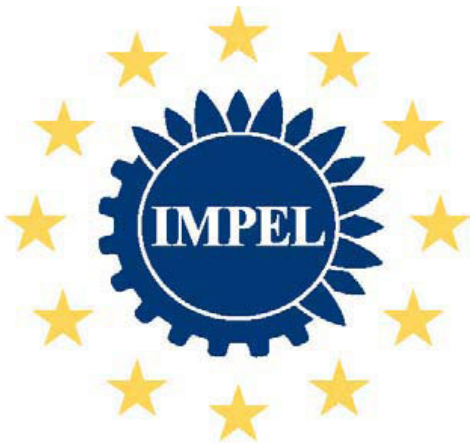
ENERGY EFFICIENCY IN PERMITTING AND INSPECTION

DEVELOPMENT OF A TEMPLATE FOR DOCUMENTS AND DATA REQUIRED REGARDING ENERGY EFFICIENCY IN THE PERMIT APPLICATION

(2011/2012)

FINAL REPORT 2012/04

10 October 2013



European Union Network for the Implementation and Enforcement of Environmental Law

In cooperation with

BiPRO

Beratungsgesellschaft für integrierte Problemlösungen

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Table of Content

1 Introduction

1.1 Project background

Energy is a priority issue within the EU. The EU 'Climate Change and Energy Package' foresees an increase in energy efficiency by 20 %, a reduction of energy consumption by 20 % and a reduction of greenhouse gases by 20 % till 2020. The new Energy Efficiency Directive (Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency, amending directives 2009/125/EC and 2010/30/EU and repealing directives 2004/8/EC and 2006/32/EC) brings forward legally binding measures to step up Member States' efforts to use energy more efficiently at all stages of the energy chain – from the transformation of energy and its distribution to its final consumption. It also requires Member States to set indicative national targets for 2020 (at least achieving new savings of 1.5 % of the annual energy sales to final customers). It is expected that the Energy Efficiency Directive will make a significant contribution towards putting the EU on track towards its energy efficiency target for 2020.

Specific reference to the use of energy is given in the IPPC-Directive 2008/1/EU and the Directive on Industrial Emissions 2010/75/EU which replaces the former one. Operators of industrial installations covered by Annex I of the Directive have to ensure that energy is used efficiently.

IMPEL activities

A good deal of fuels and electricity is used for industrial processes. The easiest and most effective way to contribute to the EU's energy efficiency target by 2020 is not to use the fuel or electricity. One instrument to support the progress in this field is to tackle the item in permit procedures. It might be most effective for new installations. It has to be addressed at an early stage because then several planning options are open and on top of that the benefit is the highest.

In 2002/03 a project on energy efficiency in environmental permits was carried out by IMPEL with Finland as lead country (see http://impel.eu/projects/energy-efficiency-in-environmental-permits/). After eight years and the development of the horizontal BREF document on "Energy Efficiency" IMPEL had identified that the item of energy efficiency in permitting and inspection needed to be explored again.

A second project on energy efficiency in permitting and inspections was carried out in 2010 (see http://impel.eu/projects/energy-efficiency-in-permitting-and-inspections/).

The evaluation of the situation in 2010 showed that during the last years only minor changes have occurred in the consideration of energy efficiency issues in permitting and supervising procedures. The IMPEL project carried out in 2010 identified 7 major challenges related to energy efficiency:

- In the IPPC Directive it is not stipulated how energy efficiency should be addressed.
- Information on energy efficiency in sector BREFs is not concrete and precise enough and the horizontal BREF on energy efficiency is complex and has not been utilised much.

- Lack of technical expertise in authorities and companies.
- Lacking or only occasional cooperation between energy and environmental authorities.
- There is no general approach in the Member States to handle the item of energy efficiency in the permit revision.
- Problems with definition of system boundaries.
- Unclear influence of other instruments like voluntary agreements, energy management systems, taxes and emission trading systems (ETS) on energy efficiency of installations.

For the project participants it was quite clear that Best Available Techniques (BAT) should be used not only for emissions and waste prevention / minimisation but also for energy efficiency. As practical and applicable supporting material was needed a step by step approach was chosen. For the future work of IMPEL in the field of energy efficiency the following proposals were made:

- Development of a template for documents and data required regarding energy efficiency in the permit application.
- Workshop on assessment of the application documents regarding energy efficiency (for new and existing installations) and development of permit conditions based on BREFs using a sector specific approach (e.g. food sector, metal processing sector, paper sector, chemical sector, waste treatment plants).
- Training course for dealing with energy efficiency in permitting and inspection.
- Integrating the discussion on energy efficiency in other sector specific IMPEL-projects (e.g. pig farming).

New developments in the EU

The development of the template had to be based on the existing EU legislation on permitting and inspection of industrial installations that was analysed at the beginning of the previous IMPEL project on energy efficiency. For this project a short update of the new developments had to be made.

Industrial Emissions Directive 2010/75/EU

In 2010 the new Directive on Industrial Emissions was adopted. It strengthens the application of Best Available Techniques (BAT) across the EU, particularly by restricting divergence from BAT to specific cases and placing greater emphasis on justifying the conditions laid down in the permits.

According to Article 11 of the Directive the installation shall be operated so that energy is used efficiently and best available techniques are applied. In order to determine best available techniques and to limit imbalances in the Union as regards the level of emissions from industrial activities BAT reference documents have been drawn up and the key elements of these documents ("BAT conclusions") are adopted by a decision of the European Commission. These **BAT conclusions** shall be the **reference for setting permit conditions (**Article 14.3) and delineate the environmental performance of installations, including the efficient use of energy.

Since the permit must include all measures necessary for compliance with the requirements of Article 11 environmental permits shall comprise conditions about energy efficiency as well, where appropriate.

However, the Directive gives Member States the option not to impose requirements relating to energy efficiency on combustion units or other units emitting carbon dioxide on the site for activities listed in Annex I to Directive on the European emission trading scheme. Nevertheless the Commission recommends in recital (28) of the Energy Efficiency Directive that actual energy efficiency levels should be monitored and compared with the relevant levels associated with the application of the Best Available Techniques.

Energy Efficiency Directive

Specifically, the new Directive obliges large enterprises to carry out energy audits (from December 2015 onwards, every 4 years). Energy audits should take into account relevant European or International Standards, such as EN ISO 50001 (Energy Management Systems), or EN 16247-1 (Energy Audits), or, if including an energy audit, EN ISO 14000 (Environmental Management Systems). Enterprises which are implementing an energy or environmental management system - certified by an independent body according to the relevant European or International Standards - are exempted from this obligation provided that the management system includes an energy audit. For small and medium-sized enterprises (SMEs) Member States should develop programmes to encourage SMEs to undergo energy audits.

Further requirements are:

Until end of 2015, Member States shall carry out a comprehensive assessment of the potential for the application of high-efficiency cogeneration and efficient district heating and cooling.

For new or existing thermal electricity generation installations with a total thermal input exceeding 20 MW a cost-benefit analysis for the operation of the installation as a high-efficiency cogeneration installation has to be carried out.

With regard to new or refurbished industrial installations with a total thermal input exceeding 20 MW generating waste heat at a useful temperature level, the utilisation of this waste heat (e.g. for cogeneration or connection to a district heating and cooling network) has to be examined.

When planning a new or extending an existing district heating and cooling network (by operating a new or refurbishing an existing 20 MW plant) the cost and benefits of utilising the waste heat from nearby industrial installations have to be assessed.

To fulfil the above requirements Member States shall adopt suitable authorisation criteria (Article 14).

Ecodesign Directive 2009/125/EC

The Ecodesign Directive establishes a framework for the setting of Community ecodesign requirements for energy-related products with the aim of ensuring the free movement of such products within the internal market. The Directive provides for the setting of requirements which the energy-related products covered by implementing measures must fulfil in order to be placed on the market and/or put into service. It contributes to sustainable development by increasing energy efficiency and the level of protection of the environment, while at the same time increasing the security of the energy supply.

Basing on working plans an increasing number of several implementing measurements are initiated or will be started in the next years. Currently 16 commission regulations have come into force and a number of more than 20 several regulations are in progress.

The primary target group of the specific regulations are the manufacturers because their products must meet certain efficiency criteria for the benefit of consumers. In the case of cross-sectional technologies like electric motors or pumps the equipment manufacturers are part of both sides. At the one hand they manufacture an energy-related product, at the other hand they consume or use energy-related sub-technologies.

The following list of energy-related products is especially interesting for industry and commerce as user: room air conditioning, electric motors, circulators, fans, water pumps, commercial refrigerators and freezers, uninterruptible power supplies (UPS), compressors, transformers, industrial and laboratory furnaces and ovens.

Energy Labeling

In line with the Ecodesign Directive, the Labelling Directive 2010/30/EU shall apply to energy-related products which have a significant direct or indirect impact on the consumption of energy and, where relevant, on other essential resources during use. The Directive establishes a framework for the harmonisation of national measures on end-user information, particularly by means of labelling and standard product information, on the consumption of energy and where relevant of other essential resources during use, and supplementary information concerning energy-related products, thereby allowing end-users to choose more efficient products.

Traditionally, only electrical household appliances like washing machines or refrigerators have been labelled. But it is planned to label products that are also interesting for enterprises: boilers, water heaters, office lighting, commercial refrigerators and freezers, professional washing machines, dryers and dishwasher, air-conditioning and ventilation systems.

Energy Management Systems (EnMS)

Systematic energy management is an appropriate instrument for continually improving energy efficiency in companies. Concerning energy efficiency the most important systems in Europe are ISO 50001, ISO 14001 and EMAS.

The ISO 50001 standard, which was published in June 2011 defines the first international standard for an energy management system. It specifies requirements to enable an organisation to develop and implement a policy and objectives which take into account legal requirements and information about significant energy aspects. It is intended to apply it to all sectors and sizes of organisations and companies.

EN 50001 can be used independently or integrated with any other management system. The structure of this standard is similar to the structure of ISO 14001. It is based on methodology known as Plan-Do- Check- Act (PDCA).

The implementation of an energy management system specified by this standard is intended to result in improved energy efficiency. Therefore, it is based on the premise that the organisation will periodically review and evaluate its energy management system to identify opportunities for improvement and their implementation. The rate, extent and timescale of this continual improvement process are determined by the organisation in the light of economic and other circumstances. Consequent implementation of the energy management system is intended to result in improvements in energy performance.

ISO 14001 versus ISO 50001: The requirements for an ISO 50001 – EnMS were substantially developed from ISO 14001. A company with an ISO 14001 – MS that wants to introduce an ISO 50001 – EnMS should review the relevant parts to ensure that they adequately reflect energy-related issues.

ISO 50001 and EMAS: ISO 14001 is an essential part of the EMAS-regulation, but as the EMAS-regulation goes beyond the regulation of ISO 14001, fewer additional requirements are necessary with an already existing EMAS validation when introducing ISO 50001. Certification according to ISO 50001 is relatively easy for EMAS companies. In most cases it is only necessary to make some adjustments with regard to specific terms for energy consumption and efficiency.

1.2 Project objectives

This project aims at the development of a template for documents and data required regarding energy efficiency in the permit application. The results of the project will help to promote the enforcement of the energy efficiency provision of the IED, the BREF Energy Efficiency and the chapters of other BREFs related to energy efficiency and perhaps national provisions concerning energy efficiency.

The main objectives of the project can be summarised as to:

- identify how the requirements of the BREF Energy Efficiency and the chapters of other BREFs related to energy efficiency need to be integrated into the permitting/inspection procedures
- explore what kind of information is needed in permit applications (e.g. description of measures, fuels, energy efficiency indicators etc.)
- find out what is important for the consideration of applications in relation to energy efficiency

- exchange information on existing guidance material
- discuss benchmarking and relevant indicators

1.3 Participants

The IMPEL project on energy efficiency in permitting and inspections carried out in 2010 indicated that it would be favourable to involve experts in the field of enforcement of requirements concerning energy efficiency and with in depth knowledge of the related BREF documents, IPPC and IE Directive and invite permit writers and inspectors with experience in the enforcement of energy efficiency provisions to contribute to the project. Further, it was proposed that the IMPEL Secretariat and the European Commission should be invited as well to provide their input to the project.

- ***Project Team***

The project team consists of 6 representatives from 5 EU Member States: Susanna Eberhartinger-Tafill from Austria, Sirpa Salo-Asikainen Finland, Marianne Ripka and Hans Erling Lundmand Jensen from Denmark, Judite Dipane from Latvia and the Project Manager, Gisela Holzgraefe from Germany.

The IPPC Bureau Seville nominated Mr. Canova as a responsible contact person for the project.

- ***Consultant***

Further, it was foreseen that a representative of a consulting agency with profound knowledge of BREF requirements and IPPC permitting and inspection supports the project team. In a tender procedure and phone interviews BiPRO GmbH, Munich was identified as the most suitable and most qualified consultancy for this task.

- ***Expert/Working Group***

In addition, 6 representatives from different institutions contributed to the project in 2011 (i.e. Expert Group) and 4 experts provided input to the 2012 project phase (i.e. Working Group).

Expert Group (2011)	
Andreas Werner (AT)	Vienna University of Technology (iron and steel sector)
Jaakko Kuisma (FI)	Southern Finland Regional State Administrative Agency (large combustion plants)
Volker Hoenig (DE)	German Cement Works Association (cement industry)
Michael Engelhardt (DE)	Federal Association of the German Glass Industry (glass sector)
Peter Maagøe Petersen (DK)	Viegand & Maagøe Aps. (food, drink and milk sector)
Sebastian Kleiner (DE)	Landwirtschaftskammer Schleswig-Holstein (intensive rearing of poultry and pigs)
Working Group (2012)	
Alessandra Bellomi (IT)	Arpa Lombardia (Regional Agency for the Protection of the Environment)
Matteo Valota (IT)	Arpa Lombardia (Regional Agency for the Protection of the Environment)
Winfried Ebner (DE)	Agency for Agriculture, the Environment and Rural Areas of Schleswig-Holstein
Sven Helmig (DE)	Agency for Agriculture, the Environment and Rural Areas of Schleswig-Holstein

1.4 Methodology

After an in depth discussion with the Expert Group a template for documents and data required regarding energy efficiency in the permit application has been developed. Further, the applicability of the developed template was tested in practice and the document adjusted based on the received feedback from experienced permit writers and inspectors (Working Group).

For the evaluation of the requirements of the BREF Energy Efficiency and the chapters of other BREFs related to energy efficiency that have to be integrated into the procedures the Expert Group had two meetings in 2011: The first meeting for the discussion of the item in general and the determination of work packages and the second meeting for the discussion of results and further development of the template for documents and data required regarding energy efficiency in the permit application. It was decided to have one general application form for energy efficiency and sector specific supplements.

Three Working Group meetings were organised in 2012. The first meeting discussed the item in general and determined work packages for the Working Group members, taking into account the results of the Expert Group discussions during 2011 as well as considered the already drafted documents. The second meeting was devoted to the discussion of the results and evaluation of the practical tests (permit procedures in different EU Member States).

2 Template for documents and data required regarding EE in permit applications

The Project Team decided to focus on 5 different industrial sectors, in particular:

- Manufacture of glass
- Iron and steel production
- Cement, lime and magnesium oxide production
- Food, drink and milk industry
- Intensive rearing of poultry and pigs

The sectors were selected based on a number of criteria (e.g. BAT conclusions already available, up to date BREF documents, etc.) and not exclusively in relation to their energy intensity.

Further, the Project Team decided to develop the initial draft application form for energy efficiency based on the information from the:

- [IMPEL 2002] *Energy Efficiency in Environmental Permits (i.e. Annex III: Finnish application form for energy efficiency)*
- [IMPEL 2011] *Energy Efficiency in Permitting and Inspection (i.e. Compilation of answers to the questionnaire; Examples from the Netherlands: (1) Obligations in the permit and (2) Energy monitoring in the energy permit)*

The developed draft application form for energy efficiency was disseminated to selected experts in advance to the Expert Group meeting. During the Expert Group meeting it was concluded that the draft application form can be used for all selected industrial sectors. However, it was also agreed that additional sector specific information is required (i.e. sector specific supplements to the general application form). For this purpose energy related information contained in the associated BREF documents was used and experts for each industrial sector were involved to review the developed documents .

In 2012 the verified application form were tested, as far as possible, at the beginning of and/or during the permitting procedures. Further, it was decided to test the documents after the actual permitting procedure only if no running permitting procedures were available. For certain sectors, where test candidates were available but no sector specific supplements had been developed, only the general application form for energy efficiency was evaluated.

The following sub-chapters contain the general template for documents and data required regarding energy efficiency in the permit application (see Chapter 2.1) as well as the sector specific supplements to the general application form for the selected sectors (see Chapters 2.2.1 - 2.2.5).

2.1 General application form for energy efficiency

Please note: All submitted information will be treated confidentially if the operators ask for

1. CONTACT INFORMATION

Name of the company and type of business:
Assessment of energy efficiency relates to *(name and address)*:
If relevant, provide further information *(e.g. respondent's name and position within the company, etc.)*:

2. ENERGY SAVING AGREEMENT AND MANAGEMENT SYSTEMS

Does the company have an energy saving agreement? ☐ **Yes** *(if yes, indicate with whom and for which years)*: ☐ **No** *(provide brief justification):*
Does the company have an Environmental Management System *(EMS)*? ☐ **Yes** *(if yes, specify e.g. ISO 14001, EMAS, non-certified EMS) :* ☐ **Planned** *(which, when?)*: ☐ **No** *(provide brief justification):*
Does the company have an Energy Management System (EnMS)? ☐ **Yes** *(if yes, specify e.g. ISO 50001 and indicate the main targets e.g. energy reduction targets) :* ☐ **Planned** (*which, when?)*: ☐ **No** *(provide brief justification) :*

3. SYSTEM BOUNDARIES

Please provide a simplified system flow chart of the installation (including major processes and energy flows) and indicating the exact system boundaries for the calculation of energy efficiency. A more detailed flow chart and further details (e.g. number and position of measurement devices) can be included in section 12 of the general application form for energy efficiency. ☐ *further details are included in section 12*

4. TOTAL CONSUMPTION FIGURES

Electricity	☐ Estimated value (year): ☐ Measured value (year):	Further explanations
	Net consumption of Electricity (MWh): purchase (MWh): sales (MWh): *Are selling certificates available?:*	
Heat	☐ Estimated value (year) ☐ Measured value (year)	Further explanations
	Net consumption of Heat (MWh): purchase (MWh): sales (MWh): *Are selling certificates available?:*	
Fuels	☐ Estimated value (year) ☐ Measured value (year)	Further explanations
	purchase (MWh_{pa}): sales (MWh_{pa}): *Are selling certificates available?:* *Please indicate which kind of fuels:*	
Technical Gases	☐ Estimated value (year) ☐ Measured value (year)	Further explanations
Electricity, Heat, Fuels *(generated and used on the site)*	☐ Estimated value (year) ☐ Measured value (year)	Further explanations
Renewable Energy Source	☐ Estimated value (year) ☐ Measured value (year)	Further explanations

**further details and a corresponding energy flow diagram can be provided in section 13 and 15 of the application form*

5. ENERGY CONSUMPTION IN MAIN PROCESSES *(at least 10 % consumption share, respectively)*

Process 1:	☐ Estimated value: ☐ Process part energy consumption (year):	Further explanations
	electricity (MWh): heat: ○ steam (MWh): ○ hot water (MWh): ○ other heat (MWh): fuel (MWh_{pa}):	
	Process part output (in t/a or other):	
Process 2:	☐ Estimated value: ☐ Process part energy consumption (year):	Further explanations
	electricity (MWh): heat: ○ steam (MWh): ○ hot water (MWh): ○ other heat (MWh): fuel (MWh_{pa}):	
	Process part output (in t/a or other):	
Process 3:		

**further details and a corresponding energy flow diagram can be provided in section 13 and 15 of the application form*

6. ENERGY GENERATION PER BOILER *(in case relevant)*

Boiler 1	☐ Boiler estimated value ☐ Boiler energy generation in (year)	Further explanations (e.g. measurement methods)
	Use: fuel (MWh_{pa}) electricity (MWh) Output: electricity (MWh) heat ○ steam (MWh) ○ hot water (MWh) ○ other heat (MWh)	
Boiler 2	☐ Boiler estimated value ☐ Boiler energy generation in (year)	Further explanations (e.g. measurement methods)
	Use: fuel (MWh_{pa}) electricity (MWh) Output: electricity (MWh) heat ○ steam (MWh) ○ hot water (MWh) ○ other heat (MWh)	
Boiler 3		

7. ENERGY CONSUMING EQUIPMENT

Is the installed energy using equipment compliant with the ecodesign requirements laid down in the Ecodesign Directive (e.g. air conditioning and ventilation systems, heating equipment, refrigerating and freezing equipment, water using equipment, electric motors, industrial fans, el. pumps etc.)?

8. CALCULATION OF ENERGY EFFICIENCY

Please provide calculation details (i.e. formula to calculate EE, scope of the formula and a definition of relevant parameters of the formula, etc.). Detailed information can be attached in section 13 and 14 of the general application form for energy efficiency.

☐ *further details are included in sections 13 and 14*

9. INDICATORS TO MONITOR CONTINUOUS EE IMPROVEMENTS

Please specify indicators in place to monitor continuous EE improvements for single processes and the entire facility/installation. If possible, provide information/data for the last 3 years.

10. STEPS TAKEN DURING THE LAST THREE YEARS TO IMPROVE EE and ACHIEVED RESULTS

(for existing installations)

Please specify for each step/measure the implementation time, estimated energy saving, investments, etc.

11. PLANNED STEPS TO IMPROVE ENERGY SAVING *(for existing and new installations)*

Please specify for each step:

- implementation time:

- estimated energy saving:

- cost of the additional investment:

- the expected economic life-time:

- the annual saving of energy costs based on the energy tariffs valid at the point of assessment:

- an estimation of possibly other costs and income related to the energy saving:

- the payback time based on the additional investment costs and the income:

- a survey of the possible organisational and management as well as maintenance measures concerning the steps mentioned above:

12. SYSTEM BOUNDARIES

Please provide a detailed system flow chart of the installation (including major processes, etc.) and clearly indicating the system boundaries for the calculation of energy efficiency. If possible, provide information related to the measurement devices (e.g. number and position of devices).

13. DEFINITION OF MAIN ENERGY FLOWS/PARAMETERS *(needed for EE calculation)*

Main energy flows/parameters	Definition	Further comments/explanations

14. CALCULATION DETAILS FOR THE DETERMINATION OF ENERGY EFFICIENCY

Please provide calculation details for the determination of energy efficiency (i.e. formula to calculate EE, scope of the formula etc.)

15. ENERGY FLOW DIAGRAM *(if possible as sankey diagram)*

Please include an energy flow diagram (if possible as sankey diagram).
Various software tools can be used to draw sankey diagrams (e.g. STAN 2.0, developed by the Vienna University of Technology, can be downloaded free of charge from http://www.stan2web.net/index.php?option=com_content&view=article&id=15&Itemid=138)

2.2 Sector specific supplements to the general application form for energy efficiency

2.2.1 Manufacture of glass

Site specific issues affecting the energy consumption of fossil fuel fired furnaces

Please indicate the furnace type, capacity, throughput and the age of the furnace. If possible indicate further site specific issues affecting the energy consumption:		
Site specific issues		**Explanations/Comments** (if required)
Furnace type (*e.g. cross-fired furnace with regenerative air preheating, recuperative furnace, oxy-fuel fired furnace, etc.*)		
Furnace capacity [t]		
Furnace throughput [t/d]		
Furnace age [years]		
Further site specific issues (*e.g. melting area, glass bath depth, length/width ratio of the tank bath, etc.*)		

Specific direct energy consumption for melted glass

Please indicate the furnace type/capacity, differentiate fuels/electricity and indicate the total specific energy consumption for melted glass.			
Sector	**Furnace type/capacity**	**Fuels/Electricity**	**GJ/tonne melted glass ([1])**
Container Glass			
Flat Glass			
Continuous Filament Glass Fibre			

Please indicate the furnace type/capacity, differentiate fuels/electricity and indicate the total specific energy consumption for melted glass.			
Sector	**Furnace type/capacity**	**Fuels/Electricity**	**GJ/tonne melted glass ([1])**
Domestic Glass			
Special Glass			
Mineral Wool			
High Temperature Insulation Wool			
Frits			
([1]) Data refers to the furnace energy consumption			

Specific direct energy consumption for finished products

Please indicate the major processes, differentiate fuels/electricity and indicate the total specific energy consumption for finished products.			
Finished products (e.g. bottles and jars, flaconnage, borosilicate glass, glass wool, stone wool, etc.)	**Major processes applied**	**Fuels/Electricity**	**GJ/tonne finished product ([2])**

Please indicate the major processes, differentiate fuels/electricity and indicate the total specific energy consumption for finished products.			
Finished products (e.g. bottles and jars, flaconnage, borosilicate glass, glass wool, stone wool, etc.)	**Major processes applied**	**Fuels/Electricity**	**GJ/tonne finished product ([2])**
([2]) Data refers to the major processes needed to manufacture finished products			

Techniques to reduce specific energy consumption

Is one of the following techniques /combination of the following techniques applied in order to reduce specific energy consumption? Please also provide further explanations/justifications.		
Techniques	**Yes** (*provide brief explanation*):	**No** *(provide brief justification):*
Process optimisation through the control of the operating parameters		
Regular maintenance of the melting furnace		
Optimisation of the furnace design and the selection of the melting technique (*if applicable*)		
Application of combustion control techniques (*if applicable*)		
Use of increasing levels of cullet (*where available and economically and technically viable*)		
Use of a waste heat boiler for energy recovery (*where technically and economically viable*)		
Use of batch and cullet preheating (*where technically and economically viable*)		

2.2.2 Iron and steel production

Techniques to reduce specific energy consumption

Is a combination of the following techniques applied in order to reduce thermal energy consumption? Please provide further explanations/justifications.		
Technique	**Yes** (*provide brief explanation*):	**No** *(provide brief justification):*
Improved and optimised systems to achieve smooth and stable processing, operating close to the process parameter set points by using: ▪ process control optimisation including computer-based automatic control systems ▪ modern, gravimetric solid fuel feed systems ▪ preheating, to the greatest extent possible, considering the existing process configuration		
Recovering excess heat from processes, especially from their cooling zones		
Optimised steam and heat management		
Applying process integrated reuse of sensible heat as much as possible		

Important items to improve the overall energy efficiency of integrated steelworks

Are the following items in place in order to improve energy efficiency? Please provide further explanations/justifications.		
Items	**Yes** (*provide brief explanation*):	**No** *(provide brief justification):*
Optimising energy consumption *(e.g. change in energy supply, optimising tools that consider the whole integrated site)*		
Online monitoring *(e.g. for the most important energy flows and combustion processes at the site)*		
Reporting and analysing tools *(e.g. check the average energy consumption of each process)*		
Specific energy consumption levels *(e.g. for each process, specific energy consumption levels may be defined and compared on a long term basis)*		
Energy audits as defined in the Energy Efficiency BREF		

Techniques to optimise process gas utilisation

Are the following process integrated techniques applied in order to improve energy efficiency (i.e. optimised utilisation of process gases such as coke oven gas, blast furnace gas and basic oxygen gas)? Please provide further explanations/justifications.		
Technique	**Yes** (*provide brief explanation*):	**No** *(provide brief justification):*
Use of gas holders for all by-product gases or other adequate systems for short-term storage and pressure holding facilities for maximising the recovery of process gases		
If possible, increasing pressure in the gas grid if there are energy losses in the flares – in order to utilise more process gases with the resulting increase in the utilisation rate		
Gas enrichment with process gases and different caloric values for different consumers (*processes require gases with different calorific values for acceptable level of fuel efficiency)*		
Reheating fire furnaces with process gas in order to maximise the use of process gases and reduce the need to purchase natural gas or electrical power		
Use of a computer-controlled caloric value control system		
Recording and using coke and flue-gas temperatures		
Adequate dimensioning of the capacity of the energy recovery installations for the process gases, in particular with regard to the variability of process gases		

Techniques to improve heat recovery

Are the following process integrated measures used to improve energy efficiency in steel manufacturing by improved heat recovery? Please provide further explanations/justifications.		
Technique	**Yes** (*provide brief explanation*):	**No** *(provide brief justification):*
Combined heat and power production with recovery of waste heat by heat exchangers and distribution either to other parts of the steelworks or to a district heating network *(if there are consumers in the vicinity)*		
Installation of steam boilers or adequate systems in large reheating furnaces *(furnaces can cover a part of the steam demand)*		
Preheating of the combustion air in furnaces and other burning systems to save fuel, taking into consideration adverse effects *(i.e. an increase of NOx in the off gas)*		
Insulation of steam pipes and hot water pipes		

Are the following process integrated measures used to improve energy efficiency in steel manufacturing by improved heat recovery? Please provide further explanations/justifications.		
Technique	**Yes** (*provide brief explanation*):	**No** *(provide brief justification):*
Recovery of heat from products *(e.g. sinter)*		
Where steel needs to be cooled, the use of both heat pumps and solar panels		
Use of flue-gas boilers in furnaces with high temperatures		
Oxygen evaporation and compressor cooling to exchange energy across standard heat exchangers		
Use of top recovery turbines to convert the kinetic energy of the gas produced in the blast furnace into electric power		

Techniques to minimise electrical energy consumption

Is one of the following or a combination of the following techniques used to minimise electrical energy consumption? Please provide further explanations/justifications.		
Technique	**Yes** (*provide brief explanation*):	**No** *(provide brief justification):*
Power management systems		
Grinding, pumping, ventilation and conveying equipment and other electricity-based equipment with high energy efficiency		

Monitoring

Are relevant parameters necessary to steer the processes measured/assessed from control rooms by means of modern computer-based systems in order to adjust continuously and to optimise the processes online, to ensure stable and smooth processing, thus increase energy efficiency? Please provide further explanations/justifications.

Specific units of Iron & Steel production

Sinter Plants

Techniques to reduce thermal energy consumption

Is one of the following or a combination of the following techniques used to reduce thermal energy consumption? Please provide further explanations/justifications.		
Technique	**Yes** (*provide brief explanation*):	**No** *(provide brief justification):*
Recovering sensible heat from the sinter cooler waste gas		
If feasible, recovering sensible heat from the sintering grate waste gas		
Maximising the recirculation of waste gases to use sensible heat		

Pelletisation Plants

Techniques to minimize thermal energy consumption

Is one of the following or a combination of the following techniques used to minimize thermal energy consumption in pelletisation plants? Please provide further explanations/justifications.		
Technique	**Yes** (*provide brief explanation*):	**No** *(provide brief justification):*
Process integrated reuse of sensible heat as far as possible from the different sections of the induration strand		
Using surplus waste heat for internal or external heating networks if there is demand from a third party		

Coke Oven Plants

Use of coke oven gas as a fuel/reducing agent and/or for the production of chemicals

Is the extracted coke oven gas (COG) used as a fuel or reducing agent or for the production of chemicals? Please provide further explanations/justifications.

Blast Furnaces

Maintenance of a smooth, continuous operation of the blast furnace

Is a smooth, continuous operation of the blast furnace at a steady state maintained to minimise releases and to reduce the likelihood of burden slips? Please provide further explanations/justifications.

Use of blast furnace gas as a fuel

Is the extracted blast furnace gas used as a fuel? Please provide further explanations/ justifications.

Recovery of energy of top blast furnace gas pressure

Is the energy of top blast furnace gas pressure recovered, where sufficient top gas pressure and low alkali concentrations are present? Please provide further explanations/justifications.

Preheat of hot blast stove fuel gases/combustion air

Are the hot blast stove fuel gases or combustion air preheated using the waste gas of the hot blast stove? Please provide further explanations/justifications.

Are the hot blast stove fuel gases or combustion air preheated using the waste gas of the hot blast stove? Please provide further explanations/justifications.

Techniques to optimise energy efficiency of the hot stove

Is one of the following or a combination of the following techniques applied to optimise the energy efficiency of the hot stove? Please provide further explanations/justifications.		
Technique	**Yes** (*provide brief explanation*):	**No** *(provide brief justification):*
Use of computer aided hot stove operation		
Preheating of the fuel or combustion air in conjunction with insulation of the cold blast line and waste gas flue		
Use of more suitable burners to improve combustion		
Rapid oxygen measurement and subsequent adaptation of combustion conditions		

Basic Oxygen Steelmaking and Casting

Use of BOF gas

Is the BOF gas collected, cleaned and buffered for subsequent use as a fuel? Please provide further explanations/justifications.

Use of ladle-lid systems

Are ladle-lid systems used to reduce energy consumption? Please provide further explanations/justifications.

Are ladle-lid systems used to reduce energy consumption? Please provide further explanations/justifications.

Use of direct tapping process

Is a direct tapping process used after blowing to optimise the process and reduce energy consumption? Please provide further explanations/justifications.

Use of continuous near net shape strip casting

Is continuous near net shape strip casting used to reduce energy consumption (if the quality and the product mix of the produced steel grades justify it)? Please provide further explanations/justifications.

Electric Arc Furnace Steelmaking and Casting

Use of continuous near net shape strip casting

Is continuous near net shape strip casting used to reduce energy consumption (if the quality and the product mix of the produced steel grades justify it)? Please provide further explanations/justifications.

Use of scrap preheating

Is scrap preheated in order to reduce the total energy requirements in the EAF operations (e.g. use sensible heat for scrap preheating)? Please provide further explanations/justifications.

2.2.3 Food, drink and milk industry

Techniques to reduce specific energy consumption (entire FDM sector)

Are the following techniques applied in order to improve energy efficiency/reduce energy consumption? Please provide further explanations/justifications.		
Technique	**Yes** (*provide brief explanation*):	**No** *(provide brief justification):*
Ensure, e.g. by training, that **employees are aware of the environmental aspects** of the company's operations **and their personal responsibilities** (energy-related)		
Design/select equipment, which optimises consumption and emission levels and facilitates correct operation and maintenance		
Regular **maintenance programmes**		
Methodology for preventing and minimising the consumption of energy: ➢ obtaining management commitment, organisation and planning ➢ analysis of production processes, including individual process steps to identify areas of high energy consumption and to identify opportunities to minimise these ➢ assessment of objectives, targets and system boundaries ➢ identification of options for minimising energy consumption using a systematic approach, such as pinch technology ➢ carrying out an evaluation and doing a feasibility study ➢ implementing a programme for minimising the consumption of energy ➢ ongoing monitoring of energy consumption and the effectiveness of control measures (both measurement and visual inspection)		
Maintain an accurate **inventory of inputs and outputs at all stages of the process** from reception of raw materials to dispatch of products and end-of-pipe treatments		
Production planning to minimise associated waste production and cleaning frequencies		
Minimise storage times for perishable materials		

Are the following techniques applied in order to improve energy efficiency/reduce energy consumption? Please provide further explanations/justifications.		
Technique	**Yes** (*provide brief explanation*):	**No** *(provide brief justification):*
Optimise the segregation of water streams, to optimise re-use and treatment		
Avoid using more energy than needed for heating and cooling processes, without harming the product		
Where heat processes are applied and/or materials are stored or transferred at critical temperatures, or within critical temperature ranges, to **control the temperature by dedicated measurement and correction**		
Where materials are pumped or flow, to **control flow and/or level**, by dedicated measurement of pressure and/or dedicated measurement of flow and/or dedicated measurement of level and **using control devices**, such as valves		

Additional techniques for some processes and unit operations (number of FDM sectors)

Are the following additional techniques applied in order to improve energy efficiency/reduce energy consumption? Please provide further explanations/justifications.		
Technique	**Yes** (*provide brief explanation*):	**No** *(provide brief justification):*
*For all FDM installations carrying out **frying***		
Recirculate and burn exhaust gases		
*For all FDM installations carrying out **evaporation***		
Use **multi-effect evaporators** optimising vapour recompression related to heat and power availability in the installation, to concentrate liquids		
*For all FDM installations carrying out **freezing and refrigeration***		
Avoid keeping air conditioned and refrigerated areas colder than necessary		
Optimise the **condensation pressure and temperature**		
Keep the condensers clean		
Regularly defrost the entire system		
Make sure that the **air entering the condensers is as cold as possible**		

Are the following additional techniques applied in order to improve energy efficiency/reduce energy consumption? Please provide further explanations/justifications.		
Technique	**Yes** (*provide brief explanation*):	**No** *(provide brief justification):*
Use **automatic defrosting** of cooling evaporators		
Operate **without automatic defrosting during short production stops**		
Minimise transmission and ventilation losses from cooled rooms and coldstores		
*For all FDM installations carrying out **cooling***		
Optimise the operation of cooling water systems to avoid excessive blowdown of the cooling tower		
Install a plate heat-exchanger for pre-**Cooling ice-water with ammonia**, prior to final cooling in an accumulating ice-water tank with a coil evaporator		
Recover heat from cooling equipment		
Energy generation and use		
Use **combined heat and power generation** in new or substantially altered installations or those renewing their energy systems (installations where there is a use for the heat and power produced, e.g. in sugar manufacturing, milk powder production, whey drying, instant coffee production, brewing and distilling)		
Use **heat pumps for heat recovery** from various sources		
Switch equipment off when it is **not needed**		
Minimise the loads on motors		
Minimise motor losses		
Use **variable speed drives** to reduce the load on fans and pumps		
Apply **thermal insulation (**e.g. of pipes, vessels and equipment used to carry, store or treat substances above or below ambient temperature and to equipment used for processes involving heating and cooling)		
Apply **frequency controllers** on motors		
*For installations **using groundwater***		
Only **pump the quantities of water** that are **actually required**		
*For **compressed air generation***		
Review the pressure level and **reduce** it **if possible**		
Optimise the **air inlet temperature**		
*For **steam systems***		
Maximise condensate return		
Avoid losses of flash steam from condensate return		

Are the following additional techniques applied in order to improve energy efficiency/reduce energy consumption? Please provide further explanations/justifications.		
Technique	**Yes** (*provide brief explanation*):	**No** *(provide brief justification):*
Isolate unused pipework		
Improve steam trapping		
Repair steam leaks		
Minimise boiler blowbown		

Additional techniques for some individual FDM sectors

Meat and poultry

Are the following additional techniques applied in order to improve energy efficiency/reduce energy consumption? Please provide further explanations/justifications.		
Technique	**Yes** (*provide brief explanation*):	**No** *(provide brief justification):*
Avoid the use of flake ice by using a suitable mixture of chilled and frozen raw materials		

Fish and shellfish

Are the following additional techniques applied in order to improve energy efficiency/reduce energy consumption? Please provide further explanations/justifications.		
Technique	**Yes** (*provide brief explanation*):	**No** *(provide brief justification):*
Avoiding scaling if the fish is subsequently skinned		

Fruit and vegetables

Are the following additional techniques applied in order to improve energy efficiency/reduce energy consumption? Please provide further explanations/justifications.		
Technique	**Yes** (*provide brief explanation*):	**No** *(provide brief justification):*
Peel fruit and vegetables using a batch steam process or **a continuous steam process** not using cold water to condense the steam and, if for technological reasons steam peeling cannot be applied, use dry caustic peeling, unless the recipe requirements cannot be met if either of these techniques is used		

Are the following additional techniques applied in order to improve energy efficiency/reduce energy consumption? Please provide further explanations/justifications.		
Technique	**Yes** (*provide brief explanation*):	**No** *(provide brief justification):*
After blanching, cool fruit and vegetables before freezing them by passing them through cold water		

Vegetable oils and fats

Are the following additional techniques applied in order to improve energy efficiency/reduce energy consumption? Please provide further explanations/justifications.		
Technique	**Yes** (*provide brief explanation*):	**No** *(provide brief justification):*
Use a countercurrent flow desolventiser-toaster in vegetable oil extraction		
In vegetable oil processing, **use the vapour generated in the desolventiser-toaster in the first step of the miscella distillation pre-evaporator**		
Use the exothermic reaction heat from the hydrogenation of vegetable oil **to heat the product to the desired reaction temperature and to generate steam later in the reaction**		
Use **water ring pumps** to generate an auxiliary vacuum for oil drying, oil degassing or minimising oxidation of oil		
Deodorise vegetable oils using a double scrubber in **combination with a once-through cooling system**		

Dairies

Are the following additional techniques applied in order to improve energy efficiency/reduce energy consumption? Please provide further explanations/justifications.		
Technique	**Yes** (*provide brief explanation*):	**No** *(provide brief justification):*
For dairies		
Partially homogenise milk		
Replace batch pasteurisers with continuous ones		
Use **regenerative heat exchange** in pasteurisation		
For large dairies with highly branched tubing, use **several small CIP systems instead of a centralised CIP system**		
Re-use cooling water, used **cleaning water**, **condensates** from drying and		

Are the following additional techniques applied in order to improve energy efficiency/reduce energy consumption? Please provide further explanations/justifications.		
Technique	**Yes** (*provide brief explanation*):	**No** *(provide brief justification):*
For dairies		
evaporation, **permeates** generated in membrane separation processes and **final rinse-water after the treatment**		
*For the production of **market milk***		
Achieve the energy consumption level of 0.07 – 0.2 kWh/l		
*For the production of **milk powder***		
Produce powdered milk using **multi-effect evaporators**, optimising vapour recompression related to heat and power availability in the installation, to concentrate liquid milk before spray drying, followed by FBD, e.g. integrated FDB		
Achieve the energy consumption level of 0.3 – 0.4 kWh/l		
*For the production of **cheese***		
Use the heat from warm whey for preheating cheese milk		
Produce whey powder using **multi-effect evaporators**, optimising vapour recompression related to heat and power availability in the installation, to concentrate whey before spray drying, followed by FBD, e.g. integrated FDB		

Sugar

Are the following additional techniques applied in order to improve energy efficiency/reduce energy consumption? Please provide further explanations/justifications.		
Technique	**Yes** (*provide brief explanation*):	**No** *(provide brief justification):*
Avoid drying sugar beet pulp if an outlet is available for pressed sugar beet pulp, e.g. animal feed; otherwise dry sugar beet pulp using steam driers or using high temperature driers		

Coffee

Are the following additional techniques applied in order to improve energy efficiency/reduce energy consumption? Please provide further explanations/justifications.		
Technique	**Yes** (*provide brief explanation*):	**No** *(provide brief justification):*
When roasting coffee, **recirculate air from the roaster back into the roaster**		

Are the following additional techniques applied in order to improve energy efficiency/reduce energy consumption? Please provide further explanations/justifications.		
Technique	**Yes** (*provide brief explanation*):	**No** *(provide brief justification):*
In instant coffee manufacturing, **use the waste heat from the hot liquid coffee extract** to heat the process water prior to extraction and **use countercurrent heat-exchange to use the heat from spray drying within the roasting sector**		

Drinks

Are the following additional techniques applied in order to improve energy efficiency/reduce energy consumption? Please provide further explanations/justifications.		
Technique	**Yes** (*provide brief explanation*):	**No** *(provide brief justification):*
*For the processing of **drinks***		
If CO_2 is used in the installation, **use CO_2 which is either recovered from the fermentation process or as a by-product of another process**, to avoid the production of CO_2 directly derived from fossil fuels especially for use in the installation		
Use **multistage bottle cleaning systems**		
For breweries		
Optimise the re-use of hot water from wort cooling and recover heat from wort boiling		

2.2.4 Intensive rearing of poultry and pigs

Techniques to reduce specific energy consumption (entire IRPP sector)

Are the following techniques applied in order to improve energy efficiency/reduce energy consumption? Please provide further explanations/justifications.		
Technique	**Yes** (*provide brief explanation*):	**No** *(provide brief justification):*
Energy Management Approach		
Take regular meter reading and record results in a systematic way *(relate readings to processes, production phases, houses, etc.)* and relate collected information to production levels and external influences *(e.g. weather)*		
Carry out maintenance and repairs *(cleaning of all components to avoid dust and corrosion which are major problems for heaters, ventilation components and controllers)*		
Check the accuracy of temperature sensors		
Use information from the control system *(modern controllers store temperatures and ventilation settings)*		
Use improved controlling devices, like dimmers, thermostatic controls		
Install efficient fans and ducts		

Are the following techniques applied in order to improve energy efficiency/reduce energy consumption? Please provide further explanations/justifications.		
Technique	**Yes** (*provide brief explanation*):	**No** *(provide brief justification):*
Ventilation		
Control ventilation with heat recovery *(internal temperature of animal housing)*		
Use natural ventilation		
Use of electronic systems instead of manually controlled systems for heating *(thermostatic controls)*		
Insulation		

Use proper insulation to limit excessive cooling/heating through walls, roof and floor *(insulation thickness; rec. U-values)*		
Use heat-reflecting membranes *(lining of walls and ceiling on the indoor side with laminated plastic foils)*		
Low-energy illumination		
Apply fluorescent lights instead of conventional tungsten glowing bulbs		
Apply sodium lights		
Use dimmers for adjusting electrical lighting		
Adopt lighting controls using proximity sensors or room entry switches		
Apply lighting schemes programmes *(e.g. using a variable lighting period such as an intermittent illumination of 1 period of light to 3 periods of darkness instead of 24 hours light per day)*		
Use natural light *(also by the installation of vents or roof-lights)*		
Adopt photoelectric cells to turn artificial lights on		
Fuels for heating		
Use gas-fired infrared heaters and air blowers		
Use wood and biomass fired boilers		
Heat recovery		
Use heat exchangers (air-air/water/ground)		
Use heat pumps to recover heat (e.g from water, slurry, ground, air, etc.)		

Additional techniques for the efficient use of energy on poultry farms

Are the following additional techniques applied in order to improve energy efficiency/reduce energy consumption? Please provide further explanations/justifications.		
Technique	**Yes** (*provide brief explanation*):	**No** *(provide brief justification):*
Separate heated spaces from other spaces, and limit their size and necessary volume		

Are the following additional techniques applied in order to improve energy efficiency/reduce energy consumption? Please provide further explanations/justifications.		
Technique	**Yes** (*provide brief explanation*):	**No** *(provide brief justification):*
Correct regulation of the heating equipment and even distribution of warm air through the housing *(e.g. avoid placing sensors in spots that are too cold or too warm in the housing, which would unnecessarily activate heating or ventilation)*		
Regularly check and clean control sensors to correctly detect the temperature at the stock level *(1 metre high)*.		
Regular maintenance *(with each batch)* of heating devices and substitution of worn out parts *(full replacement every 5 – 6 years)*		
Correctly determine the quantity of heating equipment *(equipment must be run at correct (full) power, since the reduction of temperature is not proportional to the reduction of power)*		
Circulate warm air from just below the roof level down to floor level		
Minimise ventilation rates, as far as the indoor climate requirements allow		
Place ventilation vents low down on the walls (as heat tends to rise)		
Further insulation with loose material (e.g. sand) on the floor or on top of the built-in insulation		
Repair cracks and open seams in the housing construction		
Recover heat in a layer house with a calorifier between the incoming and outgoing air		
Ensure minimum ventilation with well-sealed buildings		
Use fans fitted with back-draught shutters to reduce heat losses		
Good management of minimum flows		

Are the following additional techniques applied in order to improve energy efficiency/reduce energy consumption? Please provide further explanations/justifications.		
Technique	**Yes** (*provide brief explanation*):	**No** *(provide brief justification):*
Ventilation		
Select the correct type of fans and consider their position in the building		
Install fans with a low energy use per m^3 of air		
Use fans efficiently *(e.g. operating one fan on full capacity is more economical than operating two on half their capacity)*		
Maintain and keep clean ducts, fans and controlling apparatuses		
Use circulating fans		

Additional techniques for the efficient use of energy on pig farms

Are the following additional techniques applied in order to improve energy efficiency/reduce energy consumption? Please provide further explanations/justifications.		
Technique	**Yes** (*provide brief explanation*):	**No** *(provide brief justification):*
Better use the available housing capacity		
Optimise animal density		
Lower the temperature as far as animal welfare and production allow		
Reducing ventilation *(taking into account the minimum levels required for animal welfare)*		
Insulate the building *(particularly lagging the heating pipes)*		
Optimise the position and adjustment of heating equipment		
Consider heat recovery		
Consider using high-efficiency boilers in new housing systems		
Transfer meal mechanically rather than pneumatically (blown) from the mill to mixing or meal storage		
Use improved heater lamps farrowing houses		
Heating and Ventilation		
Optimise ventilation management that balances heating and ventilation *(optimise the minimum rates of air flows) and install energy-saving fans or equipment*		

Techniques for the on-farm processing of manure (energy related)

Are the following techniques applied in order to improve energy efficiency/reduce energy consumption? Please provide further explanations/justifications.		
Technique	**Yes** (*provide brief explanation*):	**No** *(provide brief justification):*
Anaerobic treatment of manure in a biogas installation		
Evaporation and drying of manure		
Slurry belt dryer		
Incineration of poultry manure		

2.2.5 Cement, lime and magnesium oxide industry

Techniques for the cement industry

Process selection *(Process selection is subject to raw material moisture content and only applicable to new plants and major upgrades)*

Is a dry process kiln with multistage preheating and precalcination used to reduce energy consumption (use of exhaust gases and recovered waste heat from the cooler to preheat and pre-calcine the raw material feed before entering the kiln)? Please provide further explanations/justifications.

Reduction of thermal energy consumption

Is a combination of the following techniques applied in order to reduce thermal energy consumption? Please provide further explanations/justifications.		
Technique	**Yes** (*provide brief explanation*):	**No** *(provide brief justification):*
Use of **improved and optimised kiln systems** and a smooth and stable kiln process, operating close to the process parameter set points by applying: I. **process control optimisation**, including computer based automatic control systems II. **modern, gravimetric solid fuel feed systems** III. **preheating and precalcination** to the extent possible (considering the existing kiln system configuration)		
Recovering excess heat from kilns. In particular, the kiln excess heat from the cooling zone (hot air) or from the preheater can be used for drying raw materials (applicable when grate coolers are used).		
Applying the a**ppropriate number of cyclone stages** related to the characteristics and properties of raw material and fuels used (applicable to new plants and major upgrades)		
Using fuels with characteristics which have a **positive influence on the thermal energy consumption** (subject to fuel availability and for existing kilns to the technical possibilities of injection the fuel into the kiln)		

Is a combination of the following techniques applied in order to reduce thermal energy consumption? Please provide further explanations/justifications.		
Technique	**Yes** (*provide brief explanation*):	**No** *(provide brief justification):*
When replacing conventional fuels by waste fuels, **using optimised and suitable cement kiln systems for burning wastes**		
Minimising bypass flows		

Reduction of primary energy consumption

Have you considered reducing the clinker content of cement and cement products (e.g. by adding fillers and/or additions, such as blast furnace slag, limestone, fly ash etc. in the grinding step in accordance with the relevant cement standards)? Please provide further explanations/ justifications.

Have you considered employing of cogeneration plants for the production of steam and electricity or of combined heat and power plants in order to reduce primary energy consumption? Please provide further explanations/ justifications.

Reduction of electrical energy consumption

Is one or a combination of the following techniques applied in order to reduce electrical energy consumption? Please provide further explanations/justifications.		
Technique	**Yes** (*provide brief explanation*):	**No** *(provide brief justification):*
Using **power management systems**		
Using **grinding equipment and other electricity based equipment with high energy efficiency**		
Using **improved monitoring systems**		

Is one or a combination of the following techniques applied in order to reduce electrical energy consumption? Please provide further explanations/justifications.		
Technique	**Yes** (*provide brief explanation*):	**No** *(provide brief justification):*
Reducing air leaks into the system		
Process control optimisation		

Techniques for the lime industry

Reduction of thermal energy consumption

Is a combination of the following techniques applied in order to reduce thermal energy consumption? Please provide further explanations/justifications.		
Technique	**Yes** (*provide brief explanation*):	**No** *(provide brief justification):*
Applying **improved and optimised kiln systems** and a smooth and stable kiln process, operating close to the process parameter set points, through: I. **process control optimisation** II. **heat recovery** from flue-gases (e.g. use of surplus heat from rotary kilns to dry limestone for other processes such as limestone milling) III. **modern, gravimetric solid fuel feed systems** IV. **maintenance of the equipment** (e.g. air tightness, erosion of refractory) V. the **use of optimised grain size of stone** (subject to raw material availability)		
Using **fuels** with characteristics which have a **positive influence on thermal energy consumption** (subject to fuel availability and technical possibilities to feed the selected fuel into the kiln)		
Limiting excess air (only relevant for LRK an PRK within the limits of a potential overheating of some areas in the kiln)		

Reduction of electrical energy consumption

Is one or a combination of the following techniques applied in order to reduce electrical energy consumption? Please provide further explanations/justifications.

Technique	Yes (*provide brief explanation*):	No *(provide brief justification):*
Using **power management systems**		
Using **optimised grain size of limestone**		
Using **grading equipment and other electricity based equipment with high energy efficiency**		

Techniques for the magnesium oxide industry

Reduction of thermal energy consumption

Is a combination of the following techniques applied in order to reduce thermal energy consumption? Please provide further explanations/justifications.		
Technique	**Yes** (*provide brief explanation*):	**No** *(provide brief justification):*
Applying improved and **optimised kiln systems** and a smooth and stable kiln process by applying: **I. process control optimisation** II. **heat recovery** from flue-gases from kiln and coolers		
Using **fuels with characteristics which have a positive influence on thermal energy** consumption (subject to availability of the fuels, the type of kilns used, the desired product quantities and the technical possibilities of injecting the fuel into the kiln)		
Limiting excess air (usually about 1-3 %)		

Reduction of electrical energy consumption

Is one or a combination of the following techniques applied in order to reduce electrical energy consumption? Please provide further explanations/justifications.		
Technique	**Yes** (*provide brief explanation*):	**No** *(provide brief justification):*
Using power management systems		
Using grinding equipment and other electricity based equipment with high energy efficiency		

3 Main conclusions and proposals for future work

3.1 Main findings/conclusions

3.1.1 Main findings / conclusions from the expert discussions

During the discussions, the clear definition of system boundaries was identified as one of the key challenges and it was agreed to initially take the corresponding definitions from the sector specific BREFs (in case available). In this context it was also highlighted that it would be important to demand energy flow diagrams (preferably as sankey diagrams) indicating the exact system boundaries for the calculation of energy efficiency.

Regarding the use of benchmarks it was generally agreed that the use of benchmarks would be a good approach, however, due to a number of difficulties it will rather represent an ambitious task (e.g. certain plant type, complexity of the plant, plant integration, varying products). It was also pointed out that, at least for existing installations, benchmarks would be difficult to define or even in some cases technically impossible. Besides, it was emphasised that qualified experts will be needed in practice for checking the applied benchmarks.

Another important issue expressed during the discussions was to also collect, document and compare available energy efficiency figures from previous years in order to be able to follow possible developments/ improvements regarding energy efficiency of certain facilities.

3.1.2 Main findings/conclusions from the test phase

The general application form and the sector specific supplements were tested for the following sectors:

- steel sector by ARPA Lombardia (IT)
- glass industry (DE)
- intensive rearing of pigs (DE)
- small food processing companies (DE)
- slaughter house (DK)
- large combustion plant based on biomass (DK)

I. Experiences from using the application form in Italy

AIDA is a program used to collect the self monitoring data of IPPC facilities (at ARPA Lombardia or throughout Italy?). In the permit of each company there is a section specifying the details of data that has to be uploaded to AIDA. The submitted data is checked during the inspection of the facility.

During the control the fuel and energy consumption are checked based on permit indicators. Often the factories provide data for consumption but it is not possible to check this data, especially if the consumption is based on certain / different products.

Proposal:

- clarify the issue of counters
- decide upon the right approach in case that a number of different products is produced

1) Context, collaboration with Operators

The test of the questionnaire was carried out in collaboration with the Industrial Association of Brescia (AIB) and applied only at steel installations with electric arc furnace, typical steel industry in the area.

In particular, 4 electric arc furnace steel operators collaborated in the test. The test was carried out in anonymous form, on the basis of a specific request of Operators.

The description of the installations supplied by Operators is as follows:

Company 1): Production of steel rods and rebars for reinforced concrete, wire rods, billets

Company 2): Production of raw ingots and forged bars

Company 3): The company is composed of an electric steel plant and of a hot rolling mill. It produces semi-finished products (billets) of different section, in part internally processed by lamination, and in part for sale. The hot rolling mill mainly produces round bars for reinforced concrete and plain round bars for structural purposes.

Company 4): Production of billets, partly sold and partly processed in hot rolling mill

The four industries produce a total amount of 1.969.806 tons of steel per year. Total production of rolling mills is 1.841.985 tons/y, but one of the four industries only produces billets ad one rolls more than its own production in billets, buying them from the market.

The total consumption of electric energy is 1.352.980 MWh, of methane is 68.248.252 Sm^3, of coal is 31.012 tons/y, as a sum of the four installations.

2) General form for energy efficiency

The information asked in the **general form for energy efficiency** received answers with a good level of completeness from all of the four operators.

In particular it seems that there is not any kind of problem in answering to questions related to points 2. *energy saving agreement and management systems*, 4. *total consumption figures*, 5*. energy consumption in main processes*. Data are given in a complete manner, although sometimes it has been necessary to disaggregate or extrapolate energy consumption of specific production lines from the whole, if not separately available.

Point 3. *system boundaries (simplified flow chart),* received answer in form of simple schematic drawing, mainly due to the kind of industries. Only one operator produced a more articulated drawing, in annex section.

Point 6. *energy generation per boiler* received no answer from any of the operators.

In point 8. *calculation of energy efficiency*, operators give answers illustrating main indicators used to calculate specific energy consumption, eventually discriminating how to calculate steel production and rolling specific energy consumption. No answer was given, in the strict sense, to the question of Energy Efficiency, if this is to be considered different from specific energy consumption.

Point 9. *indicators to monitor continuous improvements*, received a specific answer only from one operator, practically repeating information from point. 7.

Concerning point 10. *steps taken during the last three years to improve energy efficiency*, three of the four operators which developed actions in this direction gave only broad information about what was done.

One operator, describing five actions taken in the last three years, exposed also energy saving prediction. No specific information about investment cost or other financial aspects was given. The fact was commented later, with similar situations.

Point 11. *planned steps to improve energy saving*: at present, no Operator declared programmed investments; brief information was given about proceeding studies that could bring to investments aimed to energy efficiency, in the future.

3) Sector specific annex

Related to the **sector specific annex**, part. 2.1 *Supplement to the Application Form for EE (all units of IS production)* operators gave complete information about items 1. *Techniques to reduce specific energy consumption*, 5. *Techniques to minimise electrical energy consumption*, 6. *Monitoring*.

Pertaining items 2. I*mportant items to improve the overall energy efficiency of integrated steelworks*, 3. *Techniques to optimize process gas utilization*, 4. *Techniques to improve heat recovery*, all operators gave less complete information or no answer partly due to the type of production and lack of applicability of the proposed techniques.

From this point of view, it should be considered to move one or more of the questions in this section to following sections relating specific units of IS production.

Complete answers were given for part. 2.2.6 *Electric Arc Furnace Steelmaking and Casting*, items 19. *Use of continuous near net shape strip casting*, and 20. *Use of scrap preheating*, although there is a differentiation in quality and detail of the answers.

4) General comments and suggestions

At the moment, ARPA Lombardia feels the deep need for specialization of its staff members in the field of energy saving, especially for highly specialized areas such as this. Starting from this assumption, it will be necessary to manage a training and organization update aimed to fulfill this need. Anyway, the document provided by IMPEL, with a wide description of BAT conclusions and BREF, is very valuable because it provides insight into the problem and a basic knowledge also useful for not specifically trained personnel and also draws a roadmap for specialization and training. This can be related also to operators, for a certain extent.

At the operator level, anyway, the role of energy manager is, obviously, very important, especially if enrolled in the framework of ISO 50001:2011 – Energy Management System.

For what regards the consequences of this activity over the four collaborating operators, at the moment, the work done has been used solely for the purpose of testing the questionnaires developed, and not for administrative purposes: operators offered cooperation in testing templates, outside any inspection or environmental control framework.

This situation, well known and agreed in planning of the test, prevented the display and use of economic or financial data, widely demanded in the questionnaire, considered sensitive by operators, in this phase.

It is an open question, today, if during an official licensing or inspection activity, it is really useful to obtain this kind of information, in the perspective of a correct management by inspectors which, at present, may not have the skills needed to evaluate their meanings, in general or in detail.

The experience derived from the test indicates that the use of the questionnaire should be divided into several phases, properly prepared so to get in touch with the specialists employed by the company:

1) kickoff meeting for the display of objectives and an introduction to the tools
2) release of the questionnaire for self-completion by the operator, that require data search and the acquisition of documentation,
3) meeting for verification and discussion of the results, for the completion of the non-compiled parts or to explain lack of information.

5) Further developments

We are going to plan, in cooperation with AIB, further meetings to try to improve results of the test use of templates and to obtain more detailed information.

ARPA Lombardia, in the framework of renewal of permits, will evaluate the use of the templates and specific training based upon contents of documents of IMPEL EE project.

II. Experience from using the application form in Denmark

The application form has been completed by an existing plant and a new plant which is still in the planning phase. The existing plant is a large slaughterhouse and the planned facility is a biomass based combustion plant.

The representatives from the slaughterhouse plant were not able to provide all required data. Besides, they consider some of the questions from the application form to be too comprehensive. The operator also mentioned that some of the data has been already submitted to other authorities or is included in the company's Green Account and that providing this data again in the application form for energy efficiency would be extra work for the company.

The representatives of the planned biomass based combustion plant could reply to almost all questions and had no problems with the level of details.

In general, the experience from these two facilities and from another Danish energy efficiency project is that it is difficult to collect relevant data from existing plants which have not necessarily established energy monitoring for all relevant processes. The impression is that for existing plants only the overall energy measurements are available. Quite often it is complicated and expensive to obtain detailed information on energy consuming processes of existing plants.

The earlier the energy efficiency issues are discussed with the operator during the planning of the plant the easier is to plan relevant energy measurements in the process and ensure that the operator is aware of the relevance of energy efficiency equipment.

III. Experience from using the application form in Germany

In general, the questions contained in the draft application form for energy efficiency are regarded as useful to assess the energy efficiency of certain facilities/processes. However, it can be assumed that some of the requested information will not always be readily available to the plant operators, especially in case of existing installations. Certain information may be quite difficult to obtain or operators may refuse to provide detailed information for different reasons (e.g. competitors could use the provided details to calculate the margin, etc.). Nevertheless, an accurate assessment of energy efficiency by a third party would be possible, in case all requested information is correctly collected and submitted by plant operators.

Proposals:

- In order to increase the acceptance of the application form it is important to first of all handle data confidentially and provide support to operators on how to correctly fill out the application form. This could be done by competent authorities.
- Provide 'pull down menus' in order to simplify the data submission process for the operators
- Highlight the main benefits of filling out the application form (e.g. cost reduction, etc.)
- Provide incentives for those companies that fill out the application form (e.g. simplified reporting obligations, etc.)

Additional feedback from operators:

The operators of two small meat processing companies had contacted the authority and asked for further advice how they could optimise their energy consumption and their cooling techniques. With the support and advice of the authority they were able to fill in the specific form for food industry. They were highly motivated and grateful for the discussion with experts from the authority.

A member of the project team took up contact with representatives of the Landwirtschaftskammer Schleswig-Holstein (Chamber of Agriculture). This is an administrative body (public cooperation for agriculture) giving advice to administration and to farmers. The organisation operates different installations and carries out studies for being able to offer trainings and advice concerning innovative technologies to farmers. After an on site visit the sector specific supplement on intensive rearing of pigs was filled in and the following comments were submitted:

The sector specific supplement provides a summary with the main points on the item and can be used as reference book. Detailed information about costs per product unit are missing. International data are not so very interesting for the operator. Data from regions with similar climate conditions would be better. The chapter on incineration of manure should reflect the fact that manure as fuel for incineration is considered as waste in many countries.

The check list reflects the items that are considered during the planning process for new installations. It can be used by operators to become aware of the relevant points he has to cover with the experts writing the permit application for him.

Landwirtschaftskammer proposed to carry out a project together with the authority to develop guidance on energy efficiency for pig farms in northern countries that is more specific than the proposed supplement and the draft BREF document are in that point.

IV. Experience from using the application form in Austria

The application form and the sector specific supplements were distributed to some local and regional authorities responsible for the permitting and inspection of IPPC plants.

The response indicates that the material is useful for the evaluation of the energy efficiency. One authority proposed to introduce a threshold (energy demand/year) for those main processes which would require an analysis.

One authority tested the application form and the sector specific supplements retrospectively for an extension of a dairy. Most of the requested data was present in the licensing procedure. The sector specific supplement was considered quite complete although some proposals for further specifications were given. Since the authority had already an energy management system in place and the energy consumption for the plant would be much lesser than the BAT range given in the FDM BREF, the authority abstained from further investigations concerning energy saving potentials.

3.2 Existing permit conditions

Examples for permit conditions given for IPPC installations (AT)

General permit conditions:

- Establishment of an energy management system (EN 16001, ISO 50001)

Permit conditions for large combustion plants:

- Feasibility study for district heating network or extension of existing network, investigation of possibility of setting up heat intensive plants in the vicinity
- Strive for a fuel utilisation of at least xx %
- Use of waste heat for heating buildings
- Monitoring: Continuous measurements of fuel used, electricity produced and delivered to power grid, heat and steam used, monthly and yearly report, energy balance
- Reference/compliance to/with ecodesign regulations (electric motors etc.)

Permit conditions for iron and steel production:

- information on and analysis of the technical developments in the iron and steel sector referring to energy efficiency and report this to the CA annually

- carry out an energy monitoring (annual energy balance, according to energy carriers, use of specific benchmarks, trends) for the important installations (sinter plant, blast furnace, hot rolling mill, power plant etc.), which has to be submitted to the CA
- 5 years after issuing the permit: new assessment of the energy saving potentials on the basis of the energy monitoring
- obligatory recovery of the blast furnace gases in the walking beam furnace
- insulations of steam pipes (amortisation time: 6 years)

(DK)

Once a year, the company must send a statement to the Authority with the following information:
Amount of waste by categories(fuel)
· Not accepted quantities of waste, indicating the destination of the diverted waste
· Imported waste
· Operating hours for each boiler
· Used amounts of auxiliary chemicals
· Production of district heating and off-cooled energy
· Production of electricity
· Production quantities of waste from the production specifying delivery site
· Produced quantities of slag
· Produced quantities of residue and specifying delivery site
· Consumption of electricity, heat, oil
· Consumption of biomass by type
· Consumption of water
· Report of emission measurements on gas turbine

Based on the information, the following key performance indicators(KPI) should be calculated for the waste incineration plant operations:
· Energy consumption per. ton of incinerated waste kWh / ton
· Flue-gas cleaning product per ton of incinerated waste ton / ton
· Production of slag per. ton of incinerated waste ton / ton
· Water consumption per. ton of incinerated waste m3/ton
· Consumption of auxiliary chemicals per. ton of incinerated waste kg / tonne
· Energy produced by. ton of incinerated waste MWh / ton

Based on the information, the following KPI (key performance indicators) should be calculated for the gas turbine:
· Energy consumption in MJ per. MJ natural gas consumed
· Water consumption in m3. MJ thermal gas consumed
· Consumption of axciliary material in kg / MJ natural gas consumed
· Produced energy in MJ per. MJ natural gas consumed

The KPI's can be calculated on the basis of estimations in cases where consumption / production is not measured separately.

Development of key indicators should be commented on, and the report shall also include a list of the actions that the plant has done to introduce the best available techniques including improving energy efficiency as well as any future plans for the introduction of this, including evaluation of

completed actions.

Deadline for submission:
Reporting must be made by January 1'st and must be received by the Authority before March 1'st. The annual report can be replaced by the green account to the extent that the required information is provided thereof.

4. Evaluation of the applicability of the BAT conclusions

At the beginning of the project the European Commission had asked the project team to give feedback on the applicability of the BAT conclusions concerning the item of energy efficiency. At that point of time BAT conclusions for the iron and steel sector, manufacture of glass and cement, lime and magnesium oxide production were available. As energy efficiency is one criterion for determining BAT (IED annex III number 9) permit application documents must contain relevant data and documents on the item and permit writers have to include it in their assessment.

Concerning energy efficiency the quality of the information is different in the different sectors. Each document on BAT conclusions has to be seen in connection with the related BREF document. Concerning the above mentioned BAT conclusions that were relevant for the project the project team concluded the following:

1. Production of cement

Energy efficiency is dealt with in the chapter on Environmental management system and in a separate chapter on energy consumption. A BAT-associated energy consumption level (2900-3300 MJ/tonne clinker) is given.

The project team regarded the information as sufficient. This has to be seen in the light of the variety of different procedures and products that are covered by the BREF document. For a systematic analysis of potential for improvement of energy efficiency operators normally need a study covering the relevant parts of the plant.

2. Production of iron and steel

Energy efficiency is addressed under the general BAT conclusions in a chapter on energy management. The relevant items for the sector are covered. The specific BAT conclusions highlight the items relevant for the different techniques applied on site. The information in the BAT conclusions was regarded as sufficient by the project team. In this field operators normally need systematic expert studies too.

3. Manufacture of glass

The information in the BAT conclusions concerning energy efficiency refers only to the combination of seven measures and gives no further explanations. This is not enough.

The following conclusions are drawn:

If there is a specific BAT-associated energy consumption level given in a BAT conclusion the project team considers this requirement binding (i.e. it must not be exceeded).

With regard to other, softer criteria like "BAT is to use a combination of techniques" or "BAT is to consider cogeneration" it remains debatable whether all techniques have to be implemented or how far economic viability can be used as an argument. The information concerning the applicability of the techniques is substantive in this respect.

In comparison to BREFs for which no BAT conclusions exist (e.g. Food, Drink and Milk Industry) the BAT conclusions provide a user-friendly access to specific information on energy efficiency measures in the sector.

5. Summary of results / Proposals for further work

5.1 General results

Energy efficiency has to be addressed at a very early stage in the planning process of industrial installations because then several options are still open and on top of that the benefit is the highest. All parties involved in permit procedures have to integrate it as one aspect into their work – the operators planning a new installation or operating existing installations, the consulting experts preparing permit applications and the permit writers (as well as inspectors).

A clear definition of system boundaries is a key challenge. It is important for allowing comparisons and determination of benchmarks.
The use of benchmarks was estimated as a good approach. Some authorities try to build up own databases for determining benchmarks.

A collection of energy efficiency data from previous years would allow for comparisons and identification of improvements.

As operators consider data concerning energy efficiency as relevant for their competitors they often declare them as confidential. The authority has to respect this. Nevertheless they have to submit it to the authority.

For operators of existing installations it is sometimes difficult to provide the necessary data (This does not apply for companies with ISO 50 001 system). They often do not have a plan for future investments for the improvement of energy efficiency. For complex installations often studies on feasibility and pay back times are necessary for this purpose.

New installations: Operators have the data available and are able to fill in the developed template and checklists of the relevant supplement for their application.

Participants in the test said that the sector specific supplements were useful and could be used as reference book.

The motivation of operators was higher when they were directly contacted by representatives from the authority and advice was offered.

The motivation of operators does not necessarily correspond with the size of the installation – two small meat processing companies were highly motivated.

5.2 Consequences for authorities

In authorities a need for specialisation / training of staff members for dealing with energy efficiency was identified.

Authorities have to include the item of energy efficiency into their guidance material and their initial discussion of new projects with operators.

The general application form and the supplements were considered as valuable. They provide basic knowledge.

The application should be well prepared and carried out in 3 steps
- a kickoff-meeting with an introduction to the tools
- completion of the forms by the operator
- meeting for verification and discussion of the results

Permit writers have to include energy efficiency into the BAT determination and conditions concerning energy efficiency become part of the permit. Some authorities have developed a set of permit conditions for their installations.

Permit conditions related to energy efficiency become part of permit review and inspections.

Exchange of information about dealing with energy efficiency in permit procedures is necessary.

5.3 Consequences for operators

Operators have to integrate the required information on energy efficiency into their permit applications. Energy efficiency should become an item in procurement activities. It should be required by the operators and laid down in the general technical specifications and should be a criterion for the contract award.

Operators have to establish monitoring systems adjusted to the current needs.

5.4 Further developments / activities reported by project participants

Arpa Lombardia will test the use of the project products for the renewal of permits.

The Agency for Agriculture, the Environment and Rural Areas in Schleswig-Holstein (DE) will continue the test of the draft application form and the annexes in permit procedures. The discussion of indicators / benchmarking with permit writers and stakeholders will continue. The activities are part of a project on regional level.

6. Dissemination of results

The final project report including the template for documents and data required regarding energy efficiency in the permit application will be made available on the IMPEL website end of 2013. It will be sent to the National IMPEL Coordinators. The report will also be sent to other target groups (via IMPEL Secretariat at the European level, via national coordinators at the national level). The report will be made available to energy efficiency initiatives and the IPPC Expert Group (IEG).

The results of the project will be reported in professional and technical journals. On top of that they will be used for inspector trainings and presented at conferences.

7. Proposals for future work

- Workshop on assessment of the application documents regarding energy efficiency (for new and existing installations) and development of further permit conditions based on BREFs using a sector specific approach
- Development of a presentation on the integration of energy efficiency into the permit procedure and a leaflet (1 – 2 pages summarising main information)
- Training course for dealing with energy efficiency in permitting and inspection
- Integrating the discussion on energy efficiency in other sector specific IMPEL-projects (e.g. pig farming)
- Developing an online tool for energy data submission (e.g. electronic application form for EE)
- Workshop including presentation of best practice examples from different Member States (exchange of experiences and good practices)

Annex I: Terms of Reference (2011/12)

No	Name of project
2011/	**Energy Efficiency in permitting and inspections** Exchange of experiences on how the issues of energy efficiency and reduction of greenhouse gases are dealt with in permit procedures and inspections in the Member States – Development of a template for documents and data required regarding energy efficiency in the permit application (2011/2012).

1. Scope

1.1. Background	**History of the project:** Energy is a priority issue within the European Union. The EU Climate change and Energy Package foresees an increase in energy efficiency of 20 % and a reduction of greenhouse gases by 20 % till 2020. During the discussion on future work of IMPEL at the General Assembly 3 – 5 June 2009 in Prague the representatives of the member states mentioned explicitly energy efficiency as a field that IMEL has to work on. They mentioned the following reasons: - increased efficiency in the use of energy is the quickest, most effective way to tackle the issue of climate change, - by developing the same standards and requirements throughout Europe and the consequent enforcement it has to be made sure that the individual Member States are not played off one against the other by industry, - small and middle sized enterprises have to be included into the efforts of minimising greenhouse gas emissions. In 2002/2003 IMPEL has carried out a project on energy efficiency with Finland as lead country. A second project on that item was carried out in 2010 and the evaluation of the current situation showed that during the last years only minor changes have occurred in the consideration of energy efficiency issues in permitting and supervising procedures. In Member States that recently joined to European Union energy efficiency has not been at the countries' political level among the main priorities. The project identified 7 main challenges concerning energy efficiency: a) In the IPPC directive it is not stipulated how EE should be addressed. b) Information on EE in sector BREFs is not concrete and precise enough. The horizontal BREF on EE is complex and has not been utilised much. c) Lack of technical expertise in authorities and companies. d) Lacking or only occasional cooperation between energy and environmental authorities. e) There is no general approach in MS to handle the item of EE in the permit revision. f) Problems with definition of system boundaries.

	g) Unclear influence of other instruments like voluntary agreements, Energy Management Systems, tax and ETS-systems on energy efficiency of installations. For a step-by-step improvement of the situation in permit and inspection authorities participants of the workshop and the project team made the following proposals for the future work of IMPEL in the field of EE: • Development of a template for documents and data required regarding energy efficiency in the permit application • Workshop on assessment of the application documents regarding energy efficiency (for new and existing installations) and development of permit conditions based on BREFs using a sector specific approach (e.g. food sector, metal processing sector, paper sector, chemical sector, waste treatment plants). • Training course for dealing with energy efficiency in permitting and inspection. • Integrating the discussion on energy efficiency in other sector specific IMPEL-projects, e.g. pig farming. The current proposal for a follow-up IMPEL project deals with the development of a template for documents and data required regarding energy efficiency in the permit application.
1.2. Link to MAWP and IMPEL's role and scope	**Legal Background:** The Sixth Community Environment Action Programme calls for the encouragement of more effective implementation and enforcement of Community legislation on the environment, among other things through the promotion of improved standards of permitting, inspection, monitoring and enforcement by Member States and through improved exchange of information on best practice on implementation. Article III, Para. 4 of Recommendation 2001/331/EC providing for Minimum Criteria for Environmental Inspections in the Member States pursues the same objectives. The IMPEL MAWP 2007 – 2010 and the new MASP of Cluster 1 indicate climate change as one of the urgent topics.
1.3. Objective (s)	The main objectives are to identify: - how the requirements of the BREF Energy Efficiency and the chapters of other BREFs related to energy efficiency have to be integrated into the permitting and inspection procedures - what kind of information is needed in permit applications, e.g. description of measures, of fuel, energy efficiency indicators etc. - what is important for the consideration of applications, - exchange of information on existing guidance material, by - establishing an expert group for the discussion of the first point (5 participants from different MS plus project team) - development of a template for documents and data required regarding energy efficiency in the permit application and if possible carrying out tests on real cases in a working group (5

	participants from different MS plus project team). All participants of the workshop in June 2010 will be kept informed and asked for comments on the draft products of the project.
1.4. Definition	The project will help to promote the enforcement of the energy efficiency provisions of the IPPC Directive and future IED, the BREF Energy Efficiency and chapters of other BREFs related to energy efficiency and perhaps national provisions concerning energy efficiency. It will be carried out by a project team consisting of representatives of 4 - 5 IMPEL Member States. During the two phases of the project the team will work together with two different groups: a) an expert group (2011): For the evaluation of the requirements of the BREF Energy Efficiency and the chapters of other BREFs related to energy efficiency that have to be integrated into the procedures the expert group will need two meetings (first: discussion of the item and determination of work packages, second: discussion of results and work on further improvement) b) a working group (2012): The working group for the development of the template will need two meetings (first: discussion of the item and determination of work packages taking into account the results of the first group, second discussion of the product and evaluation of the tests). A final report will be written which will cover the findings and make recommendations for further projects.
1.5. Product(s)	1. a documentation of the requirements identified in existing BREF documents and IPPC/IED Directive 2. a final report with a template for documents and data required regarding energy efficiency in the permit application

2. Structure of the project

2.1. Participants	▪ Experts in the field of enforcement of requirements concerning energy efficiency and with in depth knowledge of the related BREF documents, IPPC and IED Directive ▪ Permit writers and inspectors with experience in the enforcement of energy efficiency provisions will be invited as participants from IMPEL member states, ▪ IMPEL secretariat and Commission are invited to participate
2.2. Project team	Project team: Representatives of 4 – 5 MS, Finland, Germany, Austria, Latvia, Denmark, A consultant with profound knowledge of BREF requirements and IPPC permitting and inspection should support the work. A representative of a consulting agency, who will - prepare the draft documents for the expert group - prepare the meetings of the expert group - document the results of the presentations and the discussions during the meetings of the expert group

	- prepare a draft final document of the results of the expert group as input for the working group Project bearer: ▪ *to be determined*
2.3. Manager Executor	- Not yet nominated
2.4. Reporting arrangements	The project progress will be reported to Cluster "Improving permitting, inspection and enforcement" (Cluster 1, first interim report in September 2011), to the participants and to possible observers and to other Clusters which might be concerned. Cluster 1 will submit interim reporting to the IMPEL General Assembly and the IMPEL secretariat. The final report of the project is expected to be submitted to the IMPEL General Assembly in Winter 2012. Interim Report: November 2011 Final Report: Winter 2012
2.5 Dissemination of results/main target groups	The report and the template for documents and data required regarding energy efficiency in the permit application (in English) mentioned under 1.5 will be made available on the IMPEL website. It will be sent to the national IMPEL coordinators. The report will also be sent to other target groups (via IMPEL secretariat at the European level, via national coordinators at the national level). The report will be made available to energy efficiency initiatives and the IPPC Expert Group (IEG). The results of the project will be reported in professional and technical journals. On top of that they will be used for inspector trainings and presented at conferences.

3. Resources required

3.1 Project costs and budget plan		**2011**	**2012**
	1. Overhead (organisation) cost (€):		
	2 Project meeting costs (€)		
	Meetings [1]: 2011		
	- meetings of expert group: 2 with 1 night each		
	No of Participants: 10		
	Travel[2]:	10.000	
	Accommodation[3]:	2.000	
	Catering:	2.000	
	Meeting venue:	*	
	- meetings of working group: 2		
	No of Participants: 10		
	Travel[4]:		10.000
	Accommodation (1 night each)[5]:		2.000
	Catering:		2.000
	Meeting venue:	*	
	Other (specify) Project team meetings 3, 5 participants per each, 1 night Travel Accommodation: 100 €/capita Catering	 5.000 1.000 1.000	 2 500 500 500
	Other (specify) Project team meeting 1 5 participants per each, 2 nights Travel Accommodation: 100 €/capita Catering	 	 2.500 1.000 1.000
	Participation in 2 Cluster meetings	700	700
	3. Other costs: consultant		
	consultant	15.000	
	TOTAL cost per year €	**36 700**	**22 700**
	TOTAL project cost €	**59.400**	
3.2. Fin. from IMPEL budget	*2. Project meeting costs plus 3. other costs(€)*	36 700	*22 700*
3.3. Co-financing by MS (and any other)	*1. Overhead costs (€):* as co-financing contribution for the **meeting venue** by one of the members of the project team ,		
	3. Other costs (€) as co-financing contribution		

[1] *specify, like Review Group Meetings, Workshop etc.*

[2] *normative: € 500/person*

[3] normative: *€ 100/person/night*

[4]

t

***contribution from host**

	by
3.4. Human from MS	Meeting preparation and participation: 130 days (based on 5 participants in project team, 5 in expert team and 5 in working group)
3.5 Human from Host countries	Meeting preparation and support: 10 days in 2011 and 10 in 2012, Meeting participation: 16 days in 2011 (based on 2 participants from host country), 16 days 2012 Project management support: 10 days

4. Quality review mechanisms

The quality of the project will be reviewed by the project participants and appraised by the Cluster "Improving permitting, inspection and enforcement" (Cluster 1). It will then be submitted to the IMPEL General Assembly for appraisal and adoption.

5. Legal base

5.1. Directive/Regulation/Decision	IPPC Directive; BREF document « Energy Efficiency « , Directive (2006/32/EC) on Energy end-use efficiency and Energy Services; Recommendation 2001/331/EC providing for Minimum Criteria for Environmental Inspections in the Member States
5.2. Article and description	Article 3, Para. 4: establishment of a scheme, under which Member States report and offer advice on inspectorates and inspection procedures in Member States
5.3 Link to the 6th EAP	Article 3. Strategic approaches to meeting environmental objectives. Para. 2: " Encouraging more effective implementation and enforcement of Community legislation on the environment […] - promotion of improved standards of permitting, inspection, monitoring and enforcement by Member States; […] improved exchange of information on best practice on implementation including by the European network for the Implementation and Enforcement of Environmental Law (IMPEL network) within the framework of its competencies".

6. Project planning

6.1. Approval	A draft ToR for the project was presented at the Cluster 1 meeting in Oslo 1 October 2010 and supported by Cluster "Improving permitting, inspection and enforcement".
6.2. Fin. Contributions	The project is supported by IMPEL, one country has announced a contribution of 5000 € for 2011. ,
6.3. Start	The project start is scheduled for 03/2011
6.4 Milestones	Milestones: - From March 2011 onward development of the draft document for the expert group by the consultant - invitation of participants of expert group to meetings in March 2011 - April 2011: first expert group meeting - June 2011: second expert group meeting - September 2011: draft interim report

	- from March 2012 onward preparation of concept for working group meeting by the project team - April 2012: first working group meeting - June 2012: second working group meeting - September 2012: draft final report - winter 2012: final project report
6.5 Product	Final project report with template
6.6 Adoption	Presentation of the final report to the IMPEL Plenary is planned for winter 2012.

No	**Name of project**
2011/06 2012/	**Energy Efficiency in permitting and inspections** Exchange of experiences on how the issues of energy efficiency and reduction of greenhouse gases are dealt with in permit procedures and inspections in the Member States – Development of a template for documents and data required regarding energy efficiency in the permit application (2011/2012).

1. Scope

1.1. Background	**History of the project:** Energy is a priority issue within the European Union. The EU Climate change and Energy Package forsees an increase in energy efficiency of 20 % and a reduction of greenhouse gases by 20 % till 2020. During the discussion on future work of IMPEL at the General Assembly 3 – 5 June 2009 in Prague the representatives of the member states mentioned explicitly energy efficiency as a field that IMEL has to work on. They mentioned the following reasons: - increased efficiency in the use of energy is the quickest, most effective way to tackle the issue of climate change, - by developing the same standards and requirements throughout Europe and the consequent enforcement it has to be made sure that the individual Member States are not played off one against the other by industry, - small and middle sized enterprises have to be included into the efforts of minimising greenhouse gas emissions. In 2002/2003 IMPEL has carried out a project on energy efficiency with Finland as lead country. A second project on that item was carried out in 2010 and the evaluation of the current situation showed that during the last years only minor changes have occurred in the consideration of energy efficiency issues in permitting and supervising procedures. In Member States that recently joined to European Union energy efficiency has not been at the countries' political level among the main priorities. The project identified 7 main challenges concerning energy efficiency:

	h) In the IPPC directive it is not stipulated how EE should be addressed. i) Information on EE in sector BREFs is not concrete and precise enough. The horizontal BREF on EE is complex and has not been utilised much. j) Lack of technical expertise in authorities and companies. k) Lacking or only occasional cooperation between energy and environmental authorities. l) There is no general approach in MS to handle the item of EE in the permit revision. m) Problems with definition of system boundaries. n) Unclear influence of other instruments like voluntary agreements, Energy Management Systems, tax and ETS-systems on energy efficiency of installations. For a step-by-step improvement of the situation in permit and inspection authorities participants of the workshop and the project team decided to concentrate on the technical aspects of energy efficiency without taking into account buildings and the influence of tax and ETS systems on it. For the future work of IMPEL in the field of EE they made the following proposals: • Development of a template for documents and data required regarding energy efficiency in the permit application • Workshop on assessment of the application documents regarding energy efficiency (for new and existing installations) and development of permit conditions based on BREFs using a sector specific approach (e.g. food sector, metal processing sector, paper sector, chemical sector, waste treatment plants). • Training course for dealing with energy efficiency in permitting and inspection. • Integrating the discussion on energy efficiency in other sector specific IMPEL-projects, e.g. pig farming. The proposal for a follow-up IMPEL project to be carried out in 2011/2012 aims at the development of a template for documents and data required regarding energy efficiency in the permit application. Work done in 2011: The project team consisting of 6 representatives from 5 IMPEL Member States and the consultant: - identified the basic documents to be reviewed during the project, - decided for a sector specific approach and to focus initially on the industrial sectors iron and steel (revised BREF document with conclusions expected in due time), glass industry (see iron and steel), cement industry (BREF revised in 2008), milk industry, large combustion plants and possibly municipal waste incineration plants, - developed a draft application form for energy efficiency for the initial discussion with the sector experts. The team made an analysis of major changes from IPPC to IE-Directive,

	discussed the new BAT concept under IED and identified relevant IED provisions related to energy efficiency. In two expert group meetings five sector representatives made presentations on the main energy efficiency issues in the sectors and discussed the applicability of the draft form for their sector with the project team. It was found out that the form should consist of a general part and a sector specific check list. Work to be done in 2012: For 2012 the project team intends to develop the check lists further and to test the application form in permit procedures in different EU Member States. Afterwards the final report and the template shall be made available for all interested parties.
1.2. Link to MAWP and IMPEL's role and scope	**Legal Background:** The Sixth Community Environment Action Programme calls for the encouragement of more effective implementation and enforcement of Community legislation on the environment, among other things through the promotion of improved standards of permitting, inspection, monitoring and enforcement by Member States and through improved exchange of information on best practice on implementation. Article III, Para. 4 of Recommendation 2001/331/EC providing for Minimum Criteria for Environmental Inspections in the Member States pursues the same objectives. The IMPEL MAWP 2007 – 2010 and the new MASP of Cluster 1 indicate climate change as one of the urgent topics.
1.3. Objective (s)	The main objectives are to identify: - how the requirements of the BREF Energy Efficiency and the chapters of other BREFs related to energy efficiency have to be integrated into the permitting and inspection procedures - what kind of information is needed in permit applications, e.g. description of measures, of fuel, energy efficiency indicators etc. - what is important for the consideration of applications, - exchange of information on existing guidance material, by - establishing an expert group for the discussion of the first point (5 participants from different MS plus project team) - development of a template for documents and data required regarding energy efficiency in the permit application and carrying out tests on real cases in a working group (5 participants from different MS plus project team). The draft template will be sent to the participants of the previous IMPEL workshop about energy efficiency held in June 2010 in Riga. They can participate in the test and will be asked for comments.
1.4. Definition	The project will help to promote the enforcement of the energy efficiency provisions of the IPPC Directive and future IED, the BREF Energy Efficiency and chapters of other BREFs related to energy efficiency and perhaps national provisions concerning energy efficiency. It will be carried out by a project team consisting of representatives of 5 IMPEL Member States. During the two phases of the project the team will

	work together with two different groups: a) an expert group (2011): For the evaluation of the requirements of the BREF Energy Efficiency and the chapters of other BREFs related to energy efficiency that have to be integrated into the procedures the expert group will need two meetings (first: discussion of the item and determination of work packages, second: discussion of results and work on further improvement) b) a working group (2012): The working group for the practical test and the improvement of the draft template will need two meetings (first: discussion of the item and determination of work packages taking into account the results of the first group, second discussion of the product and evaluation of the tests). A final report will be written which will cover the findings and make recommendations for further projects.
1.5. Product(s)	A final report with a template for documents and data required regarding energy efficiency in the permit application including a documentation of the requirements identified in IPPC/IED Directive, in existing/revised BREF documents for the relevant sectors and the available conclusions related to energy efficiency. If already possible the practical work with the BAT conclusions will be commented.

2. Structure of the project

2.1. Participants	▪ Experts in the field of enforcement of requirements concerning energy efficiency and with in depth knowledge of the related BREF documents, IPPC and IED Directive ▪ Permit writers and inspectors with experience in the enforcement of energy efficiency provisions will be invited as participants from IMPEL member states, ▪ A representative of the IPPC Bureau Seville ▪ IMPEL secretariat and Commission are invited to participate
2.2. Project team	Project team for the project phase 2012: 6 representatives of 5 MS, Sirpa Salo-Asikainen, Finland, Gisela Holzgraefe, Germany, Susanna Eberhartinger-Tafill, Austria, Judite Dipane, Latvia, Marianne Ripka and Hans Erling Lundmand Jensen, Denmark. A consultant with profound knowledge of BREF requirements and IPPC permitting and inspection should support the work. A representative of a consulting agency will - develop the proposals for the draft sector specific annexes to the application form for sectors not yet covered in 2011for the working group - document the results of the presentations and the discussions during the meetings - collect the relevant information and make an evaluation of the test phase of the application form - prepare a draft final report

	Project bearer: ▪ Ministry for Agriculture, the Environment and Rural Areas of Land Schleswig-Holstein (Germany)
2.3. Manager Executor	- Gisela Holzgraefe (DE)
2.4. Reporting arrangements	Project phase 2012: The project progress will be reported to Cluster "Improving permitting, inspection and enforcement" (Cluster 1, progress report in March 2012), to the participants and to possible observers and to other Clusters which might be concerned. The draft final report of the project is expected to be submitted to Cluster 1 in September 2012 and to the IMPEL General Assembly in Winter 2012. Parallel to that draft final and final report will be submitted to the IMPEL secretariat. Progress Report: March 2012 Final Report: Winter 2012
2.5 Dissemination of results/main target groups	The report and the template for documents and data required regarding energy efficiency in the permit application (in English) mentioned under 1.5 will be made available on the IMPEL website. It will be sent to the national IMPEL coordinators. The report will also be sent to other target groups (via IMPEL secretariat at the European level, via national coordinators at the national level). The report will be made available to energy efficiency initiatives and the IPPC Expert Group (IEG). The results of the project will be reported in professional and technical journals. On top of that they will be used for inspector trainings and presented at conferences.

3. Resources required

			2011	2012
3.1 Project costs and budget plan	*1. Overhead (organisation) cost (€):*			
	2 Project meeting costs (€)			
	Meetings [6]: 2011/2012			
	- meetings of expert group: 2			
	No of Participants:	10		
	Travel[7]:			
	Accommodation[8]: (1 night each)			
	Catering:			
	Meeting venue:		*	
	- meetings of working group: 2			
	No of Participants: 11			
	Travel[2] : (22 x 400 € = 8 800 €)			8 800
	Accommodation (1 night each per meeting)[3]:			2 200
	Catering:			550
	Meeting venue:		*	*
	Other (specify) Project team meetings 3, (2 in 2011) 6 participants per each, 1 night Travel Accommodation: 100 €/capita Catering			 2 400 600 300
	Other (specify) Project team meeting 1 6 participants per each, 2 nights Travel Accommodation: 100 €/capita Catering			 2 400 1 200 450
	Participation in 2 Cluster meetings			700
	3. Other costs: consultant			
	consultant			**15 000**
	TOTAL cost per year €		**31 450**	**34 600**
	TOTAL project cost €		**66 050**	
3.2. Fin. from IMPEL budget	*2. Project meeting costs plus 3. other costs(€)*			*-10 000* **24 600**
3.3. Co-financing by MS (and any other)	*1. Overhead costs (€):* as co-financing contribution for the **meeting venue** by one of the authorities the members of the project team come from,			
	2. Other costs (€) as co-financing contribution by Germany: 10 000 € for the consultant costs (under			*10 000*

[6] *specify, like Review Group Meetings, Workshop etc.*
[7] *normative: €˙400/person*
[8] normative: *€˙100/person/night*

***contribution from host**

	restriction of possible budget cuts in 2012)
3.4. Human from MS	Meeting preparation and participation: 130 days (based on 6 participants in project team, 5 in expert team and 5 in working group)
3.5 Human from Host countries	Meeting preparation and support: 10 in 2012, Meeting participation: 16 days in 2012 (based on 2 participants from host country) Project management support: 20 days

4. Quality review mechanisms

The quality of the project will be reviewed by the project participants and appraised by the Cluster "Improving permitting, inspection and enforcement" (Cluster 1). It will then be submitted to the IMPEL General Assembly for appraisal and adoption.

5. Legal base

5.1. Directive/Regulation/Decision	IPPC Directive; IED Directive, BREF document « Energy Efficiency « , energy efficiency related chapters of the sector BREFs, Directive (2006/32/EC) on Energy end-use efficiency and Energy Services; Recommendation 2001/331/EC providing for Minimum Criteria for Environmental Inspections in the Member States (RMCEI)
5.2. Article and description	Section 3, Para. 4 RMCEI: establishment of a scheme, under which Member States report and offer advice on inspectorates and inspection procedures in Member States Article 11 IED Directive: Member States shall take the necessary measures to provide that installations are operated with the following principles: (b) the best available techniques are applied; Article 13, Para. 1 no. 3 IED Directive: BAT conclusions shall be the reference for setting the permit condition; Annex III IED Directive: Criteria for determining best available techniques, no. 9: 9. the consumption and nature of raw materials (including water) used in the process and energy efficiency
5.3 Link to the 6th EAP	Article 3. Strategic approaches to meeting environmental objectives. Para. 2: "Encouraging more effective implementation and enforcement of Community legislation on the environment […] - promotion of improved standards of permitting, inspection, monitoring and enforcement by Member States; […] - improved exchange of information on best practice on implementation including by the European network for the Implementation and Enforcement of Environmental Law (IMPEL network) within the framework of its competencies".

6. Project planning

6.1. Approval	The draft ToR for the two year project on energy efficiency was presented at the Cluster 1 meeting in Oslo 1 October 2010, supported by Cluster "Improving permitting, inspection and enforcement" and adopted by the General Assembly in Brussels in November 2010. The amended draft ToR for 2012 project phase was submitted to the

	Cluster 1 meeting in Paris October 2011 and supported by Cluster "Improving permitting, inspection and enforcement".
6.2. Fin. Contributions	The project is supported by IMPEL. On top of that there will be a co-financing contribution by Germany: 10 000 € for the consultant costs (under restriction of possible budget cuts in 2012)
6.3. Start	The project start for the 2012 part is scheduled for 03/2012
6.4 Milestones	Milestones 2012: - From adoption of the budget of German Federal Ministry for the Environment (BMU, DE) onward: invitation of participants of working group to meetings in 2012 - April 2012: first working group meeting - June 2012: second working group meeting - September 2012: draft final report - winter 2012: final project report
6.5 Product	Final project report with template
6.6 Adoption	Presentation of the final report to the IMPEL Plenary is planned for winter 2012.

Annex II: Example Completed Application Form for Energy Efficiency for a Large Combustion Plant (Biomass)

8. CONTACT INFORMATION *(will be treated confidentially)*

Name of the company and type of business: Large combustion Plant based on biomass (not in commission yet)
Assessment of energy efficiency relates to (name and address): Denmark
If relevant, provide further information:

9. ENERGY SAVING AGREEMENT AND MANAGEMENT SYSTEMS

Does the company have an energy saving agreement? ☐ Yes, for the year(s): ☐ No *(provide brief justification):*
Does the company have an Environmental Management System (EMS)? ☐ Yes, *please specify (e.g. ISO 14001, EMAS)?:* ☐ Planned, which, when?: ☐ No *(provide brief justification):* *In case a company has implemented an EMS, further question related to EE issues in the company's EMS could be posed at this point, such as:* ➢ *Does the company's environmental policy contain issues related to EE?* ➢ *Are clear, (preferably measurable) objectives, goals and targets related to EE formulated, also indicating the required processes, responsibilities and the time for achievements?* ➢ *etc.*
Does the company have an Energy Management System? ☐ Yes, *please specify (e.g. ISO 50001)?:* ☐ Planned, which, when?: ☐ No *(provide brief justification):* Further questions regarding e.g. organisational issues, data management, etc. could be added: ➢

10. SYSTEM BOUNDARIES *(simplified flow chart)*

Please provide a simplified system flow chart of the installation (including major processes, etc.) and indicating system boundaries for calculation of EE. A detailed flow chart can be attached in ***Annex I****.* *The system consists of all process equipment, including the following systems: fuel handling and storage, furnace/boiler, flue gas cleaning system, heat recovery system, steam turbine, turbine condensers, stack and all process related electricity consumers. The flows entering the system are combustion air (the heat associated with this flow is negligible), primary fuel (straw), auxiliary fuel for boiler start up (light diesel oil), district heating return water and electricity sales. The flows leaving the plant as losses are minor boiler losses and flue gas. The flows leaving the plant as energy*

output are district heating supply water and gross electricity production. A diagram with indication of system's boundaries is attached X further information attached

11. TOTAL CONSUMPTION FIGURES

Electricity	X Estimated value (year) ☐ Measured value (year)	Further explanations
	Net consumption of Electricity (MWh): purchase (MWh): 21,100 sales (MWh): 284,300 *Are selling certificates available?:*	*The facility is a combined heat and power plant that will produce district heating and electricity. The gross electrical production is estimated to be approximately 284,300 MWh/year that will be sold to the grid. 21,100 MWh/year will be purchased from the grid for own electrical consumption.* *These figures are based on 8,424 hours of full load operation.*
Heat	X Estimated value (year) ☐ Measured value (year)	Further explanations
	Net consumption of Heat (MWh): purchase (MWh): 0 sales (MWh): 665,900 *Are selling certificates available?:*	*It is estimated that 665,900 MWh of district heating are generated per year, both by the steam turbine condensers and by the heat recovery system (flue gas condensation).* *These figures are based on 8,424 hours of full load operation.*
Fuels	X Estimated value (year) ☐ Measured value (year)	Further explanations
	purchase (MWh_{pa}): 100 sales (MWh_{pa}): *Are selling certificates available?:*	*Auxiliary fuel for boiler start up (light diesel oil).* *This figure depends on the number of boiler start ups. One cold and one warm start up per year are considered.*
Technical Gases	☐ Estimated value (year) ☐ Measured value (year)	Further explanations
Electricity, Heat, Fuels not purchased/sold	☐ Estimated value (year) ☐ Measured value (year)	Further explanations
Renewable Energy Source	X Estimated value (year) ☐ Measured value (year)	Further explanations
	Primary fuel, straw: 926,600 MWh_{pa} (LHV based)	*As alternative fuel, woodchips might be used in co-combustion with straw. Changes in overall fuel consumption are not expected.* *These figures are based on 8,424 hours of full load operation.*

**for further details please review the corresponding sankey diagram provided in Annex V*

12. ENERGY CONSUMPTION IN MAIN PROCESSES *(if relevant)*

Process	☐ Estimated value ☐ Process part energy consumption (year)	Further explanations
	electricity (MWh) heat ○ steam (MWh) ○ hot water (MWh) ○ other heat (MWh) fuel (MWh_{pa}):	
	Process part output (in t/a or other)	
Process	☐ Estimated value ☐ Process part energy consumption (year)	Further explanations
	electricity (MWh) heat ○ steam (MWh) ○ hot water (MWh) ○ other heat (MWh) fuel (MWh_{pa})	
	Process part output (in t/a or other)	

13. ENERGY GENERATION PER BOILER *(if relevant)*

Name of boiler *(if relevant)*	X Boiler estimated value ☐ Boiler energy generation in (year)	Further explanations (e.g. measurement methods)
Straw fired boiler	Use: fuel (MWh_{pa}): 926,700 electricity (MWh): 21,100 Output: electricity (MWh): 284,300 heat ○ steam (MWh) ○ hot water (MWh): 665,900 ○ other heat (MWh)	*Primary fuel is straw (926,700 MWh/year, LHV based) and auxiliary fuel for boiler start up is light diesel oil (100 MWh/year). The generated steam is converted into electricity (284,300 MWh/year) and hot water for district heating (665,900 MWh/year, including heat recovery). 21,100 MWh/year of electricity for own consumption are purchased from the grid.* *These figures are based on 8,424 hours of full load operation.*
Name of boiler *(if relevant)*	☐ Boiler estimated value ☐ Boiler energy generation in (year)	Further explanations (e.g. measurement methods)
	Use: fuel (MWh_{pa}) electricity (MWh) Output: electricity (MWh) heat ○ steam (MWh) ○ hot water (MWh) ○ other heat (MWh)	

14. CALCULATION OF ENERGY EFFICIENCY

Please provide calculation details (i.e. formula to calculate EE, scope of the formula and a definition of relevant parameters of the formula, etc.). Detailed information can be attached in Annexes II/III

See attachment

X further information attached

15. INDICATORS TO MONITOR CONTINUOUS IMPROVEMENTS

Please specify indicators in place to monitor continuous EE improvements for single processes and the entire facility/installation.

Gross electricity production, own electricity consumption, heat production and fuel input will be measured together with a number of other parameters (steam production and temperatures for example) to monitor the plant efficiencies and their improvements.

16. STEPS TAKEN DURING THE LAST THREE YEARS TO IMPROVE ENERGY EFFICIENCY

(step, implementation time, estimated energy saving, investment)

The plant conceptual design has been performed to improve both electrical efficiency and heat efficiency.

Electrical efficiency:

- Reduction of excess air and therefore of flue gas losses to increase of boiler efficiency (which leads to higher electrical efficiency)
- Flue gas air cooler / Combustion air preheating to reduce flue gas temperature at the boiler outlet leads to increase of boiler efficiency (which leads to higher electrical efficiency)
- Highest steam parameters available for straw fired boilers to increase electrical efficiency of the steam cycle
- 2 high pressure feedwater preheaters to increase electrical efficiency of the steam cycle
- 2 district heating condensers to increase electrical efficiency of the steam cycle

Heat efficiency:

- Backpressure steam turbine is preferred to extraction steam turbine with air/water cooling to avoid heat losses at the condenser due to heat release to the environment. All the exhaust steam heat is instead recovered as district heating
- Advanced heat recovery system that consists of condensing scrubber and combustion air moisturizer (inverse scrubber) to achieve very low flue gas temperature and generate additional district heating

☐ further information attached

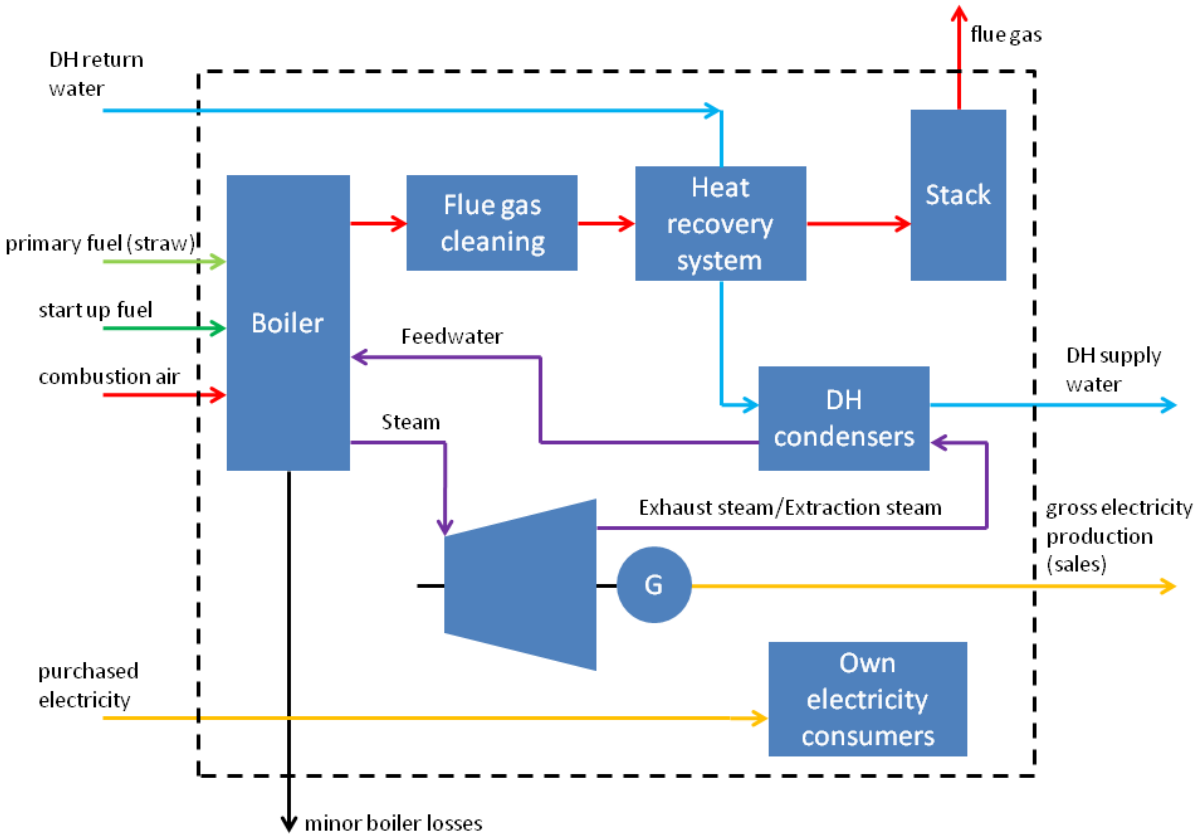
17. PLANNED STEPS TO IMPROVE ENERGY SAVING

(step, implementation time, estimated energy saving, investment)

Not relevant since energy savings will be implemented as part of the plant design and initial investment (see section 9). In future, possible improvements of energy efficiency will be considered in accordance with new available technologies and solutions.

☐ further information attached

Annex I: System Boundaries



Annex II: Definition of main energy flows *(needed for EE calculation)*

Main energy flows	Definition	Further comments/explanations
926,600	Straw, primary fuel	Primary fuel that is combusted into the boiler. It is a renewable energy source. LHV based. This figure is based on 8,424 hours of full load operation.
100	Light diesel oil, auxiliary fuel	Used for boiler start up only. Its amount depends on the number of warm and cold start ups. It is not used under normal plant operations.
284,300	Gross electricity generation	Electricity that is produced by the steam turbine, measured at the generator. This figure is based on 8,424 hours of full load operation.
3,400	Turbine generator losses	This figure is based on 8,424 hours of full load operation.
21,100	Own electricity consumption	Part of the gross electricity generation is used in house to perform processes in the power plant (fans, pumps, motors, etc). This figure is based on 8,424 hours of full load operation.
665,900	Heat production	Heat is produced in the form of hot water for district heating at the steam turbine condensers (560,200) and at the heat recovery system or flue gas condensation system (105,700). This figure is based on 8,424 hours of full load operation.

Annex III: Example calculation for the determination of energy efficiency

The following formulas are typically used for determining the energy efficiency of CHP plants.

Gross electrical efficiency = Gross electrical production / Fuel input (LHV based) = 284,300 / (926,600 + 100) = 30.7%

Where fuel input is the sum of consumed fuels, including auxiliary fuels.

Net electrical efficiency = (Gross electrical production - Own electricity consumption) / Fuel input (LHV based) = (284,300-21,100) / (926,600 + 100) = 28.4%

Heat efficiency = Heat production / Fuel input (LHV based) = 665,900 / (926,600 + 100) = 71.9%

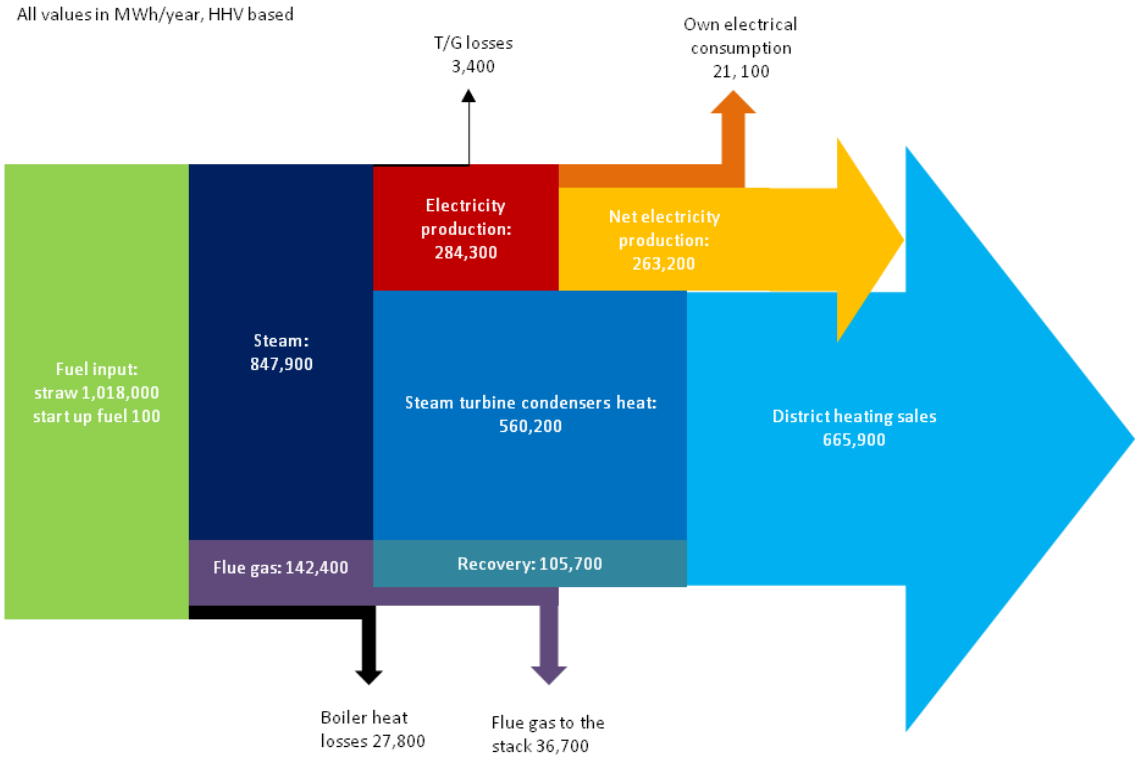
Gross CHP efficiency = Gross electrical efficiency + heat efficiency = 102.6%

Net CHP efficiency = Net electrical efficiency + heat efficiency = 100.3%

Please notice that the CHP efficiency is above 100% since the calculation is based on LHV, but condensation occurs in the heat recovery system.

Annex IV: Sankey Diagram

Important note: Energy and efficiency calculation based on LHV are widely accepted and much more common than the ones based on HHV. Nevertheless it is not possible to represent a Sankey Diagram based on LHV, if flue gas condensation occurs as in the current case. Therefore, while efficiencies are calculated in LHV, it is decided to show the Sankey Diagram in HHV.



Annex IV:

Annex V:

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