniques for the main processes

There are some energy saving and energy recovery techniques for the main processes in the cement and lime industry, principally for the clinker- and lime-burning processes. These techniques also have to be considered in the determination of BAT, so they will be described later in this chapter.

Energy data and energy saving techniques for other processes

There are two more processes in the lime industry which have to be mentioned because they are not irrelevant to energy consumption: lime hydrating and lime grinding. For lime hydrating, the energy

requirements to operate the hydrators, air classifiers and conveying equipment amount to approximately 5–30 kWh/t of quicklime.

The energy use for lime grinding varies from 4–10 kWh/t of quicklime for the coarser grades to 10–40 kWh/t of quicklime for the finer grades. The amount of energy required also depends on the equipment used (BREF 1, 81).

Best available techniques (BAT)

Principally there are two different types of techniques, those which have to be considered in the determination of BAT (techniques not yet considered BAT) and others which are already considered as BAT. For the cement and lime industry these techniques are almost the same. Further, it is possible to divide the BATs into general techniques (primary measures) and more process specific ones.

General BAT (cement industry)

The following measures can be considered as general techniques (primary measures) (BREF 1, 48):

A smooth and stable kiln process:
- Process control optimisation, including computer-based automatic control systems
- The use of modern, gravimetric solid fuel feed systems

Minimising fuel energy use by means of:
- Preheating and precalcination to the extent possible, considering the existing kiln system configuration
- The use of modern clinker coolers enabling maximum heat recovery
- Heat recovery from waste gas

Minimising electrical energy use by means of:
- Power management systems
- Grinding equipment (high-pressure grinding rolls for clinker comminution) and other electricity based equipment with high energy efficiency

Process specific BAT (cement industry)

For new plants and major upgrades the best available technique for the production of cement clinker is considered to be a dry process kiln with multi-stage preheating and precalcination. The associated BAT heat balance value is 3 000MJ/t clinker.

General BAT (lime industry)

The following measures can be considered as general techniques (primary measures) (BREF 1, 94):

A smooth and stable kiln process:
- Process control optimisation.

Minimising fuel energy use by means of:
- Heat recovery from exhaust gases to preheat the water for hydration of lime.

Minimising electrical energy use by means of:

- Utilisation of mills and other electricity based equipment with high energy efficiency (high pressure roll mills).

Process specific BAT (lime industry)

Replace or modify old kilns to reduce fuel energy use. Such modification range from minor modification (installation of heat exchangers) to major changes in the configuration of the kiln.

Specific aspects for energy saving and energy recovery measures

There were no specific aspects concerning savings or recovery measures mentioned.

Recommendation for the future

It could be useful to do a survey of the current abatement techniques, emissions and consumption and monitoring in the lime industry.

5.6 Iron and steel industry

Importance of energy efficiency

The iron and steel industry is a highly material- and energy-intensive industry. Additionally, emissions to the air and solid waste and by-products belong to the main environmental issues.

Most important processes/technologies related to energy efficiency

In this BREF the principal ways of steel making are presented, namely in integrated steelworks and in electric arc furnaces. Because of the complexity of integrated steelworks, the main production steps (sinter plants, pelletisation plants, coke-oven plants, blast furnaces and basic oxygen steel making, incl. casting) are described separately. Therefore, all these production steps have to be considered important as regards energy efficiency.

However, the most energy consuming process unit in iron and steel production is the blast furnace. For a blast furnace using coal injection and top gas pressure recovery for electricity generation the total energy input amounts to 18.67 GJ/t pig iron (subdivided in coke = 12.4, powdered coal = 1.63, hot blast 4.52 and electricity 0.12) (BREF 2, 191).

The range of energy use within the sinter plants is about 1 125–1 920 MJ/t sinter (thermal energy) with an average consumption of 1 480 MJ/t sinter. Coke is the dominant sinter plant energy input (about 85 %), with electricity and gas supplying the remainder in equal amounts (BREF 2, 44).

In pelletisation plants, energy consumption differs depending on the type of plant. If the pelletisation plant is part of an integrated steelwork, the following energy consumptions are possible: coke oven gas (COG) 398.7 MJ/t, natural gas 209 MJ/t, coke 283 MJ/t. With stand-alone pelletisation plants, energy consumption is less: coal 213–269 MJ/t, oil 38–171 MJ/t (BREF 2, 95). Electricity varies from 51 MJ/t to 128 MJ/t independent of the type of plant.

In coke-oven plants energy consumption can be 3 200–3 900 MJ/t (blast furnace gas + COG) and 20–170 MJ/t (electricity). An energy balance for a coke-oven plant (without COG treatment) shows that with an input of 43 GJ/t coke the energy loss will amount to 3.33 GJ/t (< 10 %) (BREF 2, 122, 127–128).

In the basic oxygen furnace (BOF), fuel is consumed to preheat and dry the converters after relining and repair. This thermal energy consumption is approximately 0.051 GJ/t liquid steel (LS). Electricity consumption is estimated at 23 kWh/t LS or 0.08GJ/t LS (BREF 2, 242).

Electric steel making is usually performed in an electric arc furnace (EAF). This furnace plays an important and increasing role in modern steel works in the European Union (35.3 % of the overall steel production). The total energy consumption amounts to 2 300–2 700 MJ/t (BREF 2, 281).

Energy recovery or energy saving techniques for the main processes

For blast furnaces the following process-integrated measures belong to energy recovery or energy saving techniques (BREF 2, 194–198):

- Direct injection of reducing agents
  Energy savings can amount to 0.68 GJ/t pig iron or 3.6 % of the gross energy consumption of the blast furnace.
- Energy recovery from blast furnace gas
  Approximately 5 GJ/T pig iron or 30 % of the gross energy consumption of the blast furnace.
- Energy recovery from top gas pressures
  Energy savings are estimated at up to 0.4 GJ/t pig iron for a 15 MW turbine, which correspond to 2 % of the gross energy consumption of the blast furnace.
- Energy savings at the hot stove
  About 0.5 GJ/t pig iron energy savings possible.

Within the sinter plants the following technique can be considered as an energy recovery technique:

- Heat recovery from sintering and sinter cooling (BREF 2, 53–54)
  The recovered heat amounts to 30 % of the input heat. Two kinds of potentially reusable waste energy are discharged from the sinter plants: the sensible heat from the main exhaust gas from the sintering machines, and the sensible heat of the cooling air from the sinter cooler. The amount of waste heat recovered can be influenced by the design of the sinter plant and the heat-recovery system:
  - Sinter cooler waste heat recovery with conventional as well as Eos-sintering
  - (energy recovery = 18 % of the total energy input for the waste heat boiler)
  - Sinter cooler and waste gas heat recovery with sectional waste gas recirculation
  - (energy recovery = 23.1 % of the total energy input)
  - Strand cooling and waste heat recovery with partial waste gas recirculation

The following technique can be considered as an energy recovery technique in pelletisation plants (BREF 2, 99):

- Recovery of sensible heat from induration strand
  Approximately 67.5 MJ/t pellet or 4 % of gross energy consumption.

There are no energy saving techniques mentioned for coke-oven plants.

For the basic oxygen steel-making process the following techniques have to be considered as regards energy recovery and savings (BREF 2, 244-246):

- Energy recovery from the BOF gas
  When the energy from the BOF gas is recovered (waste heat recovery and/or BOF gas recovery), the basic oxygen furnace becomes a net producer of energy. In a modern plant, energy recovery can be as high as 0.7 GJ/t LS.

In the electric steel-making industry, several energy recovery and energy saving techniques are available (BREF 2, 295–301). The most important are:

- EAF process optimisation
- Scrap preheating.

Energy data and energy saving techniques for other processes

Because of the complexity of integrated steelworks and the structure of the iron and steel BREF, all relevant processes are discussed together with the most important one (blast furnaces) in the sections above.

Best available techniques (BAT)

Principally there are two different types of techniques, those which have to be considered in the determination of BAT (techniques not yet considered BAT) and others which are already considered as BAT. In the iron and steel production industry these techniques are almost the same. All the techniques described above can be considered in the determination of BAT. In this section a short summary of the BATs concerning energy are presented.

Process specific BAT for blast furnaces

- Blast furnace gas recovery
- Direct injection of reducing agents
- Energy recovery of top blast furnaces gas pressure where prerequisites are present
- Hot stoves (where design permits).

Process specific BAT for sinter plants

- Recovery of sensible heat.

Process specific BAT for pelletisation plants

- Recovery of sensible heat.

Process specific BAT for basic oxygen steel making and casting

- BOF gas recovery and primary de-dusting.

Process specific BAT for electric steel making and casting

- Scrap preheating in order to recover sensible heat from primary off gas.

Specific aspects for energy saving and recovery measures

The information concerning energy recovery or energy saving techniques is well presented and well structured.

5.7 Non-ferrous metals industry

Importance of energy efficiency

Energy consumption and the recovery of heat and energy are important factors in the production of non-ferrous metals. They depend on the efficient use of the energy content of sulphidic ores, the energy demand of the process stages, the type and supply method of energy used and the use of effective methods of heat recovery. There is a steady improvement in the environmental performance and energy efficiency of the industry over the last 25 years. The recycling performance of the industry is unmatched by any other industry.

Most important processes/technologies related to energy efficiency

The most important processes and techniques within the non-ferrous metals industries related to energy efficiency are pyrometallurgical processes. They are highly heat intensive and the process gases contain a lot of energy.

Energy recovery or energy saving techniques for the main processes

There are a lot of energy saving techniques described for the pyrometallurgical processes. A few examples are listed below:

- The steam produced can be used to produce electricity and/or for heating requirements.
- Use of the excess heat to melt secondary materials without the use of additional fuel.
- Use of oxygen enriched air or oxygen in the burners to reduce energy consumption by allowing autogenic smelting or the complete combustion of carbonaceous material.
- Separate drying of concentrates at low temperatures reduces the energy requirements.
- Heat recovery by using hot gases from melting stages to pre-heat the furnace charge. The recovered heat is approximately 4–6 % of the furnace fuel consumption.
- Collecting and burning carbon monoxide (produced in electric or blast furnaces) as a fuel for several different processes or to produce steam or other energy.
- Re-circulation of contaminated waste gas back through an oxy-fuel burner has resulted in significant energy savings.
- Use the heat content of process gases or steam to raise the temperature of leaching liquors.

Energy data and energy saving techniques for other processes

There is a lot of information concerning energy consumption for the production of different non-ferrous metals. Basically these metals are divided into ten groups and described separately. The following information is intended as an overview.

Copper:	The energy use of the electrolytic process is most significant. The production energy (net) requirement for a number of processes using copper concentrate is in the range 14–20 GJ/t copper cathode. The energy consumed by the electro-refining stage of copper production is reported to be 300–400 kWh/t of copper (BREF 3, 214).
Aluminium:	The main cost of producing primary aluminium is electricity (about 30 % of production costs). A typical range for energy consumption is 8–13.5 GJ/t aluminium (BREF 3, 283–284).
Lead and zinc:	The energy consumption for the different lead and zinc processes varies to a large extent. Electricity is used for most of the processes (BREF 3, 359).
Ferro-alloys:	The ferro-alloys industry is a major consumer of energy. The laws of thermodynamics limit the reduction of energy necessary for the smelting process. The reduction of the overall energy consumption is therefore in most cases only possible by using an efficient energy recovery system (BREF 3, 528–532).

Nickel: The energy used for the production of matte from sulphidic ores is reported to be in the range 25–65 GJ/t of nickel for ores containing 4–15 % Ni. The energy used in the various refining stages is reported to be 17–20 GJ/t of Ni (BREF 3, 631).

Ferro-alloy production is a high energy consuming process, because high temperatures are needed for the reduction of metal oxides and for smelting. In the non-ferrous metal BREF several different measures for energy recovery and the use of the recovered energy are listed (BREF 3, 546–548).

Best available techniques (BAT)

Principally there are two different types of techniques, those which have to be considered in the determination of BAT (techniques not yet considered BAT) and others which are already considered as BAT. For the non-ferrous metals industry the BAT conclusion for energy recovery are:

- Production of steam and electricity from the heat generated in waste heat boilers.
- The use of the heat of reaction to smelt or roast concentrates or melt scrap metals in a converter.
- The use of hot process gases to dry feed materials.
- Pre-heating of a furnace charge using the energy content of furnace gases or hot gases from another source.
- The use of recuperative burners or the pre-heating of combustion air.
- The use of the CO produced as a fuel gas.
- The heating of leach liquors from hot process gases or liquors.
- The use of plastic contents in some raw materials as a fuel, provided that good quality plastic cannot be recovered and VOCs and dioxins are not emitted.
- The use of low-mass refractories where practicable.

Specific aspects for energy saving and energy recovery measures

Most of the energy recovery or energy saving methods are site specific; therefore, not every technique can be implemented. Especially the techniques to recover heat vary from site to site. A number of factors are involved here, such as the potential uses for heat and energy on or near the site, the scale of operation, and the potential for gases or their constituents to foul or coat heat exchangers.

Recommendation for the future

Additional efforts should be made to establish a basis of information including specific emission and consumption data. Energy usage should also be reported on this basis.

5.8 Pulp and paper industry

Importance of energy efficiency

The manufacturing of pulp and paper requires a large amount of process water and energy in the form of steam and electric power. Consequently, the main environmental issues associated with pulp and paper production are discharges to water, emissions to air and energy consumption.

Most important processes/technologies related to energy efficiency

There are several different pulping and papermaking processes. Depending on the type of plant, a paper mill can be integrated with the pulping operations on the same site or can produce paper in stand-alone plants using purchased pulp. This BREF is divided into five main chapters describing the different processes, whereas energy aspects are discussed for each process separately. Evaporation and the maintenance of paper machines are the most important and most energy consuming processes.

The kraft (sulphate) pulping process
Within this pulping process the major part of the heat energy is consumed for heating different fluids and for evaporating water. Electrical energy is mostly consumed for the transportation of materials (pumping) and for the operation of the paper machine. The manufacturing of bleached kraft pulp consumes about 10–14 GJ/Adt of heat energy (steam for the production of electrical power not included). The consumption of electrical energy is 600–800 kWh/Adt, including the drying of pulp. The energy consumption for pulp drying is about 25 % of the heat energy and 15–20 % of the electrical energy. Over 50 % of the electrical energy consumption is used for pumping (BREF 4, 52–56).

The sulphite pulping process
A chapter for energy demand is reserved, but no data are available (BREF 4, 132).

The mechanical and chemi-mechanical pulping process
Energy consumption depends on the particular pulping process. For groundwood, for instance, the required energy varies between 1 100–2 300 kWh/t of pulp, while for refiner mechanical pulps the energy requirement amounts to 1 600–3 000 kWh/t of pulp. Finally, the thermo-mechanical pulps consume about 1 000–4 300 kWh/t of pulp (BREF 4, 182–185).

Recovered paper processing
Paper and board mills require substantial amounts of steam for heating water and large quantities of electricity for driving the machinery, and for pumping, vacuum, ventilation and waste water treatment. In paper mills, energy is usually the main factor in the operating costs. For example, in the Netherlands for recovered paper processing an average specific electricity consumption of 322 kWh/t (neglecting the difference in specific electricity consumption between RCF processing with and without de-inking) have been reported (BREF 4, 241–245).

Papermaking and related processes
The paper industry could be generally described as energy intensive. Energy is the third highest cost in the papermaking process, accounting for approximately 8 % of turnover. The total demand for energy (consumption) in the form of heat (steam) and electric power for a non-integrated fine paper mill has been reported as:

- Process heat: 8 GJ/t (about 2 222 kWh/t)
- Electric power: 674 kWh/t

More detailed information about the energy consumption of each single production step can be found in the BREF 4, pp. 336–342.

Energy recovery or energy saving techniques for the main processes

The energy recovery and energy saving techniques for the main processes are discussed below and can be considered as BAT.

Energy data and energy saving techniques for other processes

Most of the techniques to save energy are described below and can be considered as BAT. There is some information on the following processes:

Sulphite pulping
During the recovery process of chemicals, substantial amounts of energy can be produced (in recovery boilers) for steam and for power generation of the pulp mill.

Mechanical and chemi-mechanical pulping
Depending on the particular pulping process, it is possible to recover 20–30 % of energy either as steam or as hot water. For thermo-mechanical pulps the recoverable energy as steam can even reach 40–45 %. (BREF 4, 183).

Best available techniques (BAT)

Principally there are two different types of techniques, those which have to be considered in the determination of BAT (techniques not yet considered BAT) and others which are already considered as BAT, resulting from the BAT conclusions. Further, the BATs are subdivided into general BAT concerning general aspects and measures and into process specific BAT regarding specific information.

General BAT

The following measures can be considered as general techniques (primary measures) for all processes (BREF 4, 100):

- Training, education and motivation of staff and operators
- Process control optimisation
- Sufficient maintenance of the technical units
- Environmental management system which optimises management, increases awareness and includes goals and measures, process and job instructions, among other things.

Process specific BAT for the kraft pulp and sulphite pulp mills

Measures for high heat recovery and low heat consumption (BREF 4, 110–111):

- High dry solids content of black liquor and bark
- High efficiency of steam boiler, e.g. low flue gas temperature
- Effective secondary heating system, e.g. hot water about 85ºC
- Well closed-up water system
- Relatively well closed-up bleaching plant
- High pulp concentration (MC technique)
- Pre-drying of lime
- Use of secondary heat to heat buildings
- Good process control.

Measures for low consumption of electric power:

- As high pulp consistency as possible in screening and cleaning
- Speed control of various large motors
- Efficient vacuum pumps
- Proper sizing of pipes, pumps and fans.

Measures for a high generation of electric power:

- High boiler pressure
- Outlet steam pressure in the back-pressure turbine as low technical as is feasible
- Condensing turbine for power production from excess steam
- High turbine efficiency
- Preheating of air and fuel charged to boilers.

Process specific BAT for the mechanical and chemi-mechanical pulp and paper mills

- Implementation of a system for monitoring energy use and performance
- Upgrading of equipment
- Minimisation of reject losses by using efficient reject handling stages and reject refining
- Use of effective heat recovery systems
- Application of co-generation of heat and power where the power to steam ratio allows it.

Process specific BAT for recovered paper processing paper mills

- Implementation of a system for monitoring energy use and performance
- Upgrading of equipment.
- Application for anaerobic wastewater treatment.

Process specific BAT for paper mills

- Implementation of a system for monitoring energy use and performance
- More effective dewatering of the paper web in the press section of the paper machine by using wide nip pressing technologies
- Use of energy efficient technologies, such as high consistency slushing, best practice refining, twin wire forming, optimised vacuum systems, speed adjustable drives for fans and pumps, high efficiency electric motors, well sizing of electric motors, steam condensate recovery, increasing size press solids or exhaust air heat recovery systems
- Reduction of direct use of steam by careful process integration by using pinch analysis.

BAT associated values

Energy efficient kraft pulp and paper mills consume heat and power as follows (BREF 4, 110–111):

- Non-integrated bleached kraft pulp mills: 10–14 GJ/Adt process heat and 0.6–0.8 MWh/Adt of power;
- Integrated bleached kraft pulp and paper mills: 14–20 GJ/Adt process heat and 1.2–1.5 MWh/Adt of power;
- Integrated unbleached kraft pulp and paper mills: 14–17.5 GJ/Adt process heat and 1–1.3 MWh/Adt power.

Energy consumption associated with BAT for sulphite pulp and paper mills consume heat and power as follows:

- Non-integrated bleached sulphite pulp mills: 16–18 GJ/Adt process heat and 0.7–0.8 MWh/Adt of power;
- Integrated bleached sulphite pulp and coated fine paper mills: 17–23 GJ/Adt process heat and 1.5–1.75 MWh/Adt of power;
- Integrated bleached sulphite pulp and uncoated paper mills: 18–24 GJ/Adt process heat and 1.2–1.5 MWh/Adt power.

Energy efficient mechanical pulp and paper mills consume heat and power as follows (BREF 4, 214–215):

- Non-integrated CTMP: 2–3 MWh/Adt of power;
- Integrated newsprint mills: 0–3 GJ/Adt process heat and 2–3 MWh/Adt of electricity;
- Integrated LWC paper mills: 3–12 GJ/Adt process heat and 1.7–2.6 MWh/Adt power;
- Integrated SC paper mills: 1–6 GJ/Adt process heat and 1.9–2.6 MWh/Adt.

Energy efficient recovered paper mills consume heat and power as follows (BREF 4, 302–303):

- Integrated non-deinked RCF paper mills: 6–6.5 GJ/Adt process heat and MWh/Adt of power;
- Integrated tissue mills with DIP plants: 7–12 GJ/Adt process heat and 1.2–1.4 MWh/Adt of power;
- Integrated newsprint or printing and writing paper mills with DIP plants: 4–6.5 GJ/Adt process heat and 1–1.5 MWh/Adt power.

Energy efficient non-integrated paper mills consume heat and power as follows (BREF 4, 411–412):

- Non-integrated uncoated fine paper mills: 7–7.5 GJ/Adt process heat and 0.6–0.7 MWh/Adt of power;
- Non-integrated coated fine paper mills: 7–8 GJ/Adt process heat and 0.7–0.9 MWh/Adt of power;
- Non-integrated tissue mills based on virgin fibre: 5.5–7.5 GJ/Adt process heat and 0.6–1.1 MWh/Adt power.

Specific aspects for energy saving and energy recovery measures

Some energy recovery and energy saving techniques are site specific. This means that it depends on the location of the mill whether certain techniques can be applied or not.

Recommendation for the future

Little information is available on the assessment of energy efficient technologies and practical experiences of the results of implementation in the pulp and paper industry. When energy data and balances are reported the assumptions and conditions are often not sufficiently qualified. More work on this important issue and the derivation of production specific energy consumption figures are needed before the next review.

5.9 Chlor-alkali manufacturing industry

Importance of energy efficiency

The chlor-alkali process needs huge amounts of electricity. It is one of the largest consumers of electrical energy.

Most important processes/technologies related to energy efficiency

In the European Union the chlor-alkali process was mainly used in mercury (amalgam) cell technology. Past mercury contamination of land and waterways from mercury plants is a major environmental problem at some sites. For many years, the mercury cell has been a significant source of

environmental pollution, because some mercury is lost from the process to air and water, and shows up in products and waste.

Amalgam technology needs 3 560 ACkWh/t Cl_2 (alternative current kilowatt hours/tonne of chlorine) assuming 50 % of caustic soda and before liquefaction of chlorine. The operation of a chlor-alkali plant is dependent on the availability of huge quantities of direct-current (DC) electric power, which is usually obtained from a high voltage source of alternating current (AC) (BREF 5, 36–37).

Energy recovery or energy saving techniques for the main processes/technologies

There is little information about energy recovery or energy saving techniques within mercury cell technology. More information is given in the section on BAT.

Energy data and energy saving techniques for other processes

In the chlor-alkali industry there are two other technologies that are lower in importance in the sense of frequency compared to mercury cell technology, but that are more interesting as concerns energy savings: asbestos diaphragm cell and membrane cell technology.

The total adjusted energy consumption of diaphragm technology is almost the same as that of mercury: 3 580 ACkWh/t Cl_2. For membrane cell technology, the energy consumption amounts to 2 970 ACkWh/t Cl_2 (BREF 5, 36–37).

Best available techniques (BAT)

Principally there are two different types of techniques, those which have to be considered in the determination of BAT (techniques not yet considered BAT) and others which are already considered as BAT. A best available technique for the production of chlor-alkali is membrane technology. Non-asbestos diaphragm technology is also a BAT. The total energy use associated with BAT for producing chlorine gas and 50 % caustic soda is less than 3 000 ACkWh/t of chlorine when chlorine liquefaction is excluded, and less than 3 200 ACkWh/t of chlorine when liquefaction is included.

For mercury cell plants the best available technique is conversion to membrane cell technology. For diaphragm cell plants the best available technique is conversion to membrane cell technology or use of non-asbestos diaphragms.

Specific aspects for energy saving and energy recovery measures

There are hardly any energy recovery or energy saving techniques described, because there are not many ways to save energy in mercury cell and diaphragm cell technology. The BAT is the conversion to membrane cell plants.

The chlor-alkali production technology is site specific, because of the difficulties in storage and transport of chlorine. Therefore, production usually takes place near the consumers. More than 85 % of the chlorine produced in the European Union is used on the same or on adjacent sites for other chemical processes.

The chlor-alkali BREF also contains information about national and international legislation within the European Union. The emphasis is on air emissions and discharges to water, while energy saving aspects are mentioned incidentally (BREF 5, Annex D, 136–137).

5.10 Ferrous metals

Importance of energy efficiency

The ferrous metal BREF is divided into three main parts (hot and cold forming, continuous hot dip coating lines, batch galvanising) which describe the different specific processes, and in one part techniques which might be applied to several subsectors are described. Energy consumption is a main environmental issue in the first two parts of the BREF together with air emissions (especially NO_x, SO_2) and dust emissions. In the third part energy use does not play an important role, which is probably why there is almost no information. The fourth part contains detailed technical descriptions and information on techniques which might be applied to several subsectors. Most of this information is concerned with the reduction of emissions, while energy aspects are inadequately discussed.

Most important processes/technologies related to energy efficiency

Part A: hot and cold forming
There are several techniques and processes within hot and cold forming technology, but the most important concerning energy efficiency is the heating (reheating) and heat treatment process in furnaces. The energy consumption of the furnaces depends on several parameters such as the furnace design, throughput and shift patterns, the designed length of the recuperation zone in the furnace, the burner design, among others. The energy consumption for these furnaces was between 0.7 GJ/t to 6.5 GJ/t; with a typical range being 1–3 GJ/t (BREF 6, 63–65).

Part B: continuous hot dip coating lines
As in Part A, the most important process is reheating and heat treatment in furnaces.

Part C: batch galvanising
No special process is mentioned

Energy recovery or energy saving techniques for the main processes

Almost every energy saving technique regarding re-heating and heat treatment furnaces is considered as BAT (see section “Process specific BAT”).

Energy data and energy saving techniques for other processes

More processes and techniques concerning energy consumption in part A are:

- hot rolling 72–140 kWh/t (deformation energy)
- pickling of alloy 0.015–0.3 GJ/t (electrical energy)
- cold rolling 0.2–0.3 GJ/t (electrical energy)
- annealing of alloy 0.06–0.12 GJ/t (electrical energy)
- tempering 0.02–0.15 GJ/t (electrical energy)
- finishing (cutting, inspection, packing) 0.02–0.04 GJ/t (electrical energy)
- and many more where energy data are not available.

There is limited information on energy saving techniques (BREF 6, 81–87).

In part B several other processes are mentioned; however there is only limited information on energy (consumption) (BREF 6, 276, 281–282):

- consumption for total coating line — 800–1 300 MJ/t (natural gas); 44–140 MJ/t (electrical); 20–44 MJ/t (hot water)
- aluminising of sheet — 67 kWh/t (electricity); 273 kWh/t (gas)
- lead-tin coating of sheet — 2.43 kWh/t (electricity); 1 490 MJ/t (gas)

Energy consumption data for part C (BREF 6, 345–346, 350):

- degreasing — 0–44.6 kWh/t
- pickling — 0–25 kWh/t
- hot dipping — 180–1 000 kWh/t
- and many more where energy data are not available

Additionally, for the hot dipping process there is a short description of possible savings (BREF 6, 377–378, 384).

- Enclosed galvanising pot → energy savings due to reduced surface heat loss from the galvanising bath.
- Heat recovery from galvanising kettle heating → reduced fuel consumption. Energy reductions in the range of 15–45 kWh/t black steel.

Best available techniques (BAT)

Principally there are two different types of techniques, those which have to be considered in the determination of BAT (techniques not yet considered BAT) and others which are already considered as BAT. For the ferrous metals processing industry these techniques are almost the same. Further, it is possible to divide the BAT into general techniques (primary measures) and more process specific ones.

General BAT

The following measures can be considered as general techniques (primary measures) for the hot and cold forming part:

- general measures, e.g. regarding furnace design or operation and maintenance.

Process specific BAT

For part A, hot and cold forming: re-heating and heat treatment furnaces

- Recovery of heat in the waste gas by feedstock pre-heating
- Recovery of heat in the waste gas by regenerative or recuperative burner systems
- Recovery of heat in the waste gas by waste heat boiler or evaporative skid cooling (where there is a need for steam) → energy savings 25–50 %
- Limiting the air pre-heating temperature.

Descaling

- Material tracking to reduce water and energy consumption.

For the others there are no BATs regarding energy aspects. Most of the energy related saving techniques are mentioned above.

Specific aspects for energy saving and energy recovery measures

For some techniques (also BATs) energy savings have to be traded off against NO_x emissions. Reductions in SO_2, CO_2 and CO have to be weighted against the disadvantage of potentially increased emissions of NO_x.

Recommendation for the future

For the revision of this BREF, information on emissions, consumption levels and economics should be provided. Especially for quite a number of the techniques to be considered in the determination of BAT, there is a lack of information on these aspects at the moment. Of particular interest are figures on NO_x emissions both for furnaces that use air preheating and those that do not. Such data would make it possible to do both a more thorough evaluation of the efficiency of reduction measures and a comparison of the advantages and disadvantages of energy savings versus NO_x emissions.

5.11 Glass manufacturing industry

Importance of energy efficiency

Glassmaking is a very energy intensive activity and the choice of energy source, heating technique and heat recovery methods are central to the design of the furnace. The key environmental issues are emissions to the air and energy consumption.

Most important processes/technologies related to energy efficiency

The melting operation is the central process in the glass manufacturing industry. Its environmental performance and energy efficiency is also affected by the choice of energy source, heating technique and heat-recovery methods. The three main energy sources for glassmaking are natural gas, fuel oil and electricity.

In general, the energy necessary for melting glass accounts for over 75 % of the total energy requirement of glass manufacturing. The theoretical energy requirements for the three most common glasses (soda-lime, borosilicate and crystal glass) for the melting process vary from 2.25 GJ/t to 2.68 GJ/t. The actual energy requirements in the various sectors vary widely from about 3.5 GJ/t to over 40 GJ/t. The amount of energy needed depends very heavily on the furnace design, scale and method of operation. However, most glass is produced in large furnaces and the energy requirement for melting is generally below 8 GJ/t (BREF 6, 72–75). For 1997 the energy consumption of the glass industry was approximately 265 GJ/t.

Energy recovery or energy saving techniques for the main processes

The main melting techniques are listed below:

- regenerative furnaces
- recuperative furnaces
- oxy-fuel firing
- electric furnaces
- combined fossil fuel and electric melting
- discontinuous batch melters.

For the regenerative furnaces a heat recovery system is used, while for the oxy-fuel firing melting technique, energy savings are possible because it is not necessary to heat the atmospheric nitrogen to the temperature of the flames.

Energy data and energy saving techniques for other processes

Generally, the glass industry can be subdivided into eight sectors based on the products manufactured. These products consist of container glass, flat glass, continuous filament glass fibre, domestic glass, special glass, mineral wool, ceramic fibre and frits. For each of these subsectors the melting process is dominant. However, there are a few other processes that should be mentioned.

- the forming process (2–5 %)
- annealing (about 3 %)
- forehearths (about 6 %)
- conversion (about 11 %)
- factory heating
- general services

The values show the range of the total energy consumption.

Best available techniques (BAT)

For the glass manufacturing industry, only techniques used in the determination of BAT are mentioned. These techniques for reducing energy use are:

- Melting technique and furnace design (about 15 %)
- Combustion control and fuel choice n.a.
- Cullet usage (2.5–3 %)
- Waste heat boilers n.a.
- Cullet/batch preheating (10–20 %)

The values show the range of energy savings.

Specific aspects for energy saving and energy recovery measures

There were no specific aspects concerning energy saving or energy recovery measures mentioned.

Recommendation for the future

When the work is reviewed a more in-depth assessment of techniques to improve energy efficiency would be useful, taking into account more recently available information.

5.12 Industrial cooling systems

Importance of energy efficiency

Cooling is an essential part of many industrial processes and should be seen as an important element in the overall energy management system. The intention is to reuse superfluous heat of one process in other parts of the process or in different processes on site in order to minimise the need for discharge of waste heat into the environment.

Most important processes/technologies related to energy efficiency

In this industrial sector it is easier to speak about cooling systems instead of processes. Usually it is a process that has to be cooled. There are eight cooling systems mentioned, whereas each system is principally characterised by the cooling medium, the main cooling principle, minimum approaches, the minimum achievable end temperature of the process medium, and the capacity of the industrial process. The environmental aspects are different for each of the industrial cooling systems. As far as energy consumption is concerned, the most important cooling system is closed circuit dry cooling. Most of the high energy consumption is used for driving the fans.

The energy requirement of industrial cooling systems can be considered as direct or an indirect consumption. Direct consumption is the use of energy to operate the cooling system. The major energy users are pumps and fans. The energy consumption of the production process is referred to as the indirect energy consumption caused by the cooling process.

The total (direct and indirect) energy consumption for a closed circuit cooling tower amounts to more than 34 kW_e/MW_{th} (BREF 8, 67–70).

Energy recovery or energy saving techniques for the main processes

The energy saving and energy recovery techniques mentioned here do not refer just to the most important cooling system (closed circuit dry cooling), but rather give an overview of all applied cooling systems (BREF 8, executive summary, V). Basically it is possible to reduce the direct or indirect energy consumption. For the indirect energy reduction the following measures are available:

- select the cooling configuration with the lowest specific indirect energy consumption (in general once through systems);
- apply a design with small approaches; and
- reduce the resistance to heat exchange by proper maintenance of the cooling system.

The following measures are applicable to the reduction of direct energy consumption:

- Use pumps and fans with higher efficiencies.
- Reduce resistance and pressure drops in the process by design of the cooling system and by application of low resistance drift eliminators and tower fill.
- Proper mechanical or chemical cleaning of surfaces to maintain low resistance in the process during operation.

Energy data and energy saving techniques for other processes

All measures to reduce energy consumption have been discussed above for all cooling systems, together.

Best available techniques (BAT)

Principally, the BATs are subdivided into general and process specific BATs.

General BAT

The following are BATs in the design phase of a cooling system:

- To reduce resistance to water and airflow

- To apply high efficiency and low energy equipment
- To reduce the amount of energy demanding equipment
- To apply optimised cooling water treatment in once through systems and wet cooling towers to keep surfaces clean and avoid scaling, fouling and corrosion.

Process specific BAT

The selection of wet or dry cooling or wet and dry cooling to meet process and site requirements should be aimed at the highest overall energy efficiency. To achieve a high overall energy efficiency when handling large amounts of low level heat (10–25ºC), it is BAT to use open once-through systems for cooling. In a greenfield situation this may justify selection of a (coastal) site with reliable large amounts of cooling water available and with surface water with sufficient capacity to receive large amounts of discharged cooling water.

When cooling hazardous substances that pose a high risk to the environment, it is BAT to apply indirect cooling systems using a secondary cooling circuit (BREF 8, 125–126).

Specific aspects for energy saving and energy recovery measures

It is acknowledged that the final BAT solution will be a site-specific solution.

5.13 Summary of energy issues in the BREFs

All the analysed BREFs contain a considerable amount of information and data on energy. The most specific information is available for energy consumption within more or less all the sectors. As far as energy saving and energy recovery techniques are concerned, there is less information. In general, there is a need for more information regarding all the energy aspects (consumption, savings and recovery measures and values).

BATs are generally subdivided into general and process specific BATs. In a few cases, each process specific BAT within a industrial sector is shown in a table and described separately.

The purpose of the BAT chapter is thus to provide general indications regarding the emissions and consumption levels that might be considered as an appropriate reference point to assist in the determination of BAT-based permit conditions or for the establishment of general binding rules. In other words, environmental permit conditions should be based on BATs, and BREFs (which are not binding) should be taken into consideration as one important source of information on BAT.

A description of energy aspects found in each BREF follows (summary table in Section 5.14).

5.14 Summary of energy efficiency (EE) aspects in the BREFs

	Cement and lime March 2000	Iron and steel March 2000	Non-ferrous metals May 2000	Pulp and paper July 2000	Chlor-alkali October 2000	Ferrous metals October 2000	Glass October 2000	Cooling systems November 2000
Importance of EE compared to other environmental issues	highly intensive (emission air)	highly intensive (air emissions)	important (air emissions)	high (water discharges)	important (air / water emissions)	important (air emissions)	very intensive (air emissions)	high
Which is the most important and energy intensive process/technology?	clinker burning, lime burning	blast furnace	pyrometallurgical processes	depends on the plant evaporation/paper machine	mercury (amalgam)-technology	heating and heat treatment furnace	melting	closed circuit dry cooling dry air cooling
Is energy data available?	yes, only for consumption	yes (good description)		yes, data available	yes, only for consumption	yes (good description)	yes (good description)	yes, only for consumption
Are energy recovery/savings techniques for this process mentioned?	not in detail, partly also considered as BAT	yes, a lot partly also considered as BAT	yes, consumption and recovery	yes, techniques in general considered as BAT	yes, in terms of process selection	yes, a lot partly already considered as BAT	yes, a lot	yes, but rarely
Is energy data for other processes (including techniques) available?	yes, in general for consumption	yes	yes, consumption + recovery	yes, consumption data available	yes, consumption data	yes (good)	yes, mainly for consumption	yes, consumption
BAT General BAT available	yes (primary measures)	yes	yes	yes	yes (primary measures)	yes	yes (design phase)	yes (design phase)
BAT for specific processes	yes, limited	yes, BATs for all types of plants	yes	yes	yes, limited	yes, good description	Not mentioned as BAT (to consider in the determination of BAT)	yes
Energy data in BAT	yes, only consumption (limited)	yes, table for each BAT	yes	yes, almost in every BAT	yes, limited	yes, data about consumption, saving recovery	Not concerning EE, only emission levels	yes, partly
Are energy recovery/savings measures site specific?	no	not mentioned	yes	yes, a few (CHP)	yes, because of difficulties in storage + transport	not mentioned	not mentioned	yes, but difficult to quantify
Are any recommendations for the next update mentioned?	survey of current techniques consumption is useful	n.a.	more information about consumption data	more information on the assessment of energy efficient techniques	n.a.	provide more information on emission and consumption level	more techniques for EE improvement would be useful	n.a.
Special comments	energy costs = 30–50 % of total production costs associated BAT heat balances value is 3 000 MJ/t clinker	there are many different kind of plants; each has different processes + techniques	limited information about EE in BATs. General ok!	a lot of information concerning EE for each single process. A lot of energy recovery techniques are not considered as BATs yet.	information about process conversion (technologies) and about legislation for some EU countries. associated with BAT: < 3 200 kWh per t of chlorine large consumption of electrical energy	balance between EE and air pollution (for certain techniques) very detailed description of BATs	BATs are concentrated more on emissions melting process needs about 75 % of all energy usage	BATs are described but only a few have a lot of data → the final BAT solution will be a site-specific sol. calculation model for energy conservation + saving is given

6 VOLUNTARY ENVIRONMENTAL MANAGEMENT SYSTEMS

6.1 General background

Environmental Management Systems (EMSs) are used as a tool of business management among industrial enterprises all over the world. There are mainly two systems in use: the international/European standard EN/ISO 14001:1996 and the Eco-Management and Audit Scheme (EMAS) of the European Union. Both systems are based on continuous improvement of environmental performance, including energy use. There are presently about 3 800 organisations and sites registered for EMAS in the EU and probably four times more organisations certified to ISO although the number of ISO certifications can only be estimated since many countries do not have a central ISO register.

EMAS was adopted by the EU Council in June 1993 and was revised in 2001. It has been open for participation by companies since April 1995. The overall objective of the scheme is to promote continuous environmental performance improvements of industrial activities by committing sites to evaluate and improve their environmental performance and provide relevant information to the public. The revised EMAS Regulation was adopted by the European Parliament and the Council in March 2001 and entered into force in April 2001. It now includes EN/ISO 14001:1996 as the core environmental management system. The new EMAS Regulation requires Member States to promote organisations' participation and asks Member States to identify options to avoid unnecessary duplication of effort for registered organisations in relation to implementation of environmental legislation.

ISO (International Organization for Standardization) published the environmental management standard ISO 14001 in 1996, which is based on and which replaced many national EMS standards. This standard has been adopted world wide and can be used by all kinds of organisations.

The main difference between the EMAS scheme and the ISO standard is that the latter does not require the publication of an environmental statement, and that the verification and registration system is under the control of the Member States. EMAS guarantees also legal compliance with environmental legislation in contrast to ISO. Another difference is that a whole company can be ISO 14001 certified even if the places of business are located in different countries (Palosaari 2001). EMAS remains a site-specific scheme, which means that all sites of a registered entity will be subject to verification unless they are very similar and have relatively small environmental impacts.

As instruments of environmental policy the roles of EMAS and the ISO standard are different. EMAS is a part of the official environmental policy of the European Union and the Member States have the responsibility to promote EMAS. For ISO 14001 it is the International Organization for Standardization and its national members which are responsible of the development of the standard. Private companies have a central role in this process and environmental authorities are only one stakeholder among many (Honkasalo 1998).

6.2 ISO 14001

The role of the ISO 14001 environmental management system in the permit procedure is mainly to provide background material. Only Poland and Sweden pointed out that it has no role in the procedure. According to the replies to the questionnaire, the ISO system is not an actual part of the permit

procedure. Sweden's view on this subject is that it could be used by the applicant in arguing that no specific requirements should be set. (Annex I, Table 52)

In Germany the applicants are allowed to use documents, which have been used in the ISO process, as application documents, if they are specific enough. This is very rarely the case because the ISO 14001 standard is applied to the company as whole in regard to the existing site(s) and not to planned single installations. In Ireland, the permits require the company to have an Environmental Management Programme in place. The ISO 14001 system is accepted by the Irish Environmental Protection Agency (EPA) as an Environmental Management Programme in the permit procedure. (Annex I, Table 52)

In general, management schemes do not play a dominant role in permit procedures in the Netherlands unless an applicant wants a permit where it will take over parts of the, mostly certified, scheme. The Portuguese applicants can deliver a complementary report together with the application form, including relevant information to the evaluation. A description of any environmental management system can be included in the report. (Annex I, Table 52)

Finland, Italy and Portugal are the only countries which have some legislative possibilities on the use of the ISO 14001 system in the permit procedure. In Austria the only legislative provisions refer to the supervision procedure. ISO documents must be recognised as documents for the self-evaluation of the installation. The Finnish Environmental Protection Decree says that "where necessary, the permit decision must also indicate how environmental management systems or measures and reporting based on energy saving agreements have been taken into account in setting the terms of the permit". (Annex I, Table 53)

Certification under ISO 14001 has, in general, no specified role in the permit procedure concerning energy efficiency. In the United Kingdom it may satisfy some of the energy management requirements and in Ireland the EPA may use the certification as a useful tool when carrying out its own environmental audits in a company. An example of this might be to look at the findings of an ISO audit and check whether or not non-compliance and observations were closed off. Certification under ISO 14001 and the use of the ISO standard overall are a part of the integrated approach in the permit procedure (Italy and Lithuania). Portugal's point of view is that certification does not guarantee that an installation will use energy efficiently, it merely indicates the company's commitment and effort in doing so. (Annex I, Table 54)

The general opinion about the influence of the ISO 14001 standard on the supervision of energy efficiency is that it has at least some positive effect on the supervising procedure. The standard requires that staff are properly trained and that issues such as calibration maintenance and document controls are closely managed. Energy efficiency might well be a key performance indicator in a company's ISO 14001 Environmental Policy Statement. For these reasons, Ireland will use the ISO 14001 standard to compliment the permitting of energy efficiency. In the United Kingdom it will possibly have some influence, although not to a great extent. Finland says the influence of the standard will only be on a voluntary basis because the implementation is supervised by certifiers. In Sweden the standard will perhaps be taken into account to some degree. (Annex I, Table 55)

The specific advantage of co-ordinating the ISO 14001 standard and the permit procedure as concerns energy efficiency is the simplification of the procedure through reduced work load on both the applicant and the authority. Additional advantages are the compatibility of the two procedures and the possibility for the authorities to ask the certifiers to pay more attention to the energy efficiency issue. Co-ordination of the two would provide tight control over an activity as it would have to meet

the requirements of the ISO standard as well as the permit requirements. Both sets of requirements may well be similar; however, there will be two different bodies available to assess the companies' objectives, targets and results (Ireland). (Annex I, Table 56)

The major problem concerning co-ordination is that the ISO 14001 standard is a voluntary system not regulated by law and, therefore, the legal status of it is doubtful. According to the replies of Portugal and the United Kingdom, the certification authorities do not certify performance, which is the essential objective of the permit. Nor does certification under ISO 14001 say whether the energy targets are realistic in the context of the IPPC directive. Sweden's opinion is that there are no specific problems concerning co-operation, but the lack of openness under the ISO standard can cause problems. (Annex I, Table 57)

6.3 EMAS

The role of EMAS in the permit procedure is quite similar to the situation with the ISO standard – it is used mainly as background information. Poland and Sweden pointed out that so far it has no role in the procedure. In Italy, EMAS is a part of the procedure since EMAS-registered sites benefit of an extension of the permit's validity from five to eight years. In Germany the applicants are allowed to use documents from the EMAS system as application documents if they are specific enough. The Irish permits require the applicant to have an Environmental Management Programme in place and EMAS is accepted for that purpose. EMAS can also be used in Lithuania as background material. However, there do not yet exist any EMAS-registered companies in Lithuania so far. (Annex I, Table 58)

Five countries have legislative possibilities to use EMAS in the permit procedure. The Finnish decree was already mentioned in Section 6.2. The German government adopted a decree on the possibility to simplify documents for application. In Portugal, applicants can include a description of their EMS in the application. Ireland has no legal possibilities for the use of EMAS in the permit procedure but points out that in such a case there would be two different bodies assessing the companies' objectives, targets and results. (Annex I, Table 59)

Austria has its own approach. The new Environmental Management Act from 2001 provides certain benefits for EMAS organisations. Certain changes to an installation do not need a permit procedure any more provided that the authorities are notified of the change. One condition for this simplified procedure is a binding statement of an environmental verifier that the changes take into account state-of-the-art technologies or BAT, among other things. EMAS-registered organisations may also obtain a consolidated permit, which includes all permits for an installation. The act also simplifies control and notification obligations. Companies that have registered for EMAS or ISO 14001 may be subject to self-monitoring of processes. (Annex I, Table 59)

The general opinion concerning the role of the verification of EMAS and the environmental reports is that these could serve as useful background information for the authorities, but the role is not very relevant at the moment. EMAS can also be useful for an applicant when preparing the application. (Annex I, Table 60)

In relation to the supervision of energy efficiency measures, EMAS is seen in most countries as a complimentary measure and facilitates better energy management. It can also be an instrument to support supervision by the authorities (Germany). Denmark's opinion is that the advantages will be

mainly on the companies' side. Other advantages for co-ordinating EMAS and the permit procedure are quite similar to the ISO 14001 standard:

- EMAS provides better control of an installation as it would have to meet both EMAS requirements as well as the permit requirements;
- EMAS allows simplification of the permitting procedure and can avoid extra work both for the companies and the authorities. (Annex I, Tables 61–62)

Only four countries have the opinion that there are some specific problems concerning the co-ordination of EMAS and the permit procedure. These are quite the same as for the ISO standard (Annex I, Table 63):

- the legal status can be doubtful if a permit simply refers to information from an environmental management scheme (the Netherlands);
- the environmental management targets can be unrealistic in the context of the IPPC directive (the United Kingdom);
- if a licensee has to publish an environmental report under EMAS, there might be problems with confidential information (Ireland); and
- each authority has to decide case by case how intense its own supervision can be taking into account potential problems and human resources (Germany).

The working group on the seminar considered that the EMS targets should not be transferred as such to the permit. That could affect negatively the companies' interest in setting targets and even in applying environmental management systems. However, concrete measures already decided upon may be included in the permit. In relation to this question it was noted that no financial aid can be given for conditions mentioned in the permit.

There should be clear and attractive incentives for the companies to implement management systems. Examples brought up by the group include the prolongation of the permit periods from five years up to eight years (Italy), no need for a renewal of the permit in certain cases of substantial change in operations (Austria), and a lower level of supervision by authorities. Supervision of companies and installations without any EMS should be increased.

7 VOLUNTARY ENERGY SAVING AGREEMENTS

7.1 General questions

The concept of voluntary energy saving agreements is in use in eight of the countries participating in this project. It is currently not in use in Austria, Lithuania, Poland, Portugal and Sweden. The first agreements were concluded in the Netherlands in 1992, where the implementation of the energy agreements depends on the category of the installation. In most Dutch cases companies join an agreement and plan their own objectives. For major energy consumers a long-term agreement on energy efficiency (MJA) is in use and the reduction targets are agreed at the branch level. The agreements follow a particular national form in the participating Member States except in Italy, where there are no guidelines or rules to define a standard agreement. (Annex I, Table 64)

There are many different ways that companies take part in the agreements. In most countries the objectives of the agreement apply to the companies or industrial branches. In Germany they apply only to the branches and in Finland only to the companies. The Irish approach is that the objectives generally apply to a particular site location and in the Netherlands they will apply also to the operator. If Sweden were to have these voluntary agreements in use, all alternatives and combinations of them would be considered. (Annex I, Table 65)

Most countries do not know how many installations covered under the IPPC directive and other installations have joined a voluntary energy saving agreement. A few countries have some estimates though: Denmark (114 industrial companies), Finland (approximately 125 IPPC installations and 125 other installations) and France (100–200 IPPC installations and 550 other installations). In the United Kingdom 12 500 installations, including IPPC installations, are participating. The estimates of the total energy consumption of the IPPC installations vary between more than 33 % (Ireland) and 99 % (the Netherlands). The latter figure can be explained by the fact that almost all major installations have joined the benchmarking agreement or the MJA scheme. Energy use estimates covered by all participating installations have been given by three countries varying from 30 % (France), 60 % (Denmark) up to 70–80 % (Germany). (Annex I, Tables 66–67)

At the end 2001 the voluntary energy saving agreements in Finland covered about 85 % of all industry, 89 % of power production, 76 % of electricity transmission and distribution, 72 % of district heating, 55 % of municipalities, 73 % of real estate sector, 14 % of truck transportation and 35 % of bus traffic. The connection to the IPPC directive can be seen as a joint venture in seeking methods and tools for the determination of and follow-up to energy efficiency in various sectors.

7.2 Voluntary energy saving agreements

Generally, an agreement is made between an individual company and a governmental institution like a ministry or energy agency. This is the practice in Denmark, Finland, France, Ireland and the United Kingdom. The Finnish companies sign the agreement with the Ministry of Trade and Industry and the Confederation of Finnish Industry and Employers. In all of the countries mentioned above, except Finland, different branches or representative trade bodies can join a voluntary energy saving agreement on behalf of the members. This is the only way of joining the agreement in Germany, where it is based on a declaration between the government and several industrial or trade organisations. There is also a supplementary voluntary agreement between the German government and the industrial associations which represent energy suppliers. Italians can include several parties in the agreement, and in the Netherlands companies implementing the benchmarking or long term

agreement on energy efficiency (MJA) work with their own branch organisation and the National Agency for Energy and the Environment (Novem). (Annex I, Table 68)

The main obligation of the parties involved in the voluntary energy saving agreements is, as a matter of course, to reduce (specific) energy consumption with binding reduction targets. Other important aims are to make energy efficiency an integral part of the companies' operation (Finland and Ireland), to organise monitoring and data reporting (France and Germany) and to compare and share the knowledge of outstanding energy efficiency issues (France, Germany, Ireland and the Netherlands). The main target in Germany is to reduce CO_2 emissions or specific energy consumption by a declared sector-wise range from 16 % to 66 % based on the 1987/90 aggregating to a 20 % reduction in 2005. The "Climate Change Agreements" in the United Kingdom provide several industrial sectors with an 80 % discount from energy tax on coal, gas and electricity in return for a negotiated and binding energy consumption reduction target. Agreements describe the total reduction either in absolute or relative terms. Allowances can be made for changes in product output or mix or unforeseen regulatory and planning constraints. (Annex I, Table 69)

In seven countries the agreements include regular reporting, which is the most frequently mentioned alternative of the contents (see Figure 6). Only Italy does not specify the contents of their agreements because the contents vary depending on the agreement. Other common features of the agreements are energy inspection, monitoring of energy consumption in existing installations, plans for making energy saving more effective and energy saving measures. Only three countries mentioned that one part of their agreement is the determination of energy consumption in new installations. All of the eight alternatives mentioned in the questionnaire are in use in Ireland and the Netherlands, as is benchmarking, which is an example of a national "extra" measure. Sweden plans to include all of the alternatives in its the possible forthcoming agreement system. (Annex I, Table 70)

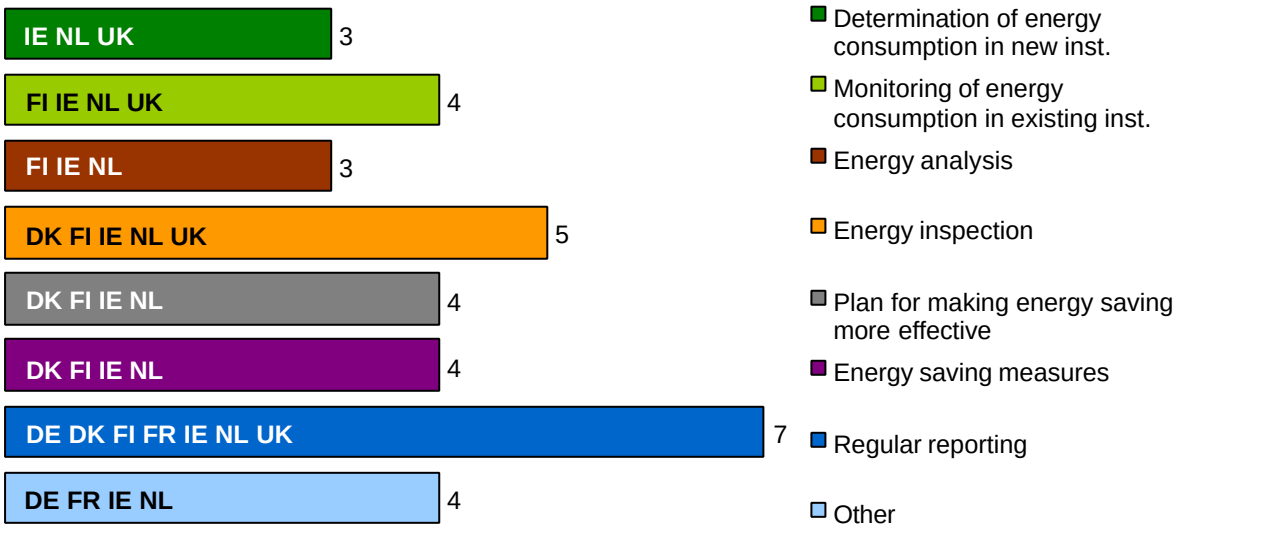

FIGURE 6 (Annex I, Table 70). Main contents of the energy saving agreements.

Energy audits are mostly done by the operator or a private organisation, such as a consultant. The former carries them out in Finland, Germany, Ireland and the Netherlands, while the latter is valid in Denmark, France and the United Kingdom. Many of the countries have two auditing bodies, for example in Finland the audit is done by consultancies certified by the Energy Information Centre for Energy Efficiency and Renewable Energy Sources (Motiva) in co-operation with the company. In France there are no energy audits, but the representative of the specified branch conducts a de-

tailed monitoring and an independent monitoring is conducted by the environmental authority at the branch level. (Annex I, Table 71)

Although the energy saving agreements are voluntary, it is important to ensure that their aims are fulfilled. Some criticisms were mentioned in the seminar about the lack of legal sanctions if the companies do not comply with the agreement. The only country which is using all three means mentioned in the questionnaire is the Netherlands. The most used means of verifying that the aims have been fulfilled is to report on the implemented energy saving measures. Two other means are to analyse the specific energy consumption or to develop an index for energy efficiency. This is the situation e.g. in Ireland, where an index is developed for the installation. The index might look like energy utilised per units produced. The resulting value is used to compare energy consumption from year to year. Germany pays attention also to a specific CO_2 emission reduction rate and examples of outstanding measures. The only means used in the United Kingdom are absolute or relative reductions achieved in measured energy use. The installations report mainly to non-environmental state organisations, only the French branches or professional unions collect the data and report to the environmental ministry. Private organisations are used in Germany and the Netherlands. (Annex I, Tables 72 and 73)

The voluntary energy saving agreements have to be attractive to the companies. In other words they are looking for some economic benefits or other added value for their business. The basic benefit, at least in the long run, is of course saving money as a result of decreasing energy consumption. Lower taxation is one of the most popular incentives judging from the replies to the answers. The German system is the only one with an incentive for avoiding legal sanctions, when the government relinquishes to propose a bill on the fixing of measures for energy efficiency or to cover energy consumption with higher taxation as long as the industry taken as a whole meets the voluntary agreement. As mentioned earlier, British companies will get an 80 % discount on tax on coal, gas and electricity use. Companies can also get grants for energy saving measures as in Denmark. Finnish parties joining the agreement can get 40–50 % aid for the energy analysis and up to 15–20 % for energy saving investments. Non-compliance with the agreement can be viewed as bad publicity in Ireland, where there are no special incentives. In France, too, the agreements and the results are made public, which is seen as a sufficient incentive. Avoidance of enforced permit conditions by individual authorities is the Dutch incentive for fulfilling the agreement. (Annex I, Table 74)

7.3 Voluntary energy saving agreements and the permit procedure

The role of the voluntary energy saving agreements in the permit procedure is quite embryonic at present. They are used as a part of the procedure only in the Netherlands and the United Kingdom. The Dutch saving or reduction measures developed as a part of the agreement are incorporated in the permit. Seven of the participating countries replied that they play a role as background material, of which Portugal and Sweden do not have the voluntary agreement system in use at the moment. Furthermore, it does not seem likely that the possible forthcoming agreements would play a role in the Swedish permit procedure. The information provided by the agreement will come up in the Annual Environment Reports, in Italy the agreement could be included in the permit case by case. (Annex I, Table 75)

According to the Finnish Environmental Protection Decree it shall be stated in the permit how the environment management systems or measures and reporting based on energy saving agreements have been taken into account in setting the terms for the permit. From the Ministry of Trade and Industry's point of view the voluntary actions come first and foremost followed by setting the permit

conditions. No other country has any supportive reference in their national legislation to use these agreements in the permit procedure. Specific guidance on this issue is available in the Netherlands, where the ministerial decision "Energie in de Milieuvergunning" is dealing with the relationship between agreement participation and permits. Statutory guidance is expected in the very near future from the British government, at present non-statutory guidance is provided by the regulators. Other participating countries have no guidance according to the replies. (Annex I, Tables 76 and 77)

It is seen unlikely that the environmental permit authorities will influence the aims of the agreement to any great extent. In the United Kingdom voluntary agreements may be revised upon application to the government if environmental regulations (IPPC) require action which results in increasing energy consumption. The Irish EPA can have an indirect effect by influencing the content of the Environmental Management Programme. This may in turn influence the agreement as there is a legal requirement between the installation and the EPA. The Swedish permit authority would not be barred from imposing stricter requirements than those set out in a potential agreement and as long as Dutch companies are in line with the agreement, authorities are not supposed to impose other measures than those developed as part of the agreement. (Annex I, Table 78)

Co-ordinating the voluntary energy saving agreements and the permit procedure is seen to have some advantages and also some difficulties. The Finnish point of view is that there could be advantages connected with avoiding the duplication of work when reporting monitoring data to different organisations, depending on whether it deals with the permit or agreement. It can also make the permit procedure less time-consuming (Sweden) and it would allow monitoring at the installation level in France. Portugal's opinion is that the operator will benefit by dealing with fewer different authorities and the authorities' benefit by using the information provided by the agreement as background material for an IPPC permit. Germany points out that the advantage is just the knowledge that there will be energy savings even if the permit authorities do not emphasise this issue.

Adopting the goals of the voluntary agreements in the permit procedure is seen as very important in Ireland. The Irish EPA use the following condition in new permits:

> "The audit shall identify all opportunities for energy use reduction and efficiency and the recommendations of the audit will be incorporated into the Schedule of Environmental Objectives and Targets under Condition 2.2 above.".

The Irish EPA and Irish Energy Centre have already begun to liaise closely on energy issues. The experience gained by the Irish Energy Centre in co-ordinating the voluntary agreement scheme will prove very helpful to the EPA. There have been some very interesting schemes developed for the control of energy in the voluntary agreements and it is likely that many of these methodologies will be used in the permit procedure (that is evaluation of energy reports submitted to the EPA). At the moment the agreements are not in use in the procedure. (Annex I, Table 79)

Four countries see some problems in using the voluntary energy saving agreements in the permit procedure. The scale and objectives can be too different if the agreements refer to industrial branches and the permits to single installations (Germany and France). In the Netherlands some authorities complain about a lack of information concerning the choices made as part of the agreements, in other words they are confronted with the outcome but have no information on how the choices have been selected and the alternatives considered. Sweden would prefer legally binding and enforceable agreements because they are desirable for all parties involved. However, there must be incentives for stakeholders to conclude agreements and these incentives will be severely weakened if the permit authority can affect issues which are regulated in the agreement, that is, impose stricter requirements (Sweden and Portugal). (Annex I, Table 80)

8 REPORTING AND SUPERVISION

8.1 Reporting of energy use and efficiency in IPPC installations

In most of the countries participating in this project there is an obligatory monitoring and reporting system of energy use (Denmark, Finland, France, Ireland, Lithuania, the Netherlands, Sweden, and the United Kingdom) (Annex I, Table 81). Austria and Germany do not have such a system. In Poland the reporting system is under preparation and it is too early to know what form it will take. However, reporting systems of energy efficiency are not obligatory in many countries (Austria, Denmark, Finland, France, Germany and Lithuania). See also Austria, Section 7.2. In some of the countries reporting on energy use is not clearly required. For example, in Sweden the report must include information on resources used. (Annex I, Table 81).

The practice varies as to which authority the report must be given (Annex I, Tables 82 and 83). In Denmark, France and Portugal the energy authority collects and treats the data, whereas in Italy, Sweden and the United Kingdom reports are sent to the environment authority. In Finland the energy authority collects reports according to voluntary energy saving agreements and the environment authority collects reports according to the environmental permitting system. The reporting frequency is every year in Finland, Lithuania and Sweden. In Portugal, energy intensive consumers have to do an energy consumption and management plan for five years. The monitoring is carried out mostly annually in the participating countries or it varies on a case by case basis.

Fuel consumption, energy production (electricity or heat) and energy consumption (electricity or heat) are the monitored parameters in all countries that have a monitoring system (Annex I, Table 84). Additionally, the energy index and specific energy use may be monitored according to the monitoring system in Ireland and in the Netherlands because each company is examined individually and the parameters depend on the agreement or permit. (Annex I, Table 84).

How the supervisory and permitting authority get the information about energy efficiency development varies extensively in the countries (Annex I, Table 85). Some of the countries are using sector-wise information and others are using installation-specific data. For example, in Denmark the competent authority uses sector analyses. In Finland some information is included in the companies' environmental reports. Any available information can be included in the permit application. In France the environment authority and energy authority share local representatives. Hence, information is shared but no institutional information sharing is organised. In Germany the operators are obliged to inform the authority of changes in energy efficiency when the authority is supervising the installation. In Ireland, the Irish Energy Centre publishes the information about the development of energy efficiency. In Sweden the authorities use an annual environment report that is obligatory for the operators.

8.2 Supervision

Most of the countries have an inspection or an audit system carried out by the authorities for energy issues. However, the definition of energy efficiency is not quite clear and there are practical difficulties in enforcement and supervision. The lack of clear definitions and guidelines also has an effect on enforcement and supervision. The supervision of energy efficiency is very difficult, if not impossible. One problem is that general and vague permit conditions are not consistently enforceable and they are difficult to supervise. Secondly, non-binding permit conditions are widely used in the permit procedure, which means that they are not enforceable at all. One solution to the problem

could be the “minimum criteria” for energy efficiency inspections. It was pointed out that there is a need for guidelines on the inspection procedure to be used in the auditing of energy efficiency.

The competent inspectorate is usually the environmental authority (Annex I, Table 86). One exception is Denmark, where the competent authority is the Energy Agency. Auditing or supervising is usually a part of the permitting or supervision process. In Austria, Finland, Portugal and Sweden the inspection or auditing system was not created specially for energy issues. In Denmark an energy management system has been developed to be used by companies entering into an agreement with the Energy Agency. In Finland Motiva is competent for supervision of energy saving agreements. In Ireland the EPA audits licensees. In Poland the Chief Inspectorate for Environmental Protection is the inspection authority. In Germany the supervising authority checks the installation.

The consequences of non-compliance with energy saving measures in the permit vary according to national practice (Annex I, Table 90, Column 6.2.5.1). For example, in France, Germany, Ireland and Lithuania the inspector has the authority to take action. In Germany the company has to pay a fine if it is responsible and culpable or the authority can shut down the installation. In France the conditions of the permit can be reconsidered. The environment inspector can demand that the environmental permit be followed and can impose administrative penalties.

Supervision of energy efficiency in voluntary environmental management schemes is arranged in most of the countries. The certifier determines in nine countries (Finland, France, Germany, Ireland, Italy, Lithuania, the Netherlands, Portugal, the United Kingdom) how to supervise energy efficiency in accordance with EMAS and the ISO 14001 standard. Austria's use of environmental management systems in the supervision process is mentioned in sections 7.2 and 7.3. Neither Poland nor Sweden have established a supervision process (Annex I, Table 87). If the energy saving measures are not fulfilled, most countries impose consequences in accordance with the ISO 14001 standard and EMAS. In France the operator establishes objectives and targets concerning energy savings if he considers that the environmental impact of the activity is significant. (Annex I, Table 90, Column 6.2.5.2) Thus, in Ireland, the Netherlands and the United Kingdom there are no consequences unless the measures are incorporated into the permit (the Netherlands).

Supervision of energy saving agreements is arranged differently in the participating countries (Annex I, Table 88). Denmark has a governmental body supervising the reporting, while in the United Kingdom there are government-appointed verifiers. Finland has a steering committee with representatives from both governmental and non-governmental bodies. In Ireland the supervision system is based on a self-audit scheme, the onus is on the company itself but the Irish EPA may place requirements on the company. In Germany the installations report to RWI (Rheinish-Westfälisches Institut für Wirtschaftsforschung Essen) and this institution supervises energy saving agreements. In the Netherlands the supervision is arranged by Novem (Agency for Energy and the Environment). In Italy the supervision depends on the agreements. Countries also have different consequences for failure to implement the energy saving measures (Annex I, Table 90, Column 6.2.5.3).
Some use tax increases or reimbursing of the tax reduction (Denmark, Germany and the United Kingdom). Denmark also withdraws grants. In Finland the company can be suspended from the agreement. In the Netherlands the permit will be adapted or enforced. The United Kingdom will carry out full site-specific regulation under the IPPC directive due to a breach of the permit condition to hold a certificate. In France, Ireland and Lithuania the violations are not likely to cause negative consequences.

In energy efficiency inspections a good alternative would be self control, meaning that the licensee carries out its own monitoring. As it is in the inspector’s interest that the enforcement of the moni-

toring is done in a certain way, there would be a need for a mechanism where the inspector can influence how the monitoring is done. The licensee should submit a plan to the inspector detailing the scope of energy efficiency audits. It could be included as a part of a permit, which would make it enforceable. The authorities can inspect and verify the reports through the submission of information and the audit process. A similar system has been established under Irish legislation. As the licensee is doing the self-monitoring, the inspectors can supervise the data the licensee gives and the inspector can define which streams should be monitored. At the seminar it was also pointed out that the licensee should be able to verify how the energy is used. A tool to do so could be the energy balance reports.

Voluntary energy saving agreements are in use in some of the Member States. One question is how to supervise the voluntary agreements if they are included in a permit system. The general view is that there should be an obligation to monitor the voluntary energy saving agreements, if they are a part of a permit. The overall view from the seminar was that the voluntary energy saving agreements should not be a part of the permit because the targets of voluntary agreements (continuous improvement) are not suitable for inclusion in a permit system. The voluntary agreement could be regulated by general binding rules (GBRs). They could also be included as a part of the licensees' annual objectives and targets.

9 ACCESS TO INFORMATION AND PUBLIC PARTICIPATION

9.1 General questions about access to information

Public access to environmental information has become an increasingly accepted part of environmental policy throughout the Member States, as was seen already in 1990 by the agreement to a directive on the subject. Access to information and public participation are also growing in importance in environmental permitting. The need to inform the public is essential in an integrated approach. Because the permitting is open to scrutiny, the risks of environmental options being ignored, or poor environmental standards being accepted, are reduced (Explanatory memorandum of the IPPC directive on Article 15). Article 15 of the IPPC directive stipulates specifically access to information and public participation in the permit procedure. In addition the international Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (known as the Aarhus Convention), which the EU is a party to, emphasises these specific rights.

Member States are required to ensure that applications for IPPC permits are made available for public review and comment before a decision is reached. That decision and its subsequent updates must be available to the public (Article 15 (1)). Also, the results of the monitoring of releases as required under the permit conditions must be publicly available (Article 15(2)). There has, however, been some criticism of the fact that there is no requirement, however, for public comments to be taken into account in reaching the decision(Emmot 1999, 39). On the other hand, such a requirement is perhaps only too obvious to be specifically pointed out at the legislative level. The requirements for public release of data are subject to the restrictions set out in directive 90/313/EEC on access to environmental information, which means that material may be withheld on grounds of commercial confidentiality or certain other reasons (Article 15 (4)). Although there may be occasions when data should be protected for reasons of commercial confidentiality, the IPPC directive sends a signal that any such restriction should be the exception rather than the rule (Explanatory memorandum of the IPPC directive on Article 15).

9.2 Access to information in the permit procedure and supervision

The requirements for access to information and public participation were generally seen as difficult to fulfil in the field of energy issues. There are a variety of limitations to access to information. To combine the demands of transparency and the means of the voluntary agreements was also seen as problematic because of the reluctance of many companies to reveal their energy data, especially exact energy figures or energy consumption (Annex I, Table 91).

The means of making data public varies. Public hearings, print newspapers and other channels can be used. The most common way is still to have the authority make the data available. When the issue was under discussion in the seminar, it was pointed out that the traditional means of publishing notices in newspapers and posting information on notice boards of the authorities were generally seen as inadequate for informing the public about the application and the emission data. The Internet was seen as a good and accessible way to promote transparency (Annex I, Table 94).

There are also various limitations in making the data public. These are mostly related to business secrets. Some countries have also protected industrial secrets by restricting the publication of information “if the number of operators is below three or if one operator represents 70 % of energy consumption” in order to protect the operators identity. Also public safety and crime prevention are

often mentioned as reasons to restrict the transparency. There are also countries where no confidentiality clauses can affect environmental issues. (Annex I, Tables 94 and 95).

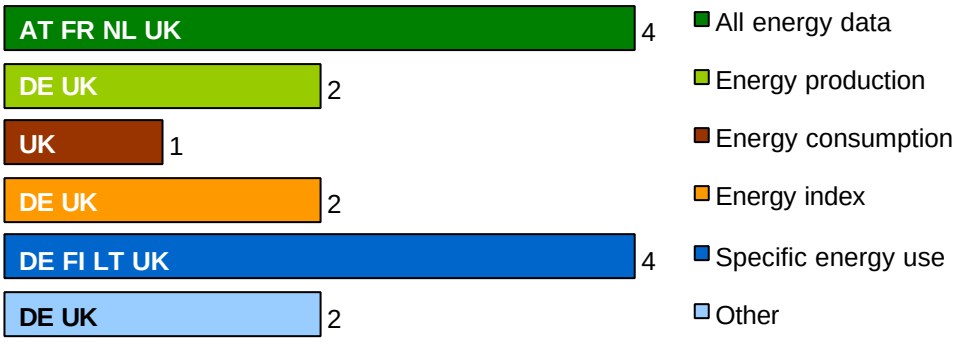

FIGURE 7 (Annex I, Table 96). The nature of data usually declared as confidential.

As mentioned above, the IPPC directive and the Aarhus Convention emphasise the role of public participation. At the seminar in Helsinki the relationships between the participatory rights and energy efficiency issues were discussed. The replies to the questionnaire showed that the differences in national legislation and confidentiality clauses could create, and have created various interpretations of the implementation of the article in question. Yet all, but two participating countries declared, that the Aarhus Convention did not demand changes in their legislation (Annex I, Table 92). Moreover the seminar discussion showed, that the interpretations of what can be declared as confidential, varies in different Member States, which was considered to be very problematic. Altogether there are many practical approaches in this field and the attitude towards transparency is strongly connected to national traditions. Additionally the authorities' point of view can vary from that of the operators'. Therefore it was also pointed out, that general harmonisation of the articles in question and definition of what can be declared as confidential are needed. This could be kept on IMPEL's agenda, to create a common understanding of the issue. General guidelines were regarded as needed, especially when there are different legal systems involved.

9.3 Openness in the voluntary measures

Voluntary measures (voluntary energy saving agreements, EMAS and ISO 14001) are agreements between authorities and the operators. There are some concerns about the role of public participation in these, which are basically agreements between two parties concerning the permitting procedure, but which also includes the rights of the "third parties". The problems were closely related to the companies attitudes and fears in revealing the, naturally important, strategic data. The companies rights are also in question in trying to make the ends of the triangles meet. Problems were also seen in the openness of the voluntary measures from the authorities point of view, as it was stated in one of the replies " In case of voluntary agreements authorities often do not have sufficient information to follow the process of analysing the energy situation and selection of measures" (Annex I, Table 91).

In general, the participating countries of the project saw the certain "lack of transparency" as one of the key difficulties in using the voluntary energy saving agreements in the permitting procedure. The data might yet be available at the branch level or in annual reports, or all data might be entirely

anonymous. If the company has nothing against publicity, specific data can be made public in agreement with the company (Annex I, Tables 100 and 101). The transparency, as it was pointed out, could also serve as a “watchdog” in systems lacking other sanctions. On the other hand, the participating countries suspected that the forms of energy use were not of such great interest to the public as the emission data.

10 ENERGY TAXES

10.1 General questions

Most of the Member States and future Member States in this project have energy taxes (except Ireland and Poland) (Annex I, Table 103). However, in those countries where the taxes are used, they are not necessarily created with environmental purposes in mind.

What is taxed varies in the different countries (Annex I, Table 104). Fuels are taxed in almost all of the countries. CO_2 is taxed in five countries (Denmark, Finland, Italy, the Netherlands and Sweden), gas in six countries (Austria, France, Germany, the Netherlands, Portugal and the United Kingdom), and coal in two of the countries (Germany and the United Kingdom).

In most of the countries the energy taxes are not connected to the nature of the installation (Annex I, Table 105). In Germany the tax for fuel used in installations for co-generation of power and heat is refunded at a rate of at least 70 per cent of usable energy per year. Only the United Kingdom has some exemptions: power generation, primary fuel to refineries, chlor-alkali and aluminium smelting.

Energy taxes could be taken into consideration while allocating allowances for emissions trading. If energy taxes are used, the revenues should be fed back into programmes that promote innovation. Lithuania pointed out in the seminar that emphasis should be put on how the revenues could be used for developing environmental protection. This was widely accepted by the working group.

EU-wide energy taxes have been proposed but a unanimous decision is required. The participants in the working group preferred a harmonisation of energy taxes and charges in Europe, and ideally worldwide.

The question of energy taxes is quite complex so a deeper investigation of this subject is not possible in this context.

10.2 Connections to other systems

None of the countries could see any direct connections between energy taxes and the permit procedure (Annex I, Table 107), while in Denmark there are some connections between energy taxes and voluntary agreements. France and Sweden also have ongoing discussions about the linkage between energy taxes and voluntary agreements. In the United Kingdom an 80 % discount on tax may be possible if entering into a voluntary agreement. In the Netherlands there is an agreement with glasshouse (horticulture) industry about a mitigated rate for a regular energy tax (REB). (Annex I, Table 106)

In Denmark a number of energy intensive enterprises have received a reimbursement, provided they agree to invest in energy saving programmes, under agreements negotiated between the individual enterprises and the authorities. The threat of a full tax liability in the case of non-compliance will act as an effective spur to encourage enterprises to abide by the agreements. Denmark believes that by applying the tax instrument towards the large body of enterprises, reserving the procedure of negotiated agreements for a small fraction of very exposed industries, and, at the same time, using the tax as an instrument in the case of non-compliance in the latter cases, the Danish scheme attempts to combine the best of the two instruments. (Energy Tax on Industry… 1995).

However, the Danish system has probably not considered such advantages in connections between energy taxes and voluntary agreements, maybe because the scheme for making agreements on energy saving is limited in time and will expire in a few years. (Annex I, Table 109). In Denmark very energy intensive companies would have difficulties operating on the competitive international market if taxes on energy use were too high. Therefore, a system has been worked out whereby energy intensive companies can reduce taxes by entering into a binding agreement on energy efficiency. In reality, the lower tax rate is the result of companies receiving a subsidy with which to pay the tax on energy use. To qualify for a lower tax rate, energy intensive companies can enter into an agreement with the Danish Energy Agency which is valid for up to three years. Agreements must be renewed after three years. The agreement system has been established to ensure that these companies use energy efficiently, even though as part of the agreement they are actually taxed at a lower rate. The agreement system is based solely on the green tax system, and cannot be seen as an individual instrument. If the companies were not to pay CO_2 taxes, there would be no incentive for entering into an agreement (The Danish Agreements… 1999).

Some problems and advantages have been seen in those countries that do not have any connections between energy taxes and the other systems. France assumes that there could be advantages in connecting voluntary agreements and the permit procedure, for example, to provide monitoring of energy efficiency. Whereas, there might be some constitutional problems in taxing industries unequally. Portugal supposes that taxes can be an incentive to promote agreements that will help companies to comply with the permits. However, some problems might occur because the taxes are not created for environmental purposes (Annex I, Tables 108 and 109).

Sweden supposes that the connection between energy taxes and voluntary agreements is beneficial, since taxes provide one important incentive to conclude agreements. Apart from this example, it seems as if the three should be kept as separate as possible at the level of implementation and enforcement (Annex I, Tables 108 and 109).

11 EMISSION-TRADING SCHEME

11.1 Greenhouse gas emissions trading scheme

The trading of emissions is a new instrument in environmental policy. The emission-trading scheme is a part of the Kyoto Protocol mechanisms to stop climate change. The European Commission has given a proposal for a directive of the European Parliament and of the Council establishing a trading scheme for greenhouse gas emission allowances within the community and amending the IPPC directive (COM/2001/0581 final). According to this proposal, the directive will at first cover only CO_2 emissions. This directive builds on and is linked to the IPPC directive. In the Member States there are only a few examples of emission-trading schemes, but in Denmark a scheme is already operating and the United Kingdom has a proposal for one (Annex I, Tables 110 and 111). CO_2 emissions are ideal and suitable for trading because they are relatively easy to monitor and they have truly global effects. Emissions trading is not yet generally considered as an instrument for other environmental substances, but there are emission-trading schemes for NOx and SO_2 in the United States and there are some plans to for such also in European countries (see Chapter 13 for more about emissions trading).

In the seminar one of the working groups concentrated on emissions trading. The participants discussed the "Non-paper on synergies between the EC emissions trading proposal (COM (2001)581) and the IPPC directive" (D(02)610019 given at 22.1.2002). In addition it was discussed whether CO_2 could at all be part of the IPPC permit. It was pointed out by the Commission that CO_2 is part of IPPC permitting because of the broad definition of "pollution" of the IPPC directive, even though it is not mentioned in the Annex III of the directive. But, according to the plans for emissions trading, in the future there can be no limit on CO_2 emissions in the IPPC permits. In any case, the greenhouse gas emissions trading will affect the application of the IPPC directive. Until now there has not been a clear picture of how the links between emissions trading and IPPC permitting will work. It was also pointed out that one of the advantages of emissions trading is that reductions can be achieved in a more cost-effective way because market forces will be operating.

A major challenge of emissions trading is how to allocate allowances in national plans. The link to energy efficiency requirements under the IPPC directive needs to be further developed, because it was felt that the link is not entirely clear at present. If the cost of production of energy rises as a result of emissions trading, this will assist energy efficiency requirements under the IPPC directive. It is important to consider the efficient use of energy in the IPPC permits even after the start of the trading scheme.

Of the Member States and the future Member States participating in the project only Denmark is using a CO_2 trading scheme at the moment and the United Kingdom from April 2002 (Annex I, Tables 110 and 111). Denmark is using the trading scheme for power plants. In the Netherlands the possibility of developing a national scheme is presently being studied (at the time of the survey). Austria, Finland, France, Germany, Portugal and Sweden are waiting for an EU-wide trading scheme. Ireland, Italy and Poland had no plans on the issue at the time when the questionnaire for this report was made.

Denmark, Finland, Lithuania, the Netherlands, Sweden and the United Kingdom suppose that the proposed EU-wide CO_2 trading scheme covering some of the most energy intensive IPPC sectors will affect their national plans regarding the permitting system (Annex I, Table 113). Sweden supposes that countries applying the IPPC directive will face the question that CO_2 emissions would have to be separated from the integrated permit procedure and the law on integrated permitting

would have to be altered. Denmark is interested in an EU-wide CO_2 scheme; however, the sectors proposed are different and may cause complications, moreover the new Danish law on tradable CO_2 quotas will have to be modified.

Legal constraints to introducing a CO_2 trading scheme at the national level were not seen as problematic to most of the countries (Annex I, Table 114). In some of the countries introducing such a scheme would require modifying the present legislation (France) or drafting totally new legislation (Germany). In other countries the question is not so clear cut and answers must wait until the EU-wide CO_2 trading scheme is completed, or the countries have studies of this question in progress (Lithuania, Portugal and the Netherlands).

11.2 Relations between a CO_2 trading scheme and the permit procedure

In order to ensure no conflict between an emission-trading scheme and the IPPC directive, the IPPC directive will have to be altered in such a way that the IPPC permit for an installation does not include CO_2 emission limits. However, the trading scheme directive might only partially restrict the efficient use of energy that the IPPC directive requires.

The Member States and future Member States are uncertain about how to take into account tradable emission quotas in the permitting procedure (Annex I, Table 112). This is natural because only a few countries have national tradable emission quotas in use at the moment and because the EU directive is still in the preparatory stage. In Germany there have been discussions on future emissions trading and it is assumed that in the future companies will not be allowed to ignore the BATs. Germany surmises that because of the BATs there will be minimum requirements on energy efficiency measures in each installation. The United Kingdom supposes that the same applies as for voluntary agreements.

One major challenge is how to allocate allowances in national plans. The link to energy efficiency requirements under the IPPC directive must be clarified, as it is not entirely clear at present. If the cost of energy production rises as a result of emissions trading, this will make the energy efficiency requirements under the IPPC directive more attractive. It is important to continue to consider the efficient use of energy in the IPPC permits.

12 CONCLUSIONS

12.1 Key difficulties in the consideration of energy efficiency

Energy efficiency is an issue to be considered among other environmental impacts in the permitting procedure. Energy issues are very complex and highly experienced people are required for assessment and evaluation. Industry is likely to employ such persons whereas authorities, including permitting bodies, not always possess such competence. In this project, according to the replies to the questionnaire and the discussions in the seminar, the following issues were seen as key difficulties.

1) The definition

Defining energy efficiency in practice is considered to be very difficult because of the differences in the nature of the installations to which energy efficiency applies. Overall guidance on energy efficiency is not possible, but the solution could be found in sector-wise guidance and efficiency could be looked at on a case by case basis. The definition of efficient use of energy must balance the reduction of energy use with the other environmental impacts; reducing emissions of pollutants can for example, increase energy consumption. Also, the lack of references and inspection methods make it more difficult. The economic aspects play a more dominant role than in the other environmental fields. Energy efficiency in environmental permitting is not a concept familiar to the environmental authorities. There is, therefore no experience of how to define efficient energy use in each individual case.

2) Binding permit conditions

One of the most difficult questions was defining a binding permit condition for energy efficiency. In most cases it is not considered possible to set up enforceable conditions for energy efficiency in a permit for an individual installation. The energy data could also be confidential. The permit conditions are not always concrete enough. It is difficult to make a specific condition for energy usage, for example, energy used per produced unit, because of many varying variables, such as basic consumption, several product lines and fast changes from one product to another.

3) Enforcement and supervision

As a clear definition of energy efficiency is not available, direct enforcement and supervision by environmental authorities is more difficult. Too general and vague permit conditions are not enforceable and they are difficult to supervise. Non-binding permit conditions are not enforceable at all. There is also a lack of knowledge among inspectors.

4) Publicity/confidentiality

In some countries industry is prepared to disclose more information than in others and it is a slow process to change attitudes. Data on energy issues might be considered as sensitive. The operator can of course separate the information in the applications into confidential and non-confidential. In France the energy authority will not publish any results on energy consumption if the number of operators is below three or one operator represents about 70 % of the consumption. In Austria concrete data are only available for legitimated parties in the permit procedure.

5) Relations to emissions trading

Greenhouse gas emissions trading will affect the application of the IPPC directive. Until now there has not been a clear picture of how the links between emissions trading and IPPC permitting will work. The interpretation has been that CO_2 is not applicable in the permit procedure. It was anyhow pointed out that CO_2 falls within the IPPC directive's broad definition of pollution (Art. 2 (2)).

6) Voluntary systems versus permit

Also the interrelationship between the voluntary agreements and permit conditions is part of this problem. The targets of voluntary agreements and the means of permitting do not always coincide, for example, the requirement of continuous improvement is too vague as a permit condition. The permit conditions should be based on BAT. The participants had different opinions on the use of voluntary energy saving agreements as a part of the permit. Some countries saw it as impossible to link the voluntary agreement system and permit system together, while some thought that there could be a partial connection for some detailed issues.

7) Lack of information and expertise

Generally there is a lack of expertise and information on how to apply energy efficiency in the permit procedure. The BREFs contain some but not enough process specific energy information. The participants in the seminar pointed out that there is not enough co-operation between energy and environmental authorities. The auditing information from the voluntary energy saving agreement is not available in formats that could be used in the permit procedure. There is not enough training for practical implementation of the energy efficiency demand.

12.2 Good practice

1) The definition

It is good practice to create practical guidelines to define energy efficiency in order to clarify the issue. Overall guidance of energy efficiency is not possible, but the solution could be found in sector-wise guidance and, in general, energy should be looked at on a case by case basis. In France there are some sector-wise general binding rules and in the United Kingdom non-statutory guidance. Several approaches are good and can be used in parallel. As good practical solutions benchmarking, pinch technology and energy balance checking were mentioned.

2) Beforehand discussions and application forms

A good application is a requirement for a smooth permitting process. In order to create good applications prior information exchange between the operator and the authorities is good practice. A good practice would be that, application forms where the information requirements concerning energy efficiency are listed should be available on the Internet. In Finland and in Portugal there are such application forms. The Finnish application form is in Annex III.

3) Energy efficiency as a permit condition

This project could not identify any good practice for establishing binding permit conditions. However, the final report gives some concrete examples of more or less binding permit conditions. The permit condition or the text in the descriptive part could also be linked to voluntary energy saving agreements, which functions very well in the Netherlands and Finland.

4) BREFs

It is good practice for the environmental authorities to use the BREFs which contain a considerable amount of information on energy. The most specific information is available on energy consumption. There is less data on energy saving and energy recovery techniques.

5) Monitoring and supervision

Monitoring and supervising of energy efficiency in permits is very difficult due to often general and vague permit conditions. In inspections of energy efficiency good practice is self control under the precondition that the inspector can influence the monitoring practices of the operator. Because of the lack of energy knowledge among the permit authorities and inspectors, there is a need for more co-operation between the energy and environmental authorities.

6) Audits

Information on energy audits can be used as a tool to give information to the environmental authorities. As in Ireland the planning of the audit of energy efficiency of the site should be developed together with the environmental authority. The audit report should also be available on site for environmental inspectors and the summary of audit findings should be submitted as a part of any annual environmental report.

7) Co-operation

Co-operation between energy and environmental authorities in energy efficiency issues is good practice and should be developed. Each authority has special knowledge that the others may need or could use in their work. Especially in this case development of co-operation is highly recommended since energy efficiency is not a very clear and simple concept. The development can be done in several ways such as joint seminars, working groups and co-operation in drafting the environmental legislation. Audit reports can be used as a tool to give information to the environmental authorities. Also, co-operation between the Member States and future Member States in implementing the requirement on energy efficiency is good practice and the IMPEL Network as such promotes this kind of co-operation.

8) Access to information and public participation

It is good practice to have transparency in environmental permitting concerning energy efficiency, too, so that the Aarhus Convention really is implemented in the same way in different countries. Good practice is that the application forms and the permits are available on the Internet. The development of general guidelines for what can be declared as confidential is also essential. Transparency in all voluntary measures is also good practice.

9) Voluntary measures

The environmental management systems provide a good tool for managing energy issues. The policy and targets set by the company should not be transferred as such to the permit. This could negatively affect the companies' interest in setting targets and even in using environmental management systems. There should also be clear and attractive incentives for the companies to join the management systems.

It is in itself good practice when voluntary energy saving agreements are made for most of the industries in a country, which should lead to energy savings and the efficient use of energy. Concrete measures are already included in the agreements and should be followed up.

10) Training

As the environmental authorities in general do not have enough knowledge of energy efficiency it is good practice to provide general training for environmental authorities and to raise the level of knowledge. It is also good practice to create fact sheets which contain information on energy efficiency as a tool for environmental permitting, supplementing the BREFs and any national BAT guidance. Good practice is that the environmental authorities are provided with information from the voluntary energy audits made by energy experts.

12.3 Proposals for further IMPEL work

- There are not many concrete examples of permit conditions concerning energy efficiency from the participating countries. This issue should be followed up after some years when a significant share of all large industries have had their new permits granted.
- General guidelines of what can be considered as confidential in the permit procedure especially in energy issues should be developed.
- Sector specific BREFs with more information on energy efficiency issues, a horizontal energy efficiency BREF and a cross-media BREF where the emissions are linked also to the need of energy should be developed.
- The link between the permit and voluntary measures should be clarified.
- The understanding of the link between the permit and the future greenhouse gas emissions trading scheme should be improved.
- There is also a need for guidelines on the inspection procedure to be used in the auditing of energy efficiency.

ACRONYMS AND ABBREVIATIONS

AC	Alternating current
ACkWh	Kilowatt hour (alternating current)
ACAE	European Automobile Manufacturers Association
ADEME	Agence de l'Environnement et de la Maitraise de l'Energie, Agency for the Environment and Energy
Adt	Air dry tonne
AMVB	Smaller Dutch installations with GBRs
ANPA	Italian National Environmental Agency
BAT	Best Available Technique
BOF	Basic oxygen furnace
BOD	Biochemical oxygen demand
BREF	Best Available Techniques Reference Document
C	Carbon
ºC	Degree Celsius
CCGT	Combined Cycle Gas Turbine
CCL	Climate Change Levy
CCLA	Climate Change Levy Agreement
CDM	Clean development mechanism
CHP	Combined heat and power
Cl_2	Chlorine
CO_2	Carbon dioxide
COD	Chemical oxygen demand
COG	Coke oven gas
COM	European Commission
DC	Direct current
DRIRE	French Regional Direction of Research, Industry and the Environment
EAF	Electric arc furnace
EC	European Council
ELV	Emission Limit Value
EMAS	Eco-Management and Audit Scheme (EC regulation 761/2001)
EMS	Environmental management system
ENEA	Italian National Agency for New Technology, Energy and the Environment
Environment DG	European Commission Environment Directorate-General
EPA	Environmental Protection Agency (Denmark, Ireland and Sweden)
ETS	Emissions trading scheme
EU	European Union
EURELECTRIC	Union of the Electricity Industry
GBR	General binding rule
GHG	Greenhouse gas
GJ	Gigajoule
HELCOM	Helsinki Commission
IMPEL	European Union Network for the Implementation and Enforcement of Environmental Law
IPPC	Integrated Pollution Prevention and Control (directive 96/61/EC)
ISO 14001	The Standard of the International Organization for Standardization (ISO) for environmental management system
J	Joule

JI	Joint implementation
kWh	Kilowatt hour (1 kWh = 3.6 MJ)
LS	Liquid steel
MAC	Marginal abatement cost
MEC	Marginal external cost
MJ	Megajoule
MJA	Dutch long-term agreement on energy efficiency
Motiva	Energy Information Centre for Energy Efficiency and Renewable Energy Sources, Finland
Ni	Nickel
NO_x	Nitrogen oxide
PJ	Petajoule
REB	Dutch Regular Energy Tax
Novem	The Netherlands' Agency for Energy and the Environment
PAMs	Policies and measures
PARCOM	Paris Commission
RCF	Recycled fiber
RWI	Rheinish-Westfälisches Institut für Wirtschaftsforschung Essen
SAVE	Specific Actions for Vigorous Energy: a programme adopted by the European Commission in October 1991
SEC	Specific energy consumption
SO_2	Sulphur dioxide
t	Metric tonne
toe	Oil equivalent tonnes
TWG	Technical working group
VDI	Verein Deutscher Ingenieure, Assosiation of German Engineers
VOC	Volatile organic compound

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