

The IPPC Directive as a Driver for Eco-efficiency

Environmental permitting in British, Danish, Dutch, Finnish and Swedish dairy industry

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Abstract

The role of environmental permits as a driver for environmental improvements has been a topic of debate for a while. Many permitting regulations were designed in the 1970's and have not been updated since then. Consequently, they have acted mostly as a driver for the adoption of pollution control technologies. Some experts now see that appropriately designed and implemented environmental permitting regulations have a substantial potential to drive improvements in the operation of industrial installations, whereas others consider permitting as a means to force the worst performers to act. Ever since the IPPC (Integrated Pollution Prevention and Control) Directive on the environmental permitting of large industrial installations was being planned in the first half of 1990's, its role as a driver for improvements has been discussed. This thesis explores the IPPC Directive as a driver for eco-efficiency of the dairy industry in five European countries. A minority of dairies in Denmark, Finland, the Netherlands, Sweden and the UK have been permitted, according to the IPPC at the time of writing and there are already interesting signs on what the outcomes may be.

In this thesis, environmental permitting is seen as a process and the IPPC Directive is investigated from the perspective of this process. The permitting process includes everything that is connected to the environmental permit, from the perspective of a company that applies for a permit. The thesis explores whether the permitting process encourages the companies to become more eco-efficient and a study framework is created to assess the permitting process as a driver for eco-efficiency. For example, challenging permit conditions and information on opportunities can motivate the companies to improve eco-efficiency. Eco-efficiency — a combination of good economic and environmental performance — was chosen to be the focus of the study due to the nature of the main environmental aspects of the dairy industry. All of the sector's major environmental aspects are related to efficient use of resources (energy, water and raw material use and related wastewater issues) and improvements in environmental performance are thus directly connected to business benefits.

The design of the IPPC Directive, features of its implementation and actors who influence the permitting process are investigated in the thesis. Also, a few dairy plants' permits are studied from each country. The effectiveness of the implementation process is assessed and conclusions are drawn, both on the extent of the possible improvements in eco-efficiency and the environmental aspects that are likely to be influenced. In order to facilitate a more favorable outcome, some improvements to the implementation of the IPPC Directive are suggested.

Executive Summary

Introduction to the Topic

This thesis explores the IPPC (Integrated Pollution Prevention and Control) Directive as a driver for eco-efficiency in dairy industry. The goal of the IPPC Directive is to “to achieve a high level of protection for the environment as a whole” and common procedures for environmental permitting of large industrial installations throughout Europe are the means for reaching this goal. At the moment the implementation of the IPPC Directive is in an interesting state, because the regulators and companies are making efforts to get the installations authorized by a deadline in October 2007.

The IPPC Directive strives to call increasing attention to the prevention of pollution on source. In the past, environmental regulation has had a major impact to environmental impacts of industry, but it has mostly driven the adoption of end-of-pipe technologies. If IPPC Directive manages to shift the focus to pollution prevention, there is a possibility that it yields also economic benefits for the dairy industry. Water, energy and raw material use are the main environmental aspects of the dairy industry and decrease in the use of these resources would also lead to economic savings. In other words, the eco-efficiency would increase. The concept ‘eco-efficiency’ goes includes also other aspects than resource efficiency, but the focus of this thesis is on resources.

The objective of this thesis is to find out

1. if the IPPC Directive will drive improvements in eco-efficiency of the dairy industry in Denmark, Finland, the Netherlands, Sweden and the United Kingdom
2. when these improvements are likely to taken place and
3. how the eco-efficiency may be improved (improvements in energy efficiency/water efficiency/raw material efficiency/chemicals use)

A fourth objective is to develop a framework for studying IPPC Directive as a driver for eco-efficiency and identify the hotspots that influence the directive’s influence to the eco-efficiency of an industry sector. This framework is used to guide the study. It can also be used later on in other studies on similar topics, or it can provide ideas on how to look at the impact of the IPPC Directive.

Permitting Process as a Driver for Eco-efficiency

Environmental permitting goes beyond a piece of paper that contains industrial installations’ permit conditions. This thesis explores the whole permitting process as a driver for eco-efficiency. The permitting process refers to everything that is connected to the environmental permit from the company perspective. For example, information on IPPC related requirements, interaction with the regulators before and after the permit has been issued, collection of information for the permit application and the permit conditions are part of the permitting process.

To investigate whether the permitting process is likely to act as a driver for eco-efficiency of dairy industry, an ideal permitting process was identified. Six characteristics that drive eco-efficiency in the permitting process form the basis for the framework of this study (Figure 1). The following two characteristics were found out to be the most important ones. The companies must **receive signals that improvements are required**. Without these signals there is no drive for any change. The second issue is that the permitting process has to **focus**

on the manufacturing process. Resource efficiency can be improved only by making changes in the process and its operation.

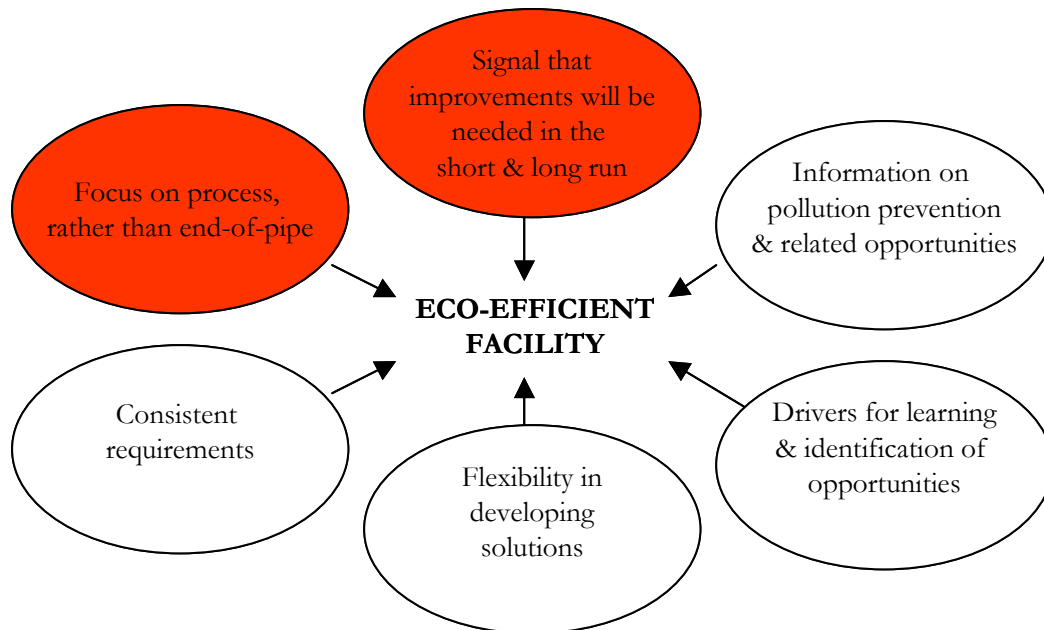


Figure 1 – Characteristics the permitting process should have in order to drive improvements in eco-efficiency

In addition to those two characteristics, an ideal permitting process meets also other conditions. **Information on pollution prevention and related opportunities** can be provided to the company from outsiders, but to develop performance continuously a company also needs to be **encouraged to learn** to use its own capacity in finding solutions. To find, select and develop process-integrated solutions to improve eco-efficiency, a company needs some **flexibility in meeting the requirements**. For example, time is needed as well as approach that takes into account the environmental performance as a whole. **Consistency of requirements** between installations is partly contradictory to this flexibility, but it is important to include both in the framework, because a balance between them is essential. Consistency helps the companies to take action, because there are clear signals on what is required. It is also a basis for the realisation of first mover advantages.

The characteristics of the permitting process were used in the analysis of the IPPC Directive and its implementation in the dairy industry. The study assesses, whether the IPPC Directive and its implementation lead to development of permitting process with ideal characteristics.

IPPC as a Driver for Eco-efficiency of Dairy Industry

Potential within the Design

Case specific and integrated approach to pollution prevention and control are the key characteristics of the IPPC Directive. The holistic consideration of the environmental aspects, and the flexibility the regulators are guaranteed when they set the permit conditions facilitate prevention of pollution at source.

The IPPC Directive addresses the actual requirements mainly by obliging the operators of industrial installations to adopt Best Available Techniques (BAT). The permit conditions must

lead to attainment of environmental performance that can be achieved with BAT. From economic point of view, BATs have been interpreted to be technologies that are affordable for majority of European industry. However, also technical characteristics of the installation in questions, local conditions and geographical location have to be taken into account when the permit conditions are decided. Taking into account these factors provides flexibility that is important for pollution prevention, but at the same time it gives the regulators an opportunity to deviate from the level of performance that is considered BAT level from an economic point of view. There is a concern that deviations towards lower environmental performance will take place.

Earlier research suggests, that highly competent regulators with adequate resources are needed in the implementation of integrated, flexible environmental permitting. High competence and process related knowledge is required, because without that the regulators may limit the scope of the permitting process to the end-of-pipe treatment. The generous amount of freedom the regulators are guaranteed by the design of the directive leads to positive outcome only if it used wisely. The lack of resources within the regulatory bodies in the studied countries does not indicate the best possible outcome for the implementation.

Potential within the Reference Document on BATs

In practice, the IPPC relies on the Reference Documents on BATs (BREFs) on the target setting and consistency of requirements. To support the implementation, information exchange is being carried out on BATs within the sectors in the scope of the Directive. BREFs present the outcome of the information exchange. The dairy sector is covered in the BREF in the Food, Drink and Milk Industry¹. Due to the design of the Directive, IPPC is not likely to effectively harmonize the permit conditions throughout Europe, but the BREFs have a potential to increase the consistency of requirements. The BREFs do not have a binding force, but the regulators have to take them into account when they decide the permit conditions.

From the point of view of eco-efficiency, an ideal BREF would provide regulators and companies with useful information on advanced, available techniques and include BAT levels. BAT levels are indicative performance levels that can be achieved with best available techniques. They give clear signals on the possible requirements and contribute to the consistency of permit conditions. The BREF in the Food, Drink and Milk Industry has shortcomings that prevent it from acting as a driver for eco-efficiency of dairy industry in an optimal way. Due to the wide scope of the document and unclear structure, it is difficult to extract information on BATs in dairy industry. Also BAT levels on resource use are completely missing. Originally, the BREFs were supposed to be updated every five years, but this has not happened regarding other BREFs. Less frequent updating may lead to decreased level of requirements on the dairy industry.

Implementation in Denmark, Finland, the Netherlands, Sweden and the UK

A few large players dominate the dairy processing in each of the studied countries. The Danish, Dutch and Swedish industries have been regulated through environmental permitting for a while, whereas Finnish and British industries face this type of regulation for the first

¹ The BREF on Food, Drink and Milk Processes is still at draft stage, but substantial changes are not expected.

time. Among the studied countries, Finland is the only one where the integrated approach to environmental permitting is new to the authorities.

Regulation of eco-efficiency is inherently more difficult than control over emissions, because it requires the regulators to have competence on a broader field. Based on the investigation of some permits that have already been issued for the dairy industry, it seems that so far the IPPC has not managed to shift the focus of the permitting to the resource efficiency. Binding limit values to restrict the resource use are very rare, but softer measures, for example requirements to investigate opportunities to reduce water use are more common. Authorities in most of the studied countries gave priority to raw material efficiency and related wastewater issues among the environmental aspects that they wish to influence through permitting. Regulation of energy efficiency is considered difficult and it has a minor role in the permitting. Other environmental policy instruments are often used to increase energy efficiency.

Improvements in the environmental performance and eco-efficiency are likely to take place, when the Member States ensure that the dairy industry meets the requirements before the deadline in 2007. Dairy plants that have average environmental performance in the country where they are located will most probably not be heavily influenced. The influence to the worst performers is likely to be more significant. If the implementation is not improved radically, significant improvements in the eco-efficiency of studied dairy industries is not likely to be seen in the near future. There are of course differences between countries. The British dairy industry may be an exception among the studied countries and substantial improvements in eco-efficiency are more likely there.

The **UK** has put more effort to the implementation of the IPPC in the dairy sector than the other studied countries. Support that the BREF fails to provide is given on national level: the application form provides a selection of dairy specific BATs and a few dairy specific benchmarks on eco-efficiency. Also, the British regulators appear to see a larger need for improvements within the dairy industry than the regulators in the other studied countries. The improvements are likely to be divided between several years in the UK, because the aim of the first round of permitting is mainly to set the environmental issues higher on the agenda of the companies and prepare both regulators and companies for later improvements. The improvements have already started, but the peak may come as late as after the second round of permitting in 2008-2010². Improvements are most likely to be seen in water and raw material efficiency because these are considered the priorities by the Environment Agency.

In the **Netherlands**, the likelihood of the IPPC to drive companies to improve their eco-efficiency is lowest. Eco-efficiency related issues are going to continue to be addressed mainly within the voluntary agreements the dairy industry is committed to. The review of the permits that have been issued before the transposition of the IPPC is unlikely to lead to significant changes in eco-efficiency. Both the role of the permits as a safety net that supports the covenants and the fact that IPPC did not add any new environmental aspects to the permitting are reasons behind this.

In **Sweden**, an opportunity for improvements in eco-efficiency lies in the inspection on whether the companies meet the requirements of the Directive. Uncertainty on what is the actual level of requirements and appropriate signals from authorities may lead the companies to act, because they have to take the initiative and prove that they have adopted BAT.

² The British dairy companies have to apply for their first environmental permits in 2004 or 3005. The first permits have to be updated 4 years after they have been issued.

Improvements in eco-efficiency may start as soon as the companies have been given information on their responsibilities. Improvements can be expected on areas that used to have less significant status in the legislation: energy efficiency, waste avoidance, risks, accidents and chemical substitution.

In **Finland**, equally significant improvements in eco-efficiency cannot be expected as in the UK, although the Finnish dairies will also be issued their first environmental permits. Due to a positive impression of the industry's environmental performance, the motivation of the regulators to drive improvements is lower than in the UK. The focus of the issued permits is on permit conditions that influence at the end-of-pipe. The possible improvements in eco-efficiency are mostly likely to be related to raw materials, because this aspect is highest on the regulators' agenda. Finnish dairy companies have to apply their permits by the end of year 2003.

The increased frequency of permit updating is likely to improve the role of the regulation as a driver for eco-efficiency in the long term in **Denmark**, because a decision was taken to reconsider the environmental permits every eight to ten years. Earlier the permits could be reconsidered less frequently. Since the other changes made in the legislation are minor and the implementation has been vague, the type of permit conditions is not likely to change. They continue to be focused on issues that can be solved at the end of pipe. There is not likely to be a peak in the number of submitted permit applications, because Denmark is not planning to take adequate measures to ensure that all the dairy installations meet the requirements by October 2007.

Recommendations on the Implementation

The course of the study revealed hotspots that influence the IPPC most as a driver for eco-efficiency. The following factors were identified as hotspots: design of the Directive, former regulation, implementation within the regulatory bodies, regulators' resources and competence, the BREF and the receptivity of the European food and drink industry to IPPC. The industry's receptivity turned out to have a major role, because their influence to the BREF was substantial. The implementation has many shortcomings exactly in the points that are most important for eco-efficiency. Thus some improvements to the implementation of the IPPC Directive are suggested.

On European level, the BAT information exchange process and especially the BREF in the Food, Drink and Milk Industry could be improved substantially. More balanced participation of experts from different interest groups to the information exchange on BAT should be guaranteed in order to produce practical documents with ambitious techniques and BAT levels. Unfortunately, suppliers and NGOs did not participate to the information exchange for the current BREF. Secondly, the scope of the BREF should be smaller. The dairy industry is the second largest subsector within the food industry. Thus it could have its own BREF. Dairy specific BREF would solve majority of the problems of the current BREF. In the dairy specific BREF, BAT levels on energy, water and raw material use should be provided for the largest product groups in order to promote eco-efficiency.

An increase in personnel resources involved in the implementation is an obvious, but not easily available measure to improve the outcome of the Directive. Another way to improve the implementation is for example to encourage the regulators to increase the use of other permit conditions than binding limit values. Many regulators see the regulation of resource use through binding limit values as inappropriate, but more attention could be paid to eco-efficiency with other measures. Monitoring of eco-efficiency should be improved, and

improvement programs and requirements to investigate opportunities on energy, water and raw material efficiency can be part of the permit.

Concluding Remarks

Environmental regulation is challenging, especially in the EU that is comprised of so different Member States. It is not easy to improve the design of environmental permitting in such way that it would be a substantial driver for eco-efficiency throughout Europe. Semi-binding standards could be considered instead of a completely integrated and flexible approach, but finding an appropriate level of performance would be extremely difficult. Due to large differences in environmental performance of industrial installations across EU, such level may have to be selected, that standards would not drive adoption of eco-efficient practices in countries where environmental issues have traditionally had higher priority. Strengthening in the role of the BREF could however be considered.

Environmental permits do not necessarily have to act as a driver for eco-efficiency of the majority of industrial installations. They can be used as safety net that ensures a certain level of performance, if other policy instruments are used successfully to drive environmental performance in more proactive ways.

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1. Introduction

The development of the European industry during the last 20 years proves that simultaneous economic growth and significant improvements in environmental performance are possible. In relative terms, energy and raw material use and major emissions (carbon dioxide and other greenhouse gases, ozone precursors, acidifying gases) from the manufacturing sector have all decreased. The most striking example is the development in emissions of acidifying gases over the last 20 years: the absolute quantity fell more than 60% at the same time as the production increased 30%. Similar and greater achievements are still needed. (European Commission, 2002). As the ultimate goal for business is to create profits, it is no surprise, that eco-efficiency - a concept that emphasizes the combination of economic efficiency and improvements in environmental performance - became famous in less than ten years. The World Business Council for Sustainable Development launched the term in 1991.

The earlier achievements in eco-efficiency were made largely under the pressure of national environmental regulation. Nowadays environment is one of the core areas of EU policies. The goal of improved quality of the surrounding environment and the global nature of the environmental problems are not the only reasoning behind more than 200 Directives and Regulations. The European Union wishes to create a level playing field for the business. (Glachant, 2001). In 1996, the Commission accepted a new environmental regulation, Integrated Pollution Prevention and Control (IPPC). The target of the IPPC Directive is the large industrial installations and objective "to achieve a high level of protection for the environment as a whole" (Council Directive, 96/61/EC). Environmental permitting of the industry is to deliver this ambitious goal.

The implementation of the IPPC Directive is in an interesting stage at the moment, as the Member States are striving to issue their industries environmental permits by the deadline in 2007. Permitting systems existed throughout Europe already prior to the IPPC Directive, but now the installations have to be authorized according to the common European requirements. But even before the industry has got its permits, there have been a few critics who doubt the successfulness of the directive in meeting its ambitious goals (Ganzleben, personal interview, July 1, 2003) (Bohne, 2001).

The IPPC Directive contributes to the harmonization of the industrial pollution control by introducing union wide rules for issuing environmental permits for the largest industrial installations. The IPPC Directive is an example of procedural EU legislation (Glachant, 2001). It harmonises the procedures of issuing environmental permits to a certain extent but does not prescribe emission limits that would be applied uniformly across the EU. Instead, the concept of Best Available Technique (BAT) guides the authorities and companies in choosing how to prevent and control pollution. The flexible approach has been chosen to give the authorities a possibility to take into account the geographical location, local environment and technical characteristics of the installation (Gislev, personal interview, July 9, 2003). The directive aims also at taking into account European industry's competitiveness and innovation.

The aim of this thesis is look at the eco-efficiency effects of the IPPC Directive in the dairy industry. The thesis explores whether the Directive may act as a driver for such improvements in the environmental performance that have a potential to improve simultaneously the economic efficiency. Energy and water use and discharges of effluent are considered the most significant environmental aspects of the dairy sector (COWI Consulting

Engineers and Planners AS, 2000). All three are related to the resource consumption. The effluents contain mainly biologically degradable substances – milk that is being wasted. Savings due to the reduced energy, water and raw material use would clearly improve eco-efficiency as they yield economic benefits at the same time as environmental performance is improved. Worldwide, the potential for this type of savings in dairy industry has been estimated considerable (Nilsson R., personal interview, June 16, 2003). The IPPC Directive aims at promoting clean technologies rather than pollution control technologies and thus it could have a potential to yield this type of improvements in processes and their operation.

Dairy industry is an interesting sector when it comes to the IPPC Directive, because food processing is among the industries that have in some Member States faced little regulatory pressure to improve their environmental performance (European Commission, 2003b). The IPPC Directive also increases in several Member States the number of environmental aspects to be taken into account in the permits. A closer look is taken in this thesis at British, Danish, Dutch, Finnish and Swedish dairy industries. British and Finnish dairy industries are examples of industries that have not been under environmental permitting prior to the IPPC directive³. Denmark and the Netherlands are interesting countries, when it comes to the dairy products, because their dairy industries are among the most significant ones in Europe (Dutch Dairy Board, 2003b). The Netherlands is one of the largest exporters of dairy products in Europe and a substantial share of the Danish dairy products is also imported. Sweden is generally considered a forerunner in environmental issues and thus the Swedish dairy industry was selected among the studied industries.

³ The regulation of Finnish dairies was reduced in the eighties when a decision was taken to include only dairies that are not connected to municipal sewage in the scope of environmental permitting. Prior to that, wastewater related permits were required. (Enckell, personal interview, July 18, 2003).

2. Methodology

The thesis explores the outcome of the IPPC Directive before most of it has been realized. The peak of first permits that meet the requirements of the IPPC Directive is yet to come and thus the approach of the thesis is *ex ante*. The investigation of a few permits that have already been issued provides a glimpse of what may happen on a larger scale. Qualitative research methods were used to gain an understanding on how the implementation works in the studied countries and how the key actors are likely to contribute to it.

2.1 Objectives of the Thesis

The thesis aims at providing answers to the following three questions:

1. Will the IPPC Directive drive improvements in eco-efficiency?

The thesis aims at looking whether the IPPC Directive is likely to act as a driver for eco-efficiency in the dairy industry. Eco-efficiency is a broad concept and reductions in the consumption of resources and related savings are not the only way to improve environmental and business performance simultaneously. However, the main focus of this thesis is on the consumption of resources, because the main environmental aspects in dairy plants are related to resource use. Other environmental aspects, for example the selection of more environmentally benign resources (e.g. substitution of chemicals) are touched more briefly. The key issue is whether the IPPC Directive acts as a driver for measures that lead to increased resource efficiency and create savings by influencing the manufacturing process. Treatment or capture of emissions at the end-of-pipe does not contribute to resource efficiency.

2. When are these improvements likely to take place?

New installations were required to be authorized according to the IPPC Directive already in 1999, when the Directive came into force. Since the transposition of the Directive into the national laws, a few existing installations have already been authorized according to its requirements. Transposition was supposed to take place by October 1999 and the existing installations must meet the requirements of the Directive latest October 2007. Some Member States have set their own schedules to authorize the existing installations that would not otherwise apply for a permit by the deadline. The Member States ensure this way, that all the installations meet the requirements by 2007.

The thesis is focuses on the permitting of existing installations rather than the new ones. The purpose is to look when the improvements, that are related to the first permits issued according to the requirements of the IPPC Directive, taken place. If the Member States have made longer-term plans on the implementation of the directive, these plans are also taken into account.

3. How may the eco-efficiency be improved?

In addition to the role of the different environmental aspects in the directive itself, other national policies and priorities of the authorities influence the focus of the permits. The thesis explores where the focus of the permitting is likely to be. The aim is also to find out whether there is more specific information on the measures that may be required.

In addition to meeting the objectives that were mentioned above, an important objective is also to develop a framework that can be used in studying the IPPC Directive as a driver for eco-efficiency. The framework can be used as such in other studies on the topic, or it can provide ideas on how to look at the influences of the IPPC Directive. Within the framework, the “hotspots” that influence the IPPC Directive and its implementation most as a driver for eco-efficiency, are identified.

2.2 Research Questions

The following research questions guided the study. The first two questions are related to how the IPPC Directive and its implementation should be assessed in order to find out whether it drives improvements in eco-efficiency. Based on the answers to these questions, two models that form the framework of the study were created. The models are presented in Chapter 4. The third question leads to the information collection on the Directive, influenced actors and the implementation and the assessment of the collected information.

1. What are the ideal characteristics of an environmental permitting process for it to drive eco-efficiency improvements?

IPPC Directive has a possibility to influence the eco-efficiency of a company through the permitting process. The permitting process refers in this thesis to everything that is connected to the environmental permit from the company perspective. It starts from the point when the company gets the information related to the IPPC. For example, interaction with the regulators before and after the permit has been issued, collection of information in order to get the permit or meet its conditions and the permit conditions are part of the permitting process. The ideal characteristics of the permitting process could be related to the environmental aspects that are given priority in the permitting, the quality of the information the company receives in the process etc.

In order to find an answer to the first question, literature on eco-efficiency and its drivers was explored. Based on the literature, a model (Model 1 in Chapter 4) was created on the characteristics the permitting process should have in order to drive improvements in eco-efficiency.

2. What are the factors that influence the permitting process as a driver for eco-efficiency?

How the permitting process eventually looks like, depends on many factors. Among others, the regulator, who issues the permit, influences it, as well as the operator of the installation in question and the legislation that is being implemented by issuing the permit. The purpose of the second research question is to identify the factors that influence the permitting process in the case of the IPPC Directive.

Knowledge on regulation as a driver for improvements on environmental performance in general and eco-efficiency more specifically is needed in order to identify these factors. After exploration of relevant literature, and the main characteristics of the directive, the key factors influencing the outcome of the IPPC Directive were found. A model (Model 2 in Chapter 4) was created based on the findings.

2. Methodology

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- IPPC Directive, legislation that was introduced to transpose it and material concerning its implementation
- permit applications forms
- a few environmental permits that have been issued to the dairy industry after the transposition of the Directive in the studied Member States (See Appendix I)

Interviews

The study relies largely on the semi-structured interviews of people who are either in key position in the implementation of the directive and its influence in studied industries or have essential knowledge on it. The information on implementation on national and EU level is gathered to a few people and thus interviews are an appropriate method to access this information and try to gain the understanding on how the Directive and its implementation work. The dairy companies in the studied countries are relatively large and thus also majority of them could be covered in the interviews.

The interviewees included

- 9 Representatives of domestic Environment Protection Agencies or corresponding institutions
- 6 Regulators who issue the permits to dairy industry (apart from UK, at least one regulator from each country)
- 9 Company environmental managers (or other employees who are responsible for environmental issues in dairy companies)
- 4 European Commission employees: 2 representatives of Directorate General Environment, 1 representative of Directorate General Enterprise, the coordinator of the information exchange on BAT
- 3 Experts: 1 researcher with expertise on the IPPC in another industry sector, 3 consultants with knowledge on cleaner production in dairy industry
- 1 Dairy industry trade body representative

Denmark, Finland, the Netherlands and the UK have altogether 8 experts in the EU level information exchange on BAT on food, drink and milk processes (Sweden does not have any representatives in the Technical Working Group). At least one representative from each country, altogether 6 representatives were interviewed for this study. Most of them work in the Environment Protection Agencies and they are included in the list above.

2.4 Scope

The adoption of eco-efficient practices that lead to savings in resource use and decreased environmental impacts is a complex process and the influence of the IPPC Directive to eco-efficiency depends eventually on a combination of diverse factors. Some of them are directly related to the Directive and its implementation, for example input of the Member States to the implementation. Other factors, that are not dependent on the IPPC Directive, play an

equally important role. The IPPC is a part of the combination of policy instruments that are directed to influence the environmental performance of the industry. In addition to the EU level and national policies, for example the market-related factors drive the eco-innovation in the industry. The environmental awareness, knowledge on clean and pollution control technology and staff's motivation to improve environmental performance in companies have a deep impact on the outcome of the directive. The emphasis of the thesis is on the factors that are directly related to the directive. Chapter 4 contains more specific information on these factors and the focus of the thesis. Factors that are not directly related to the Directive and its implementation, for example the main policies that overlap with the objectives of the IPPC Directive in the dairy industry are mentioned shortly.

The Directive obliges the operator to apply BAT to prevent pollution, avoid waste production and use energy efficiently. Pollution refers in the Directive to emissions of "substances, vibrations, heat or noise into the air, water or land". Out of different type of emissions, only substances are within the scope of the thesis. The whole life cycle of a plant is covered in the Directive. BAT must be taken into account in the way the installation is designed, built, maintained, operated and decommissioned. The focus of this thesis on the way the dairy processing plant is maintained and operated.

2.5 Limitations

Certain limitations of the study can be associated to the semi-structured interviews the study relies on. The outcome of the interview depends largely on the skills of the interviewer and the interaction between the interviewer and the interviewee. The interviewer should be able to understand not only, what the interviewee says, but also the world he or she lives in. This is crucial for the interpretation of the actual meaning of what has being said. Another challenge commonly related to interviews is the interview bias. The interviewers tend to impose their own thoughts on the interviewees and see the answers through their own reference frame. (Easterby-Smith, Thorpe, Lowe, 1991).

Some of the limitations of the study are connected to the ex ante approach, trying to anticipate what is going to happen in the future. There are uncertainties, some of them known, and some of unpredictable, that could still have a significant influence. For example, the Netherlands and Sweden have yet to confirm what they are going to do to meet the deadline for complying with the Directive. The early timing made it also difficult for example to assess the extent of changes. Many individual dairy plants do not know yet about the IPPC and even fewer are familiar with the Reference Document on BATs, that is going to be used as a source of information in the permitting process. Thus they could not have anticipated what may be required from them in the future. Few permits were available to investigate, because most of them will be issued in the future.

In general, the quality of the study is weaker regarding the factors that depend on the local level. Like mentioned before, some of this is related to the fact that the study was conducted in a relatively early stage. Also regulators on the local level were not always aware of the IPPC. The most significant barrier to studying the issue on the plant level is however related to the large number of actors involved. At least one regulator issuing the permits was interviewed from each country. This increased the understanding on permitting but did not provide a representative view on the permitting process and conditions that are likely to be imposed. On the other hand, this study is concerned with change – whether the IPPC is going to influence eco-efficiency in a different way than the environmental permitting in the country in question used to do. The permitting on local level is not likely to change due to

the IPPC unless measures are taken on the national level. Thus it was legitimate to focus the efforts on finding out what happens on the national level.

3. Background

The purpose of this chapter is to provide a basis for understanding how the IPPC Directive could drive the increase in the eco-efficiency of the dairy industry. The first sections discuss eco-efficiency, eco-efficient organisation, external drivers for eco-efficiency and especially regulation as a driver for eco-efficiency. The general information on these topics is followed by the introduction of the IPPC Directive. Based on the information in this chapter, models to study the IPPC Directive as a driver for eco-efficiency are presented in the next chapter.

3.1 The Dynamics of Eco-Efficiency

3.1.1 Eco-Efficiency

The term eco-efficiency was launched in 1991 by the World Business Council for Sustainable Development (WBCSD) (WBCSD, 2000). It joined the group of concepts that are to deliver the environmental aspect of sustainability: cleaner production, pollution prevention, industrial ecology and so on. What differentiates eco-efficiency from the other concepts is the focus on business benefits. UNEP differentiates cleaner production and eco-efficiency in the following way (UNEP, 2001): “The slight difference between them is that eco-efficiency starts from issues of economic efficiency which have positive environmental benefits, while Cleaner Production starts from issues of environmental efficiency which have positive economic benefits.” Eco-efficiency measures the relationship between economic growth and environmental impact. One way to calculate it is to divide the value-added output by the resource input or quantity of polluting emissions (European Commission, 2002).

Eco-efficiency = Output/Environmental pressure (European Commission, 2002).

According to WBCSD, eco-efficiency is concerned with three main goals: reduction of resource consumption, reduction of environmental impacts and increasing value of products and services. Reduction of resource consumption refers to minimising energy, water and material use and increasing recycling and reuse. Reduction of environmental impacts means in this context the reduction of emissions and sustainable use of renewable resources. The product value can be increased for example by improving the functionality of products and selling additional services. The idea is to serve the customers’ functional needs rather than provide them with material products. (WBCSD, 2000) Products are obviously not the focus of the IPPC Directive and thus improvements are expected to be mainly limited to the installation, not the product and its whole life cycle.

There are different ways to profit from improvements in environmental performance. The issue is not whether it in general pays to be green but what kind of environmental investments deliver returns in a certain company. The opportunities to increase eco-efficiency are company specific and the management has to identify investments that are likely to pay off in their company (Reinhardt, 1999). Reduction of resource consumption obviously yields economic efficiency through decreased costs. Reduction of environmental impacts may contribute to economic efficiency for example due to improved image, decreased environmental risks or decreased waste treatment costs. Functional products may help the company to capture an additional market share or enable the company to command higher prices.

3.1.2 Reducing Consumption of Resources and Environmental Impacts

3.1.2.1 Extent of Associated Changes

Eco-efficiency, like cleaner production, pollution prevention and industrial ecology, is concerned with change towards better environmental performance. Thus eco-efficiency and innovation - the main concept describing change - are inseparably linked. A broad definition of innovation includes also diffusion of techniques, not only their invention (Markusson, 2001). Technique refers in this thesis to both technology and organisational measures, for example operation of an installation.

The concept eco-efficiency covers a large variety of measures to improve environmental performance. Varying extent of change may be associated to them. From the perspective of a single firm, eco-efficiency includes improvements that are made within a technique that the firm already applies and the adoption of a completely new technique. On the global level, eco-efficiency includes also initial invention of improvements on existing techniques and completely new techniques (WBCSD, 2000). The former are called incremental innovations and the latter radical innovations. To illustrate the difference between radical and incremental, incremental changes are described as continuous and radical changes as discontinuous. The importance of radical innovations is obvious, since the improvements associated with incremental innovations tend to be more limited. However, incremental innovations have an important role also in the application of radical innovations. A significant part of the improvements associated with radical innovations are often realised over time, when learning and increasing knowledge bring about smaller improvements in the technique. (Gouldson, Murphy, 1998). Due to the nature of the studied sector and the design of the Directive, the focus of this thesis is on the adoption of existing techniques and improvements in them, not invention of innovative techniques.

3.1.2.2 Clean Technologies versus Pollution Control Technologies

To become more eco-efficient, a company may invest in new technology. Environmental technologies are categorised as clean technologies or pollution control technologies. The environmental and economic impacts of these two types of technologies differ. Pollution control technologies are distinct stand-alone units that are added to the production process. They capture and/or treat emissions. Clean technologies are technologies used to produce goods and services - their primary objective is non-environmental. Environmental considerations have been taken into account in their design or application to reduce the environmental impacts. The possibilities to solve environmental problems with pollution control technologies are limited. Clean technologies address environmental impacts at source, whereas pollution control technologies only treat emissions that have already been created. (Gouldson, Murphy, 1998).

Costs and benefits of clean technology and pollution control technology are realised at different times. In long term, the adoption of clean technology is more economically beneficial due to related savings etc (Gouldson, Murphy, 1998). It may also involve increased product quality and other benefits (Hitchens, 2001). The initial investment may however be larger. Pollution control technologies tend to look more attractive if the investment is assessed in short term. (Gouldson, Murphy, 1998). However, they may reduce the manufacturing performance of the plant (Klassen, Whybark).

From the point of view of eco-efficiency, clean technology appears superior in many respects. However, adoption of pollution control technology has often been industry's response to increased environmental demands. The barriers related to lack of knowledge and associated change tend to be more substantial in the case of clean technologies than pollution control technologies. Because pollution control technologies are additions to the existing process, they do not require significant changes in the process they are added to. Installation of pollution control technologies in an existing installation is easier than installation of clean technologies. Clean technology may involve significant modifications in the production process and sometimes also high costs and problems in the quality during the introduction stage. Suppliers of control technologies are easier to find, because there is a distinct market for these technologies and comparisons in the technologies' economic and environmental performance are simpler. These factors favour the development and adoption of pollution control technologies. (Gouldson, Murphy, 1998).

Both clean technologies and pollution control technologies are needed. Prevention of pollution at the source should be a priority, but it is not always possible. Pollution control technologies are needed to complement clean technologies. Aragón-Correa found evidence, that the companies with leading-edge environmental management have adopted a combination of pollution prevention and pollution control technologies, whereas some less advanced companies rely predominantly on prevention (Aragón-Correa, 1998).

3.1.2.3 Housekeeping and Process Optimization

Considerably enhanced eco-efficiency may be achieved also by taking less expensive measures than technology investments. Good housekeeping, such as proper maintenance and improved work practices, and optimized operation of the processes play an important role in an eco-efficient company. They may contribute significantly for example to the reduction of waste. Improvements in housekeeping practices impose typically low costs on companies and optimization of processes low to medium costs. (COWI Consulting Engineers and Planners AS, 2000).

3.1.3 Eco-efficient Organization

As stated above, a company may invest in technology or adopt good housekeeping practices to reduce the consumption of resources and environmental impacts. These changes follow usually other changes that have first taken place in the organization. Internal and external factors influence the process of increasing eco-efficiency of an industrial installation. This chapter introduces the internal factors and the external factors, especially regulation are presented on the next chapter.

Vickers and Cordey-Hayes use the concepts 'internal selection environment' and 'external selection environment' to explain why a company does or does not adopt cleaner production. Internal selection environment is comprised of the internal factors that influence the development within the organization. A capacity to learn and adopt new knowledge is crucial characteristic for an organization that aims at increased eco-efficiency. The organization must be receptive to eco-efficiency. Values and organizational culture influence the commitment that the company is able to make to improve its eco-efficiency. Systematic environmental management, or its absence plays an important role. (Vickers, Cordey-Hayes, 1999). In addition to the factors that Vickers and Cordey-Hayes mention, also financial capital has been suggested to be one of the main factors determining whether a company explores opportunities associated with environmental issues (Ashford, 1993).

3.1.3.1 Management

Skillful implementation of the systematic approach to pollution prevention is a key issue. The systematic approach needs to be implemented and managed continuously. Long-term goals and specific plans to reach them are equally important. One way to ensure that eco-efficiency becomes an important goal of the company and gain the support of the management is to integrate the eco-efficiency linked values and needs of stakeholders that are linked to eco-efficiency in the eco-efficiency programs. (Pojasek, 1999) Environment management system (EMS) may be used as a framework to build the process of becoming eco-efficient on. However, EMS is only a framework and to provide results a meaningful vision and perspective on how the company should direct its work to become eco-efficient (Burns, 1999).

The core of the concept eco-efficiency is related to a combination of economic and environmental benefits and it have to be managed accordingly. It must not be separate from other operations of the company. Pollution prevention requires the focus of the measures that are taken to be at the source of pollution, the process. Eco-efficiency can and should be included in strategies and operations that do not directly consider environmental issues. Integration with the systems to improve quality and productivity is important. (Pojasek, 1999)

Eco-efficiency should be managed based on facts, which means continuous monitoring. Monitoring is needed to manage the environmental programs, set and control the targets and to develop the corporate environmental strategy. To support continuous improvements, the monitoring should be both physical monitoring of the process and its inputs and outputs and financial monitoring. (Verschoor, Reijnders, 2000). Financial monitoring complements the management of eco-efficiency, because it makes the economic benefits of cleaner production explicit.

3.1.3.2 Information and Learning

The staff needs to be involved in the continuous process of becoming eco-efficient. Their knowledge is crucial to identify the opportunities. The focus on process requires also the involvement of other people than those specialized on environmental issues. It is important to identify with the staff why emissions and waste are produced in the process. This gives a solid ground for seeking opportunities and finding solutions. The support of staff is also easier to get for changes in the company if the staff has been involved right from the beginning. (Pojasek, 1999) The organizational culture defines largely how the employees in all levels of the company are able to participate to the learning process (Vickers, Cordey-Hayes, 1999).

The employees must have a capability to search for and select information, recognize the potential for its use in the organization and communicate it to others (Vickers, Cordey-Hayes, 1999). Willingness to become more eco-efficient plays a major role. In addition to the general attitude towards changes in production, it is influenced by knowledge about the possible changes (Ashford, 2002). For example environmental innovation is significantly hindered due to information related problems (Markusson, 2001). Environmental issues tend to be rather complex and considerable uncertainty is often involved. External partners may help the company to gain knowledge. For example suppliers, regulators, consultants and universities have been found out to provide useful information for companies. Networking with other companies may provide benchmarks and give a platform for sharing experiences and exchanging knowledge. (Pojasek, 1999)

3.1.3.3 Characteristics of Eco-Efficient Companies

Environmental performance has often been found out to correlate with business performance. Roberts and Gehrke found out in their study on five metal companies that the company with the best environmental performance also had a strong focus on quality and efficiency, well-developed strategy and good teamwork (Roberts, Gehrke, 1996). Studies on the adoption of BAT in European cement, metal and pulp and paper industry concluded that companies that had adopted BAT shared some specific characteristics. They were generally large and also growing, strongly competitive, with high input to research and development and possessed quality skills (Hitchens, 2001). Some other characteristics typical for companies that have taken environmental issues high in their agenda are related to industry structure. Industries that are more flexible and have experienced often changes in the processes and continuously change their products are in general more likely to be enthusiastic about sustainable production that involves continuous change (Ashford, 2002).

Interestingly, Klassen and Whybark argue that companies that have developed their strategic organizational resources in connection with other management initiatives may have superior eco-efficiency even if they do not have a proactive environmental policy. This may happen, if the organizational resources have been developed in connection with such management initiatives that are connected to environmental performance, for example quality or productivity management (Klassen, Whybark).

3.1.4 External Drivers for Eco-Efficiency

3.1.4.1 Potential for Eco-efficiency

There is a widespread disagreement on the potential to decrease environmental impacts and improve business performance simultaneously. Some believe, that there is a considerable potential for savings to be realized. For example Porter and van der Linde and Ashford argue that the numerous barriers on the road towards eco-efficiency have led to the fact that opportunities are being unexploited (Ashford, 2002; Porter, van der Linde, 1995). Managers have limited time and attention and incomplete information on opportunities. Many low-hanging fruits are still be waiting to be picked up. Others consider this view too optimistic. They remark that it is part of managers' job to reduce costs and thus considerable potential for savings is unlikely. An important argument is also that even in cases where savings can be realized, time and resources must be used to find the opportunities. (Reinhardt, 1999) Vickers and Cordey-Hayes argue against the whole idea behind strategies that strive for harmonization of economic and environmental interests. They believe, that economic and environmental interests continue to be in dynamic tension and companies will make choices that favor one and compromise the other. (Vickers, Cordey-Hayes, 1999).

It is important to realize, that the potential for eco-efficiency is not static. Companies operate in a continuously changing environment. Market conditions, availability of cleaner technologies, legislation and other policy measures and pressure from the surrounding society are a part of the external selection environment that influences whether companies have incentives to become eco-efficient or not (Vickers, Cordey-Hayes, 1999). They determine how a company could benefit from good environmental performance.

3.1.4.2 Stakeholder Expectations

Some drivers of eco-efficiency are directly connected to the expectations on the environmental performance of a company, for example regulatory pressure and the expectations of the stakeholders. The stakeholders include for example environmental groups, financial institutions, consumers, employees, insurers and above all customers (Brorson, Larsson, 1999). Stakeholder pressure can naturally drive any type of improvements in environmental performance, not only resource efficiency. When it comes to the broader field of sustainable development and not only eco-efficiency, the importance of firm image and brand value make the companies most keen on working for environmental issues (Dearing, 2000).

3.1.4.3 Savings

Other factors that influence specifically resource efficiency are more directly connected to the economic aspects, for example price of material inputs and energy. Fierce competition may drive the companies to search more actively opportunities to improve efficiency. Also the rate of technological progress influences the use of resources as well as the rate of capacity utilization. When the capacity utilization is low, the eco-efficiency tends to decrease. (European Commission, 2002).

3.1.4.4 Policy

Policy makers have the same reasons to promote eco-efficiency as any other concept that is associated to the reduction of environmental impacts. Markets do not allocate the environmental resources effectively, because environment is a public good. Companies can benefit from good environmental performance, but some benefits are always realised somewhere else. For example, surrounding society, rather than a company enjoys benefits related to clean air.

If policy-makers wish to promote eco-efficiency, they have to take it into account also in the policies with focus on non-environmental objectives. Public policy can affect the resource use in many ways. Taxes can be introduced to change the relative prices of resources and subsidies removed. A number of the inputs of industrial processes, for example water and energy have been significantly subsidized (Reijnders, 2003). From the perspective of the environment, these subsidies are harmful. Agricultural policies and subsidies have a major influence to the prices of raw material of food industry. Policies that are concerned with the market conditions also play a role in the companies' capability and motivation to improve eco-efficiency. Competition and trade policies affect the competitive pressures to increase efficiency (European Commission, 2002). Innovation policies contribute to the availability of eco-efficient technology and they should be environmentally motivated (Markusson, 2001) .

Regulation has traditionally been the most popular environmental policy instrument, but at the moment there is increasing interest towards the economic and communicative instruments. For example emission trading and voluntary agreements are getting increasingly popular. (Markusson, 2001). Liability-based approaches have been used successfully to combat waste (Reijnders, 2003). A combination of policy instruments rather than one superior instrument is commonly considered the best approach (Ashford, 2002). All the policy instruments have their advantages and disadvantages and their appropriateness depends on the issue that is to be addressed, the technical system the target industry (or other

type of target) is situated in, the institutional framework that implements the policy and many other issues.

3.2 Regulation as a Driver for Eco-efficiency

3.2.1 Typical Characteristics of Regulation

Regulatory instruments include for example the authorisation of polluting industrial installations, product bans and take-back requirements. Regulation has the advantage among the other policy instruments, that authorities have a lot of experience on it. Another advantageous characteristic is that at least in theory the outcome of regulation is more certain than the outcome of the other instruments. In practise the design of the regulation is only one of the factors that influence the outcome. To achieve the wanted outcome in reality, authorities need to devote resources to the implementation and enforcement of the regulation. Inefficient resource use in the economy is one of the main drawbacks of regulation. The costs of complying are different among companies and if everybody has to meet the same requirements, the economic outcome is not optimal. Regulation also does not encourage the companies to further improvements after the requirements of the regulation have been met. (Markusson, 2001).

Past experience shows that regulation can contribute significantly to the environmental performance of the manufacturing industry. In the past it has been the main driver for improvements. Regulation drives the diffusion of technology, environmental management systems and improved working practices (Brorson, Larsson, 1999; Reijnders, 2003). However, it has largely acted as a driver for pollution control technology rather than clean technology. Some authors argue, that regulation is not a suitable instrument for promotion of clean technology. They state for example, that the requirements on the competence of authorities that implement regulation are unrealistic (Reijnders, 2003). Also, the inability to promote continuous improvement is a major disadvantage. An explanatory factor for regulation driving mainly adoption of pollution control technologies is that many regulations have been designed in the 1970s and they have not been modernized since then (Haeton, Banks, 1997). According to Ashford, there is a considerable potential for regulation to drive eco-efficiency if its design is appropriate (Ashford, 2002). For example the British Integrated Pollution Control (IPC) Regime, that is a relatively new regulation has been found out to act as a driver for cleaner production. The changes caused by the IPC have mainly been incremental. (Gouldson, Murphy, 2000)

3.2.2 Permitting Process as a Driver for Improvements

The eventual permit conditions are not the only part of the regulatory process that drives eco-efficiency in the companies. Regulation forces especially companies that have not experienced pressure on environmental issues from their stakeholders, to take environment on their agenda. The regulation with environmental permits includes interaction with the regulator. If the company is willing to view the regulator as a source of information and the regulator competent enough to possess and share it, the regulatory process can deepen the understanding on environmental issues and act as a platform for knowledge transfer. The regulator can help the company in specifying cleaner technologies and encourage them to strengthen the organizational capacities in environmental issues. (Vickers, Cordey-Hayes, 1999).

The permit conditions can take different forms. They can be for example emission limits, requirements to invest on specific equipment or adopt specific procedures or obligation to monitor environmental performance. Regulation is the most important driver for environmentally related monitoring in companies (Verschoor, Reijnders, 2000). Often the company is obliged to find out how they could improve the environmental performance in some environmental aspect and make plans on improvements. These requirements may be part of the permit that is issued, or the information can be used as a basis for the permit conditions.

3.2.3 Design of a Permit Based Regulation that Drives Eco-efficiency

The design of regulation that aims at promoting eco-efficiency is crucial. Good design contributes to the reduction of the disadvantages associated with regulation. First of all, regulation that promotes eco-efficiency should be effective enough to drive change in general. Secondly, it has to have characteristics that promote the adoption of housekeeping practices, process optimisation and clean technology rather than the adoption of pollution control technology. Focus on pollution prevention is more preferable also from the point of view of efficiency and effectiveness in general, as the outcome is better both from environmental and economic point of view.

Following characteristics are usually associated to regulation that promotes eco-efficiency. The list relies largely on the literature on innovation, as the general characteristics of regulation that drives of any type of eco-innovation are valid for eco-efficiency as well. There is an emphasis on the characteristics that can be associated to a permit based regulation for the industrial installations.

- Stringent
- Clear signals that requirements are going to get even more stringent in the future / long term targets
- Consistency in requirements
- Requirements set in such form that industry has freedom in choosing how to improve environmental performance e.g. emission limit values instead of obligation to use certain technology
- Enough time to find, develop and try techniques
- Promotion of diffusion of information
- Adaptation to different industry sectors
- Holistic view on environmental aspects

(Ashford, 2002; Gouldson, Murphy, 1998; Markusson, 2001; Porter, van der Linde, 1995)

In addition to the stringency of requirements, also other signals are needed to motivate the industry to take action. The industry and its partners have to be convinced that their efforts will be rewarded. The consistency of requirements and a message that improvements will be needed also in the future help the companies to take environmental issues high in their

agenda and commit resources to achieve better performance (Ashford, 2002). Level playing field is needed for the realisation of first mover advantages (Hager, personal interview, July 9, 2003). For example, companies that meet the requirements of the regulation before their competitors may gain good reputation in environmental issues, because they took action earlier. This advantage is not available for companies that follow later. For the realisation of this advantage, also the other companies must be obliged to meet the same requirements.

When environmental issues are taken into account in long term planning it is more likely for the companies to end up taking the effort to make organizational changes and choose clean technology rather pollution control technology, because the benefits of pollution prevention are realised over a longer period of time. Holistic view on environmental aspects and performance is also believed to support the adoption of clean technologies. Technology has often several environmental impacts and compromises may be needed in one environmental aspect, if the adopted technology is superior in another.

When industry has been convinced about the need for change, they should be given the freedom to choose how to reach the targets they have been given. This is a key characteristic of regulation that promotes innovation and learning. Industry has expertise in their own activities, products and processes and thus their capability to develop and choose environmentally friendly solutions is better than regulators'. Time is needed for the process of developing solutions and choosing between different techniques. (Majumdar, Marcus, 2001; Porter, van der Linde, 1995). One way to support the industry in inventing and adopting innovations is to combine the implementation with projects and tools that increase diffusion of information.

There can also be a need to adapt the regulation to fit better different industry sectors (Markusson, 2001). Institutional framework that implements the policy will influence outcome in practise and thus attention should be paid to it already in the design of the regulation (Kemp, 1998).

In practice, the characteristics of a regulation that is to promote innovation need to be balanced against each other and other important aspects. Regulators should be flexible enough to give the companies time to meet the requirements and perhaps certain freedom in choosing which environmental aspect they want to focus on more. Too short deadlines in meeting the requirements have in some cases led to less optimal solutions and the adoption of end-of-pipe techniques (Porter, van der Linde, 1995). However, there should not be so much freedom, that it leads to negligence of some environmental aspects or in general gives the industry a signal, that there is no need to take action. Regulation should also not be too stringent, because this could violate severely the competitiveness of the industry. A compromise has to be made also between flexibility and consistency. Requiring exactly the same environmental performance is not economically optimal approach because the costs of achieving this performance differ between companies. However, excessive flexibility hinders the formation of level playing field and gives too much space for negotiations.

3.2.4 Implementation of Environmental Regulation

3.2.4.1 The Role of Implementation

Implementation transforms the legislative documents into policy outcome. Its importance has been widely recognised, but in practice the implementation has not been taken into account accordingly. (Gouldson, Murphy, 1998) The processes of policy formulation and

policy implementation are generally separate. The implementation involves the practical application and enforcement. Practical application refers to the individual decisions that are made, for example issuing a permit. Following action to ensure the compliance is enforcement. It includes for example site visits, monitoring and sanctions in case of non-compliance. (Glachant, 2001)

The implementation stage enables the actors involved in the implementation to influence the outcome. Some flexibility is embedded in the policies for the regulators to be able to take into account the specific circumstances of the application and thus improve the policy outcome. However, this flexibility improves the outcome of the policy only if the regulator is competent and has sufficient resources available in the implementation. As mentioned earlier, part of the benefits of regulation are realised in the communication between the regulator and the regulated party. The flexibility embedded in the policy may lead to negotiations between these actors. They have unequal access to information and in the negotiations the regulator must often take his or her decision based on information provided by the regulated party. (Gouldson, Murphy, 1998)

3.2.4.2 Implementation in the European Context

Implementation Process

The formulation of the policies on the EU level increases the gap between policy formulation and implementation. If the policy in question has been given out in the form of directive, the Member States have to transpose the content of the Directive to their national legislation after the policy has been formulated. It is possible that the policy is altered already in this stage. The national policy makers might interpret the policy in a different way than what the EU policy makers intended. After transposition follows the practical application and enforcement by national authorities, whose values and behaviour also influence the policy outcome. The administrative bodies in the EU level cannot impose sanctions on the targets of the policy, for example an industrial installation located in a Member State. Enforcement is completely in the hands of the Member States and the European Court of Justice may punish only them, in case the Member State fails to implement the policy properly. (Glachant, 2001)

Difficulties in the Implementation

There is a general belief that the EU environmental policy suffers from serious problems in the implementation stage. Glachant makes a distinction between the formal and practical compliance of the EU policy. By formal compliance he refers to the legal transposition of the directives and by practical compliance to the outcome of the policy compared to its objectives. The formal non-compliance is widespread, but the extent of practical non-compliance is largely unknown. In practice these two do not correlate. The objectives of the directive may be met completely despite of an imperfect transposition. (Glachant, 2001)

In addition to the gap between policy formulation and implementation there are other reasons to believe that the implementation of EU policies could encounter more problems than the implementation of national policies. The administrative structures of the Member States vary considerably and it is impossible to design policies that would fit equally well all of them. There are also considerable differences in the importance that has been given to the environmental issues in the Member States. (Glachant, 2001)

In the study of three European environmental policies, Glachant found out that surprises in the implementation of the EU policies are very common and that over-compliance is usual. Over-compliance is often the consequence of pre-existing more ambitious policies. Policy interactions were found out to have both negative and positive influences to the outcome of the community legislation. (Glachant, 2001)

Successful EU Policy

Glachant suggest decentralisation, substantive legislation and integration with the parallel policies as solutions to the problems that have been faced. Decentralised political systems would be more flexible and thus better equipped to face the surprises in the implementation. They would also have the knowledge on the costs of the compliance, which is highly dependent on the Member State and other circumstances. Substantive policies are focused on objectives, not procedures on how to meet them. If the policies were focused on the objectives, the countries would have more freedom in choosing how to meet them. By integrating the policies more carefully, negative influences of policy interactions could be reduced. (Glachant, 2001)

The suggestion to focus on targets is contradictory to the approach of many current community policies. EMAS regulation and IPPC Directive are examples of procedural legislation. The implementation of procedural legislation has been suggested to be more difficult than substantive legislation, because it requires adjustments by the administrative bodies. (Glachant, 2001) Substantive legislation involves heavy negotiations on the targets in the EU level.

3.3 The IPPC Directive

This section describes the key characteristics of the IPPC Directive. It contains information that was needed to create the models that form the framework for the study (Chapter 4) and provides background for more detailed exploration of the Directive.

3.3.1 Main Objectives

The main purpose of the IPPC Directive is to institutionalise integrated approach to pollution prevention and control in all the Member States, harmonise the environmental legislation in Europe and raise new issues that did not exist in the EU environmental legislation or environmental legislation of some Member States, for example energy efficiency. The flexibility embedded in the regulation is to facilitate its use in the diverse Member States even after enlargement of EU (Emmott, 1997). Prevention at source and clean technology are promoted as the means of improving the level of environmental performance.

3.3.2 Schedules for Transposition and Implementation

The IPPC Directive was published in 1996 and as it is a Directive, the Member States are required to incorporate its main principles and objectives in their national laws, but they can themselves choose the methods of implementing the Directive. The Directive was supposed to be transposed into the national laws by October 1999, but there have been some delays in the Member States. The IPPC Directive demands that all installations included in the six main industry categories must have an environmental permit for their activities. New

companies must be authorized under the Directive before the start of operation. The existing installations were provided a transition period of eight years to get prepared to meet the requirements of the Directive. They are obliged to meet the requirements latest in October 2007.

3.3.3 Addressed Industries and Environmental aspects

The IPPC Directive covers six main categories of industrial activities: energy, production and processing of metals, mineral industry, chemical industry, waste management and other activities. They include for example pulp and paper industry and food, drink and milk industries. The IPPC targets mainly large installations. Emissions – the term refers to substances, vibrations, heat and noise – to land, water and air are covered (Council Directive 96/61/EC). In addition to the energy efficiency, the new issues raised by the directive include transboundary pollution, decommissioning of installations and inclusion of landfill operations in waste management categories (Vivian, 1997). Also avoidance of waste production and accidents are addressed (Council Directive 96/61/EC). The IPPC is also concerned with environmental management and communication. Companies are obliged to monitor their environmental performance and transparency is increased for example by ensuring public's rights to information.

3.3.4 Permit Conditions

Each country decides in the process of implementation which institutions are responsible for carrying out the obligations arising from the directive. The permits must be updated for example in case of significant changes in the installation or occurrence of other incentives to make changes, such as development of technology (Council Directive 96/61/EC).

The focus of the permits is on Emission Limit Values (ELVs) that are based on the best available techniques and Environmental Quality Standards (EQSs). BATs are defined as technologies and organisational measures that minimise the overall environmental impact at an acceptable cost. The Directive defined 'best' as "most effective in achieving a high general level of protection of the environment as a whole." 'Available techniques' mean "those developed on a scale which allows implementation in the relevant industrial sector, under economically and technically viable conditions, taking into consideration the costs and advantages, (...), as long as they are reasonably accessible to the operator" (Council Directive 96/61/EC). Economics play a key role in the determination of BAT. EQSs mean the requirements that a certain environment must fulfil according to other Community legislation. When the best available technique cannot guarantee environmental quality required by the existing environmental quality standards, additional measures must be included in the permit (Council Directive 96/61/EC).

3.3.5 Implementation Support

The European Commission supports the implementation in various ways. A key feature of the Directive is to stimulate an exchange of information on best available techniques between Member States and the industries falling within the scope of the Directive. Perhaps the most important measure taken to support the implementation is the formation of BAT Reference documents (BREFs) that are based on the information exchange. They are published for 30 different industrial sectors. BREFs do not have binding force but competent authorities are

to consider them when setting the permit conditions for industrial installations (Doppelhammer, 2000a)

Another means of support is the European Pollutant Emission Register (EPER). The emission data from the IPPC installations is collected and stored in a publicly available database. The Commission is also committed to make the information more easily accessible for the public by disseminating the data and publishing reports based on it. Every three years the Commission will publish a report on the emissions and their sources. The objective of the EPER is to improve the environmental awareness and enhance transparency and comparability. The emission data will be published in the database on the level of individual plants, industry sectors and countries (European Commission, 2003a).

4. Models Supporting the Study

The study relies on the combination of the two models presented in this chapter. The IPPC Directive has a possibility to influence the eco-efficiency of a company through the permitting process. As mentioned before, the permitting process refers to everything that is connected to the environmental permit from the company perspective. The models present the characteristics that the permitting process should have in order to the companies to improve their eco-efficiency and the factors that influence the permitting process.

4.1 Model 1 – Characteristics of the Permitting Process

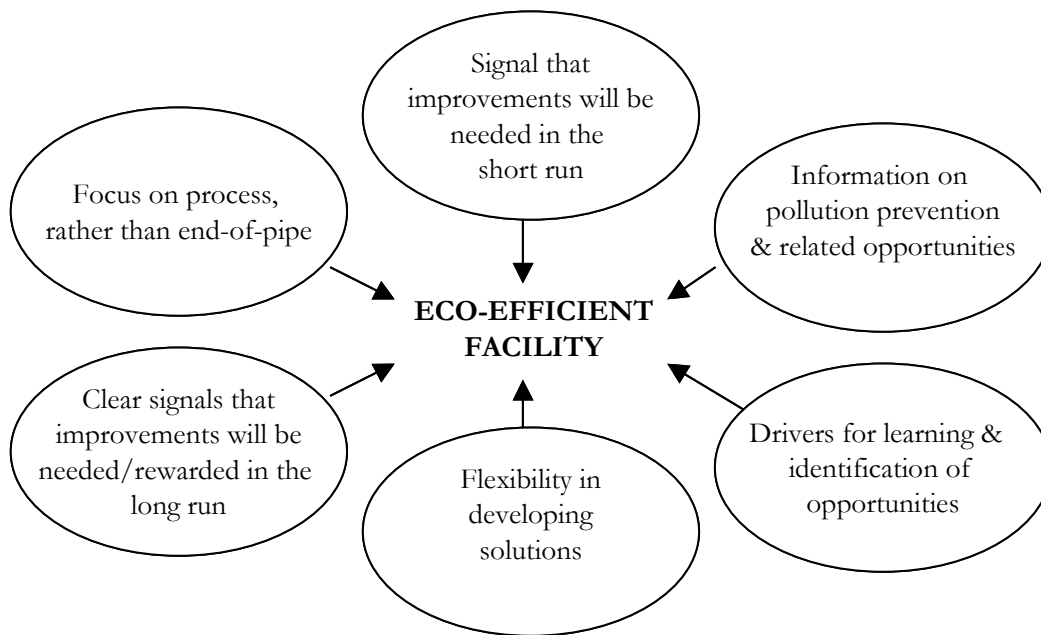


Figure 4-1 Characteristics the permitting process should have in order to drive improvements in eco-efficiency

The first model presents the main characteristics or conditions that should be present in the permitting process, in order to drive eco-efficiency. To motivate the companies to improve eco-efficiency, there has to be signs that their efforts are needed to comply with the legislation or rewarded through first mover advantages if they respond before the others⁴. A clear message that improvements will be needed even in the future encourages them to commit resources to improving environmental performance. For example information on a specific level of performance that has to be achieved, gives the companies a signal that they need to take action.

Information on pollution prevention and related opportunities can be provided to companies from outsiders, but to develop its performance continuously a company also needs to learn to use its own capacity in finding solutions. Also, outsiders are not specialists on what happens in the company and thus the effort of the regular employees is needed. Thus it is

⁴ First mover advantage can in this case be for example a reputation of an advanced and responsible company that may follow if you comply first. First movers also learn earlier than the others and can then utilise their learning.

both important to be provided with information from outside and develop own capacities. Regulation can support both the development of own capacities and provide the companies with relevant information and their sources.

The focus of the permitting has to be on the manufacturing process, because otherwise the permit conditions may be met through the adoption of pollution control technology. To find, select and develop process-integrated solutions, a company needs some flexibility in meeting the requirements. For example, time is needed as well as approach that takes into account the environmental performance as a whole. Prescription of technologies in permit conditions can reduce flexibility and learning, if it becomes a common practice.

Some of the listed characteristics are specifically related to eco-efficiency, others are relevant for any type of improvements in environmental performance. The IPPC Directive should first of all act as a driver for any change. Sufficiently strong signals on the need for improvements in the near future and in long term are the drivers in this respect. The rest of the listed characteristics direct the change towards eco-efficiency.

4.2 Model 2 – Factors Influencing Permitting Process

The second model describes the main factors that influence the characteristics of the permitting process in the case of IPPC Directive and the connections between these factors. The model is already relatively complex, but in reality the number of factors influencing the permitting process is even larger. Also, some more connections would be found between the factors.

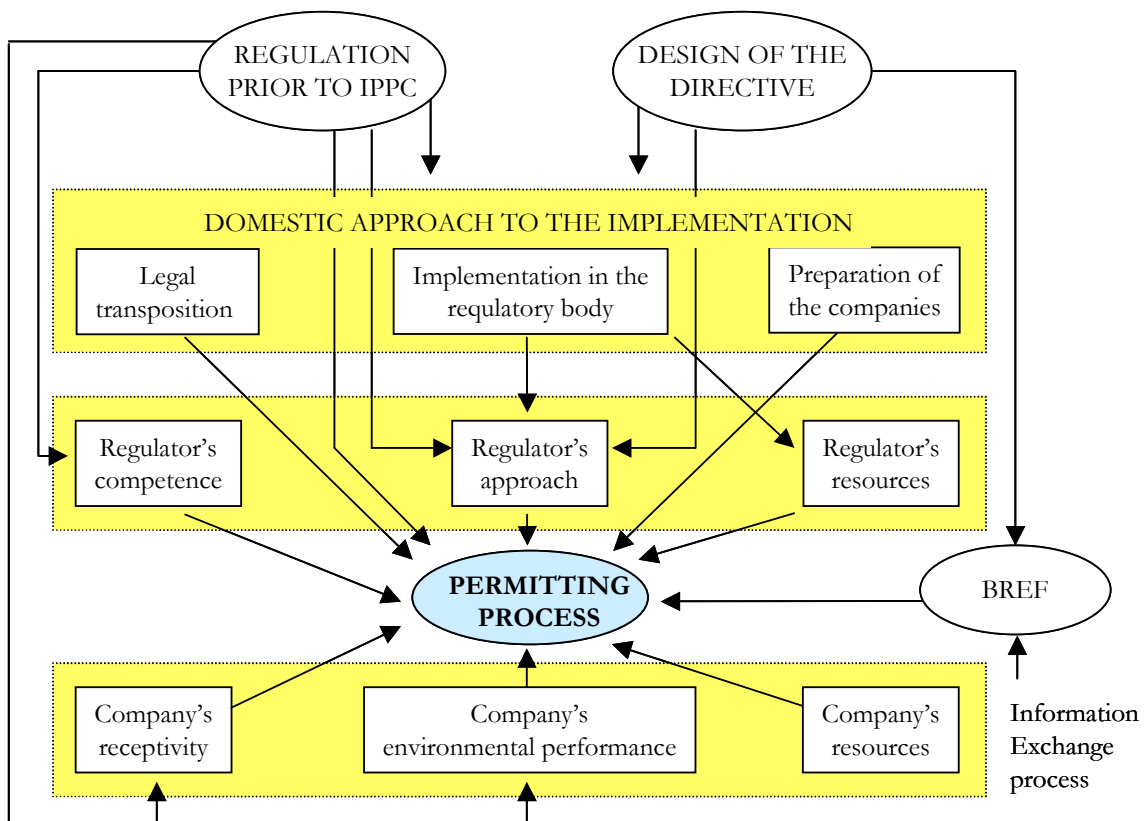


Figure 4-2 Factors influencing the permitting process in the case of the IPPC Directive

In addition to the design of the IPPC Directive, the regulation prior to IPPC, including the working procedures of the authorities and the approach they used in their daily work, influences the process from many directions. Member States took their decisions on how to transpose and implement the Directive largely based on their former regulation. Former regulation is reflected also in the way the authorities issue the permits under the new regulation. In some cases changes from the former approach are not even needed. Companies' attitude towards regulation depends on their earlier experiences.

The implementation of the Directive is divided into three main components: the legal transposition, implementation in the regulatory bodies responsible for practical application and preparation of the companies. Implementation in the responsible institutions refers to the possible changes that took place because of the IPPC Directive and the guidance the authorities have been given on how to deal with the permitting. Implementation in the regulatory institutions determines largely whether the authorities alter their working practices because of the IPPC Directive, or if they stick to their old approach. Preparation of the companies means the possible contacts between the companies and authorities and how the companies have got the information on the changes in the permitting. Preparation of the companies enables them to get ready to meet the requirements and influences their willingness and capacity to act.

The contribution of the regulators who issue the permits has a major role. The company faces the regulation through the regulators responsible for the authorization and control of compliance. The regulators' competence, resources and approach formulate large part of the permitting process. Regulator's competence refers here largely to the knowledge on process related issues and environment, and regulator's approach for example to what environmental aspects he or she considers important, if the regulators strives to focus on the manufacturing process etc. Naturally these two are related. Resources are related to the available time and possible consultation of other experts.

The company's contribution is crucial. The company is the target of the permitting and they decide how the environmental performance is managed and what measures are taken. Thus their cooperation in the permitting is necessary. Also, the regulators are often dependent on the information provided by the companies. The BREF gives information for both sides on the expectations on the company and available opportunities to improve performance. The content of the BREF is formulated in the information exchange process on the European level. If the company's environmental performance is already on the level the BREF presents and both parties believe it to be sufficient, the regulator is not equally likely to push the company towards improvements.

4.3 Use of the Models

The thesis explores whether the factors that influence the permitting process (implementation in the regulatory body, regulator's competence, company's receptivity etc) are likely to drive it to such direction that it promotes eco-efficiency. This means exploring whether the factors in the Model 2 bring to the permitting process the characteristics that drive eco-efficiency (Model 1). For example, the thesis explores whether the IPPC Directive is implemented in the regulatory body in such way, that the focus of the permitting process is likely to be in the manufacturing process.

The structure of the thesis relies largely on the Model 2 – factors that influence the permitting process as a driver for eco-efficiency are investigated. The main characteristics of

the dairy industry and the former regulatory systems are first presented in the thesis. The thesis moves on to take a look at the design of the IPPC Directive and the BREF as a driver for eco-efficiency. After this the national approaches to implementation are presented. The legal transposition and changes compared to the old legislation speak about the need to alter the permitting in practice. The implementation in the regulatory bodies is explored to be able to anticipate whether the regulators are going to change their behavior or not. Finally, the regulators' priorities on dairy industry's permits are presented and some permits are investigated. The issued IPPC permits provide a glimpse on the outcome of the implementation.

The IPPC Directive and its implementation are analyzed using the models provided in this Chapter. Concluding remarks on the topic of each chapter are made already in the end of the chapter (Sections 5.5; 6.8; 7.4; 8.8; 9.4), but final conclusions are provided in the very end of the thesis. They discuss the issues listed as the objectives of the thesis. Recommendations are provided on the implementation of the directive and the role of environmental permitting as a driver for eco-efficiency is discussed.

The models are evaluated within the course of the study and as mentioned before, improved models are presented in Chapter 10. Also, the hotspots of the implementation of the IPPC Directive are identified.

It is important to notice that the study is concerned with change although it is not evident in the models. If the domestic system prior to the IPPC Directive already had characteristics that drive eco-efficiency in the companies, and changes are not made, IPPC Directive is not an additional driver for eco-efficiency in the country in question. For these reasons, there is for example no need to take a closer look at regulators' competence, if the implementation of the IPPC Directive does not bring about changes in it.

5. Dairy Industry and the Regulation Prior to the Directive

The success of the IPPC Directive as a driver for eco-efficiency depends not only on the design of the directive and measures that are taken to implement it, but also on the conditions prior to the implementation. This chapter describes the studied dairy industries that face the regulation, their environmental issues and the main characteristics of the regulation prior to the directive. Also the administrative styles and resources in the regulatory bodies in the studied countries are described.

5.1 The Regulatory Approach Prior to the IPPC

Two main characteristics of the regulatory approach prior to the IPPC Directive determine largely the extent of the changes the industry and regulators face in the permitting system. Firstly, the studied Member States had all adopted permitting systems for industrial installations, but dairies were not covered in all of them. In some countries the dairies will thus be applying for their first environmental permits.

The second characteristic is related to the organization of the permitting and relevant regulatory bodies. Originally, many European countries had adopted sectoral approach to environmental law. The protective measures could be found in various pieces of sectoral legislation protecting for example water, soil or air. Sectoral legislation meant usually also sectoral permitting, an industrial installation could need various permits for its activities. The opposite approach is integrated permitting, the type of permitting that the IPPC Directive represents. All environmental aspects are considered within one permit that is issued by a single regulatory body⁵.

Also some factors that influence the authorities capability to implement integrated permitting are discussed in this section. Administrative styles - the way the authorities approach the companies - influences the outcome of environmental permitting as well as the resources available for the authorities.

5.1.1 The Evolution of Environmental Permitting

Nordic countries enjoy among the EU Member States the reputation of leaders in environmental issues. In general the environmental awareness developed faster in the Northern European countries than in the south (Munk Christiansen, 1996). Sweden introduced integrated environmental permitting system already in the 1960's and Denmark in the 1970's (Bohne, 2001). Finland followed later taking much the same steps that Denmark and Sweden had taken earlier. However, Finland did not choose to have an integrated permitting system like Denmark and Sweden. The importance of water resources had created strong institutions in this field and they were not combined to the permitting related to other environmental aspects prior to the IPPC Directive. (Munk Christiansen, 1996).

When the IPPC Directive was introduced in 1996, Swedish and Danish dairies had been authorised under integrated permitting system for a long time. Finland took a decision in the

⁵ IPPC does not require fully integrated permitting. It only requires coordination between different environmental aspects.

1980's that dairies did not need a permit considering wastewater if they had joined the municipal sewage system. Very few dairies chose to treat their wastewater themselves (Enckell, personal interview, July 18, 2003). Thus most of the Finnish dairies face the environmental permitting for the first time.

The environmental issues were introduced to the political agenda in the **Netherlands** in the 1970's like in many Western countries. Major changes to modify the permitting process to the form it has today started in 1989, when the Netherlands adopted an approach based on National Environmental Policy Plans (NEPP) in 1989. NEPPs represent strategic environmental planning on national scale and they set targets both on short and long term. They aim to reach the targets with an approach that is based on consultation and cooperation of the target groups. Covenants are an instrument that is used to realize the targets. They are voluntary agreements between the interested parties. Gouldson and Murphy remark that the covenants should perhaps not be seen as voluntary regulation but rather as "a management tool and a communication instrument through which government attempts to disseminate information and mobilize support for its environmental targets" (Gouldson, Murphy, 1998). The first covenant with the dairy industry was signed in the first half of the 1990's (van Gennip, personal interview, July 11, 2003). The covenant covers the most important environmental aspects of the dairy industry and sets the overall targets for the sector. The companies make company environmental plans (CEP) that commit them to specific targets to improve environmental performance. The targets are to be based on BAT. (Gouldson, Murphy, 1998)

The regulatory approach in the Netherlands was not fully integrated when the IPPC Directive was introduced – it could rather be described as coordinated. Industrial installations needed two permits: one for water issue and another for other environmental aspects. The regulators issuing the permits were supposed to cooperate and take into account also aspects that are not within the scope of the permit they issue. (Gouldson, Murphy, 1998)

The **UK** is considered among the Member States to be one of the laggards in the environmental issues. Action has often been taken only based on sound scientific understanding. This approach is not in line with the precautionary principle that is one of the most basic principles of managing environmental issues. Sometimes scientific proof comes only after the problems have become increasingly difficult to solve. There has also been unwillingness to interfere with the market forces. Among others these factors have hindered the progress of environmental policy in the UK. Significant improvements were made in 1990's when the Integrated Pollution Control (IPC) was introduced. The IPC regulation was later on one of the regulations that were used as the basis for the design of the IPPC Directive. (Gouldson, Murphy, 1998) The IPC Regulation did not cover dairies and thus the British dairy industry will apply now for its first environmental permits.

5.1.2 Administrative Style

Administrative style influences the potential to deliver a specific type of regulation. "Cooperation and consensus" style of regulation is typical for all the **Nordic countries**. At the level of individual firm, this means that the solutions to problems are the outcome of interaction of the regulator and the firm. The interaction has often had characteristics of bargaining process. (Munk Christiansen, 1996). Regarding different interests, the Swedish and Danish regulators have been found out concentrate in the policy implementation on the protection of the state interests, for example environment or take a mediating role between the state and private interests (Bohne, 2001)

The **Dutch** and **British** administrative styles have also characteristics of a consultative approach – the regulator can be more focused on promoting private interests in some aspects of the process. However, the consultative approach is not the prevailing one. The Dutch and British regulators are usually most concerned with the interests of the state (Bohne, 2001). The regulators implementing the British IPC Regulation have formulated close relationships with the companies. This hands-on approach is associated with an efficient transfer of information and understanding, but on the other hand, the negotiations may lead to reduced requirements (Murphy, Gouldson, 2000).

According to Murphy and Gouldson, the administrative styles of the Dutch regulators from the water boards and the provincial authorities differ. The provincial authorities have more flexible, hands-on approach while the water authorities have mainly arm's-length approach (Murphy, Gouldson, 2000). The Dutch interviewees for this study disagreed with this statement. According to them, there are differences in individual regulators' approach, but they had not observed a difference between the regulatory bodies (Teekens, telephone interview, June 26, 2003, Petraeus, personal interview, July 8, 2003, van Gennip, personal interview, July 11, 2003)

5.1.3 Potential for Integrated Permitting

A study on the environmental permitting in eight EU Member States prior to the IPPC concluded, that the potential for the holistic assessment of environmental impacts was highest in the UK, Denmark and Sweden. The potential was considerably smaller in the Netherlands. The potential for holistic assessment was estimated based on the existing generic emission standards⁶ and the authorities opinion on whether the emission standards are needed. Even in the countries where the potential for holistic assessment of environmental impacts was largest, the authorities would have preferred to have more binding emission standards: 80% of the Swedish and Danish authorities and 50% of the British authorities requested for more binding generic emission standards. (Bohne, 2001).

5.1.4 Constraints in the Permitting

The regulatory bodies implementing the IPPC Directive suffer from a significant lack of personnel resources. At the time when the Directive was transposed to the national laws, 65% of Danish, 50% of Dutch, 80% of Swedish and 65% of British regulators considered the lack of personnel to be at least a medium problem. Correspondingly, altogether 10% of Danish, 25% of Dutch, 70% of Swedish and 65 % of British regulators considered the problem severe or very severe. The lack of technical and information resources was perceived smaller. Regarding other type of problems, the Dutch, Swedish and British regulators considered economic constraints as the most serious barrier in their work, whereas Danish regulators saw the lack of public awareness as the most problematic issue. (Bohne, 2001).

5.2 Studied Dairy Industries

Food and drink industry is the leading industry sector in Europe Union with more than 600 billion € of production (CIAA, 2003a) Dairy products represent 15% of the production of

⁶ Holistic assessment is generally hindered by the binding emission standards that reduce flexibility.

the food and drink industry, only the share of meat products (20%) is larger than dairy products (CIAA, 2003b). Dairy products include liquid milk, butter, cheese, yoghurt and products with longer life: UHT and condensed, evaporated and powdered milk products (COWI Consulting Engineers and Planners AS, 2000). The demand of the European food industry's customers is in general characterised by a combination of homogenised global products and traditional products on national and regional scale (European Commission, 2003b). Also dairy products include a wide range of local specialities (Korsström, Lampi, 2001). The combination of the large number of diverse products and traditions related to their production has led to diversity in dairy processing across Europe (Gara-Nagy, telephone interview, August 4, 2003).

5.2.1 Products

The dominance of liquid milk within the product range is typical for Finnish, Swedish and British dairy industries, whereas Denmark and The Netherlands produce relatively more cheese (Danish Dairy Board, 2003a). Cheese is considered their leading dairy product and majority of it is exported – Denmark and The Netherlands are major exporters of cheese in Europe (Danish Dairy Board, 2003a). Feta dominates the cheese production in Denmark (Korsström, Lampi, 2001), whereas gouda is important in the Netherlands (Dutch Dairy Board, 2003a). The variety of the fresh dairy products is large in all the Nordic countries and it includes specialties that are not produced in other parts of Europe (Korsström, Lampi, 2001). The prominent product types influence the dairy companies' profits, because the profit margin of the dairy products varies significantly. Liquid milk is a product with low added value and for example cheese has a higher added value (KPMG, 2003).

5.2.2 Dairy Processing Companies and Plants

A few large players dominate the dairy processing in all the studied countries. The situation is most extreme in Denmark, where Arla Foods receives more than 90% of the domestic milk supply (Danish Dairy Board, 2003b). The UK has a larger number of companies sharing the majority of milk supply than the other countries. The number of the dairy processing companies is however expected to decrease in the UK. Arla Foods plc and Express Dairies have proposed a merger that is at the time of writing (August 2003) investigated by the Competition Commission (Arla Foods, 2003). The largest dairy companies and their share of the milk supply are presented in Table 5-1.

The British dairy industry has suffered in the recent years of low milk prices for dairy farmers, overcapacity and many other problems (KPMG, 2003), and the merger of Arla Foods and Express Dairies is hoped to stabilize the market (Dohm, 2003). In the time period 1996-2001, the Netherlands, the UK and Denmark have managed to add the value of the output of their national dairy chains only little or the growth has even been negative. At the same time, for example French and German dairy industries have been more innovative when it comes to products - their rate of new product launches has been significantly higher than in the Netherlands, the UK and Denmark.(KPMG, 2003)

The dairy industry has been going through a rationalisation in all the studied industries during the last years and the number of production plants has been decreasing. Increasing efficiency combined to health and safety regulations are the main reasons for the trend towards larger plants. In some cases the companies have estimated the modernisation of the least advanced plants to be too expensive and the production has been concentrated to fewer installations (Sahlstein, personal interview, August 22, 2003). Following number of dairy

plants is located in each country: Denmark 78 (Danish Dairy Board, 2003a), Finland 24 (Kotronarou, 2001), The Netherlands 58 (Dutch Dairy Board, 2003a), Sweden 45 (Swedish Dairy Association, 2003) and the UK (England & Wales) 102 (MDC Datum, 2002).

Table 5-1 The largest dairy companies in Denmark, Finland, the Netherlands, Sweden and the UK according to the milk intake. Out of these companies, 4 are also among the 10 largest dairy companies in Europe: Arla Foods (1), Campina (3), Friesland (4) and Dairy Crest (8) (Danish Dairy Board, 2002).

| Country | Company | Share of milk supply (%) |
|------------------------------|---|--|
| Denmark ⁷ | Arla Foods amba | 91 |
| Finland ⁸ | Valio | 80 |
| | Ingman | 9 |
| The Netherlands ⁹ | Friesland Coberco Dairy Foods | 56 |
| | Campina Melkunie | 30 |
| Sweden ¹⁰ | Arla Foods amba | 66 |
| | Milko | 12 |
| | Skånemejerier | 12 |
| The UK ¹¹ | Dairy Crest Express Dairies Robert Wiseman dairies Arla Foods plc Glanbia | Altogether the British Companies mentioned in the table receive 60% of the milk supply |

5.3 Environmental Aspects

Information on the environmental aspects of the dairy industry, and measures to reduce environmental impacts is necessary in order to understand what issues environmental permitting should focus on. It also provides background knowledge for understanding how the permitting could address these issues.

As a result of the rationalisation of the industry, most of the dairy plants have become relatively large in major dairy processing countries all over the world. The trend towards larger plants includes a decreasing number of employees. (COWI Consulting Engineers and Planners AS, 2000) Dairy processing is mostly automated in the large installations. Thus the opportunities to influence environmental impacts are largely in the selection, design and operation of process equipment. Operator practices play a role in the environmental impact of the plant especially in the milk delivery, plant maintenance and cleaning. Good housekeeping has a potential especially in these areas. (COWI Consulting Engineers and Planners AS, 2000) According to a consultant for cleaner production in dairy industry, it is even more important to operate a dairy plant optimally than invest in efficient equipment

⁷ (Danish Dairy Board, 2003b).

⁸ (Korsström, Lampi, 2001; Valio Ltd, 2003b).

⁹ (Mauser, 2001).

¹⁰ (Swedish Dairy Association, 2003).

¹¹ (KPMG, 2003).

(Nilsson R., personal interview, June 23, 2003). If the production and cleaning and not carefully planned and the equipment is not adequately maintained, even most advanced equipment may not make the plant efficient.

High consumption of water and energy and discharge of effluent containing organic substances are considered the most significant environmental impacts of dairy industry. In some cases noise, odour and solid waste can also be problematic. (COWI Consulting Engineers and Planners AS, 2000). The use of toxic and hazardous substances and their emissions are minimal compared to for example chemical and metal industry, but it should not be overlooked (Kotronarou, 2001). The environmental impacts depend naturally on the processes applied in the plant and the local conditions.

5.3.1 Water Use

Water is mainly used in dairy plants for cleaning of equipment and production facilities and cooling operations. Monitoring of water consumption and screening of operations are recommended before taking measures to reduce the consumption (COWI Consulting Engineers and Planners AS, 2000; Korsström, Lampi, 2001). Automated cleaning in place (CIP) can reduce the water consumption considerably. Optimised cleaning operations contribute also to reductions in chemical use. (Korsström, Lampi, 2001). Keeping effluents from different sources separated facilitates the reuse and recycling of water (World Bank, 1999).

5.3.2 Raw Material Consumption and Wastewater

Wastewater contains mainly organic matter in the form of milk and other product residues and chemicals used for cleaning operations. The BOD is high as well as nitrogen and phosphorus content, and the temperature and pH fluctuate. In addition to optimised cleaning, reuse of chemicals reduces the chemical use. (Korsström, Lampi, 2001) World Bank recommends the avoidance of phosphorus-based cleaning agents (World Bank, 1999). If the dairy is connected to a municipal wastewater treatment plant, fat removal and neutralisation are recommended as a pre-treatment at the dairy plant. (Korsström, Lampi, 2001).

Product losses and thus also the organic load of the wastewater can be reduced by better production control. The Nordic report on BAT in dairy industry recommends for example the following measures to reduce the organic load: draining of pipelines before cleaning, recycling of whey into useful products, control of tanks to prevent overfilling, detection of transition points between water and raw materials during start-up and flushing etc. The quantity of non-conforming products can be reduced by a system of traceability. Non-conforming products should be separated from other wastes and utilised as animal feed or in other products. (Korsström, Lampi, 2001)

5.3.3 Energy Use

Energy is mainly used in the form of steam and electricity. Steam is needed for heating and cleaning. Refrigeration, operation of machinery, ventilation, lighting and production of compressed air consume electricity. Energy efficient equipment, heat recovery systems and good housekeeping help reduce the consumption (Korsström, Lampi, 2001). When steam is produced in on-site boiler, the dairy has also a possibility to control the selection of fuel. Air

emissions are the main environmental impact of energy production (COWI Consulting Engineers and Planners AS, 2000).

5.3.4 Other Aspects

Packaging material forms the largest share of solid waste. It includes carton, cardboard, plastic, metal and wood. Selection of environmentally friendly materials, segregating, reuse and recycling reduce the environmental impacts associated to packaging waste. Noise is generated both by milk deliveries and machinery inside of the plant. Easiest way to avoid problems caused by noise, is to locate the dairy far from residential areas. Soundproof equipment reduces the disturbance caused by noise. Odour is mainly caused in relation to accidents. (Korsström, Lampi, 2001)

Food safety is a priority in all stages of the production and the related legislation is excessive. While planning measures to improve environmental impacts, food safety must be taken into account. Compromises in environmental performance may be needed to secure safety. For example the potential to reduce water use is limited due to food safety reasons (Korsström, Lampi, 2001)

5.3.5 Priorities on BAT

In a survey made by IMPEL (European Union Network for the Implementation and Enforcement of Environmental Law), the authorities from EU Member States expressed their priorities for BAT in dairy industry. According to the authorities it is most important to apply BAT in the following three areas: waste water treatment, recycling, recovery and reuse and adoption of best operation practices (Kotronarou, 2001). In other words, good housekeeping and optimal operation is needed in all the areas and product losses must be reduced with recycling, recovery and reuse. Wastewater treatment is an area that has been addressed by regulation for a long time in many Member States, but the IMPEL survey reveals that continuous work on this area is needed.

5.4 Environmental Issues in Studied Dairy Industries

The aim of this section is to give an impression on how the dairy industry in the studied countries has taken up the challenges related to environmental issues. Profound studies that would express the differences between all studied countries were unfortunately not available. However, the provided information on the adoption of environmental management systems and BAT in some countries gives some implications on the importance of environmental issues in the industries' agenda and their environmental performance. The development of regulation that was described shortly in chapter 5.1 is also relevant in this context.

5.4.1 Environmental Management

Most of the largest dairy companies in the studied countries have taken the decision to adopt ISO 14001 environmental management systems. Some of them have already managed to get all the plants certified. The share of certified production is probably at the moment largest in Finland, because all Valio plants have an ISO 14001 certificate (Valio Ltd, 2003a). In Sweden Milko and Skånemejerier both have ISO 14001 environmental management system (Korsström, Lampi, 2001), but the rate of certification in Sweden and Denmark will not rise

to similar level as in Finland until the plants of Arla Foods have ISO 14001. Arla aims at the certification of all its installations by year 2005 or 2006 (Arla Foods, 2002).

In the Netherlands, FCDF has taken a decision to rely on its own environmental management systems. The annual report mentions environmental management to be on an advanced stage in the plants located in the Netherlands (FCDF, 2003). Most of Campina Melkunie's production sites in the Netherlands have ISO 14001 certificates (Petraeus, personal interview, July 7, 2003).

In the UK, Arla Foods, Dairy Crest, Express Dairies and Robert Wiseman Dairies all have taken the decision to get their plants certified with ISO 14001. The plants of Dairy Crest have already been certified (Dairy Crest, 2003) and Robert Wiseman Dairies was hoping to gain certification for the whole group in the beginning of year 2003 (Robert Wiseman Dairies, 2003).

Regarding all types of manufacturing industries, there is a perception that environmental issues have played a role in the management of Nordic companies for while. The Nordic countries, especially Sweden has adopted more advanced practices in environmental management than most European countries (Chadwick, Garrod, Larsson, 1996). A study that was made on the business performance and management systems in the British food and drink industry revealed that their management practices are in general less developed than in the other British industries, but on the other hand, resource and process management are the main areas of strength for the food industry (Mann, Adebajo, Kehoe, 1999). This is definitely a key area when it comes to eco-efficiency. The interviewed representatives of the Dutch dairy companies expressed, that the covenants had brought a lot of improvements. The system that involves both short and long term targets was perceived to support environmental management very well. (Petraeus, personal interview, July 8, 2003, van Gennip, personal interview, July 11, 2003)

The interviews revealed a slight difference in the attitudes between the dairy companies located in the UK and in other countries. Some of the British representatives of the dairy industry implied in the interviews that the environmental impacts of the industry are not very relevant. They had presented similar comments also in the interaction with the Environment Agency (Maleham, personal interview, June 29, 2003). Whether the Dutch, Danish, Swedish and Finnish dairies share this view or not, dealing with environmental issues has probably become a part of daily work and they did not question its importance in the interviews.

5.4.2 Environmental Performance

Finnish, Danish and Swedish dairy industries' environmental performance has been studied a few years ago. The energy and water consumption was slightly lower in the Danish dairies than in the Finnish and Swedish dairies and the energy consumption in Finnish dairies was slightly higher than in Sweden. The researchers mention however, that the small sample may have given the results that show the Danish dairies to have a better performance. The Danish dairies that participated in the survey were relatively new (Lampi, personal interview, July 21, 2003). Overall, there were not significant differences between the countries and the report concludes that the technical solutions are generally known and available to all in the Nordic dairy industry. The sector is technically homogenous and well developed. The study concludes that improvements in the environmental performance have been made, but further progress is still required in some areas. (Korsström, Lampi, 2001) Information that is based

on the emission and consumption levels of the dairy industry was not available on the Dutch and British industries.

The information in the multinational dairy companies' environmental reports gives interesting insight to the dairy industry's environmental performance in different countries. Both Campina Melkunie and FDCDF describe the work for environmental issues in the Netherlands to be more advanced than in other parts of Europe¹² (FCDF, 2003). The environmental report of Arla Foods is focused on achievements in Denmark and Sweden, rather than environmental issues in the UK. The plants of Arla Foods have been working for environmental issues for a longer time in Sweden and Denmark than in the UK and they have thus also achieved a better performance on general level (Page, personal interview, April 8, 2003).

The Swedish, Danish and Finnish regulators believed the environmental performance of the dairy industry to be in general good. The companies expressed similar thoughts. The same holds for the Dutch companies and regulators. The British regulators did not seem to have an equally positive perception on the environmental performance of the dairy industry, though they did not express it to be weak either. British companies believed the performance of the largest companies to be relatively good.

According to consultants who have been working on the environmental issues of the dairy industry in the international arena, there are significant differences in the performance of individual installations (Lampi, personal interview, July 21, 2003, Nilsson R., personal interview, June 16, 2003). For example in the Nordic countries, the differences between individual installations are far more significant than the differences between countries (Lampi, personal interview, July 21, 2003). Installations with substantial potential to improve eco-efficiency can be found everywhere. Overall, a consultant specialised on the eco-efficiency of dairy plants, gave a different impression on the availability of opportunities for saving of resources than the interviewed companies or regulators. The dairy plant reviews that focused on energy and water consumption had revealed valuable opportunities and low hanging fruits to be picked (Nilsson R., personal interview, June 16, 2003).

5.5 Concluding Remarks on the Parties Involved

The main environmental aspects of dairy plants are related to raw material efficiency and energy and water use. Thus there is a straightforward connection between environmental and economic performance and the eco-efficiency can be increased through savings. The knowledge based on profound research on the extent of the potential for eco-efficiency is limited and the perceptions vary on the topic. However, there are some implications that the potential for enhanced eco-efficiency is larger than the companies and regulators believe. There are also significant differences in the environmental performance of individual installations.

The subjective opinions the regulators and operators have on the environmental performance of the industry are relevant, because they are likely to play an important role in the permitting process, whether they reflect the real situation or not. The interviewed Danish,

¹² Campina Melkunie and FCDF have production sites in several East and West European countries. Out of the studied countries, they have plants only in one country: Campina has a few production facilities in the UK. (Campina Melkunie, 2003; FCDF, 2003).

Dutch, Finnish and Swedish regulators had a positive impression on the environmental performance of their domestic dairy industry. If these perceptions are more widespread, the regulators may not be motivated to force the companies actively towards increasing eco-efficiency. The British regulators appeared more convinced on that improvements are needed.

The recent or on-going adoption of environmental management systems implies that the dairy companies are building their organizational capacity to respond to environmental challenges. In Finland and UK this is likely to prepare them for the environmental permitting and related requirements that they face for the first time. Due to the earlier developments in the Danish, Dutch and Swedish regulation of the dairy industry, the companies are already familiar with environmental permitting and less in need to change their organizational and management practices to meet legal requirements.

Out of the studied countries, Finland had prior to the implementation of the IPPC Directive the most significant need to change the existing permitting system and the organization of the regulatory bodies to be able to issue the permits in an integrated manner. In the other countries, the potential for integrated permitting was lower in the Netherlands than in Sweden, the UK and Denmark. Interestingly, the majority of authorities in Denmark, the Netherlands, Sweden and the UK, would have preferred to have more binding generic emission standards. Thus they may not welcome the IPPC Directive with its integrated, flexible approach very warmly. Lack of personnel resource may also have negative influence to the implementation. However, the administrative style in all studied countries had characteristics of discussion and cooperation. This is likely to facilitate the information exchange and interaction that is a central characteristic of a successful implementation of the IPPC Directive.

6. Design of the Directive

The main characteristics of the design of the IPPC Directive are presented and discussed here. The focus is on the characteristics that are relevant from the point of view of eco-efficiency. They include integrated and case specific approach, determination of BAT, operator obligations that determine how an installation must be run etc. In the end, the design as a whole is assessed from the perspective of eco-efficiency.

6.1 Integrated and Case Specific Approach

The IPPC Directive represents procedural environmental legislation. Its focus is on the procedures that are used to meet targets rather than the targets themselves. Administrative bodies must adjust to follow the procedures. (Glachant, 2001)

The core of the selected procedures is the integrated approach to pollution prevention and control. The environmental performance of the industrial installation is seen from a holistic perspective. All environmental aspects must be taken into account in the consideration of the permit and decisions on permit conditions. An important advantage of integrated permitting is that it allows the consideration of cross-media impacts. For example, in some cases, reduction of water consumption may lead to increased chemical consumption. When the permit is issued in an integrated manner, this type of issues can be taken into account in the consideration of permit conditions and different options can be evaluated.

The approach of the IPPC Directive is also case specific rather than based on common emission standards. Case specific approach supports the integrated approach, because it provides better possibilities for consideration of cross-media effects than binding emission standards. The flexible approach is also believed to create conditions that make adoption of clean technology easier (O'Malley, 1999). For example, if there is an emission standard that a company can almost reach with clean technology, but not exactly, the company is instead forced to make the investment on pollution prevention technology.

The case specific approach of the IPPC Directive requires the regulators to take into account in the permit conditions the technical characteristics of the installation, its geographical location and local environmental conditions. Taking into account these factors facilitates deviations from techniques that could from the economic perspective be considered BAT (Doppelhammer, 2000a). However, taking into account the case specific factors also provides an opportunity to set stricter permit condition. For example, the sensitive local environment may require more stringent permit conditions than in other places. And higher performance can be required from the new installations than the old ones.

In addition to the influences to the stringency of the permit conditions, taking into account the case specific factors naturally influences the consistency in permit conditions across Europe. The influence to consistency can be considered only negative. To maximise the consistency in permit conditions, the IPPC Directive should have set emission standards that are valid in the whole EU. However, the approach of common standards involves the very real danger of selecting less stringent values to make sure that the wide majority of the installations comply with the legislation. Setting common emission limit values in the EU that consists of diverse Member States would be a time-consuming effort.

However, the directive provides an opportunity to adopt common emission limit values if the European Commission proposes so. This has been mainly interpreted as a possibility to set emission limit values in case the implementation of the directive does not lead to satisfying results. The Member States can also decide on the national level what is BAT in certain sector and apply common emission limit values for these installations.

6.2 Determination of BAT

6.2.1 Economic Aspects

The definition of BAT in the IPPC Directive requires the techniques to be “developed on a scale which allows implementation in the relevant industrial sector”. This definition makes the directive to support diffusion on existing techniques rather than invention of new techniques. Industry can be required to adopt a technique that has been commercialised and proved successful.

The definition of BAT includes economic filters for the adoption of eco-innovations. For a technique to be available, it has to be “economically viable”. Economically viable has been interpreted as something that does not violate the competitiveness of the industry sector in the European level (Hager, 2002). IPPC Directive is expected to increase competitiveness through savings in resources use. But if substantial investments are required to be made in techniques that have a long payback or no payback at all, the competitiveness could be altered. Regulation in general has had little impact to competitiveness according to most studies made on this topic (Jaffe, 1995; Pearce, Palmers, 2001).

The interpretation the experts offer for the “economic viability” is problematic in practical use. Without excessive studies, there is very limited knowledge to judge what requirements are stringent enough to harm the industry on the European level. Regulators who issue the permits decide what economic viability is partly based on the information provided by the industry. The regulators interviewed for this study possessed a limited knowledge on the industry outside their own country. The BREF provides them information on what can be considered BAT, but it does not cover all the aspects and details. Information on the costs and benefits was rarely available in the process of collecting information for the BREF (Enckell, personal interview, July 18, 2003).

6.2.2 Dynamic Nature

The principle of continuous improvement is embedded in the IPPC Directive. The concept of BAT is dynamic. Once new techniques become available BAT changes. BREFs that give information on BAT are updated regularly. The Directive requires also the environmental permits to be updated periodically. These updates must lead to stricter permit conditions in cases where new techniques have become available. In addition to regular updates, regulators have to consider the need to update the permits conditions also when changes are made in the installation, or there have been substantial changes in BAT that “allow significant improvements without imposing excessive costs”. The directive does not give guidance in interpreting what are significant improvements and excessive costs.

6.2.3 Environmental Aspects

The IPPC states issues that have to be taken into account in the determination of BAT. This list supports the adoption of clean technology, because it mentions issues that cannot be solved at the end of pipe. For example, the use of less hazardous substances, low-waste technology and consumption and nature of raw materials are to be taken into consideration when determining BAT.

6.3 Operator Obligations

The IPPC directive lists operator obligations that require the application of BAT in order prevent pollution. Operator obligations require the operator also to avoid waste production, use energy efficiently and avoid accidents. The operator obligations aim at environmentally benign operation of the plant. Like the list on issues to be taken into account in the determination of BAT, the operator obligations address issues that cannot be solved with pollution control technology.

The wording on the operator obligations is such that it falls on the regulator to ensure that the operator does what he is obliged to do (Ganzleben, personal interview, July 1, 2003). Stronger wording would have made it possible, that the operator is responsible to adopt BAT even if the regulator does not express it in the permit conditions.

6.4 Form of Permit Conditions

The directive addresses the form of permit conditions by recommending the use of emission limit values and if necessary “equivalent parameters or technical measures” (Article 9.3). The prescription of “one specific technique or technology” is forbidden (9.4). It is clear that the directive aims at focusing the permit conditions on emission limit values. This leaves the companies the freedom to choose the means of pollution prevention and is hoped to encourage learning. However, the denial to prescribe specific techniques is not completely straightforward. “Technical measure” is not explained in the directive and this has caused problems in the interpretation of article 9 (Gislev, personal interview, July 9, 2003). The unclear wording provides a loophole that may facilitate the prescription of specific technique in the permit conditions.

The IPPC Directive mentions monitoring several times. Permit conditions on monitoring are required both to control compliance and to improve the management of environmental aspects in the company. Monitoring can motivate the industry into improvements and provide information that the action can be based on. Whether an obligation to adopt environmental management system can be a permit condition is not stated directly in the Directive. A management system could be interpreted as a specific technique. In this case its adoption could not be a permit condition.

6.5 Time to Respond to Requirements

The Directive was adopted in 1996 and came into force 1999. The three years in between ensured that those who were planning to open a new installation after October 1999, had time to take the new requirements into account. The existing installations were given an 8-year transition period to get prepared for the requirements of the directive after its enforcement. In practice the preparations of industry depend strongly on how early the authorities in Member States have chosen their approach to the implementation and how

well the companies are informed about it. Companies also lack essential information on the expectations on them until the BREF documents have been finalised.

The directive does not address directly the time that is provided for the companies to find and develop their solutions to prevent and control pollution in a normal permitting situation. Annex IV mentions that “the length of time needed to introduce the best available technique” should be taken into account when determining BAT. This could primarily be interpreted as a denial to set permit conditions that require too long time to be met. Thus the Member States are rather free to choose how long time the installations are provided to meet the permit conditions.

6.6 Implementation Support

6.6.1 Information Exchange on BAT

Information exchange on BAT is expected to increase the knowledge on BAT. See Chapter 7 for further details on information exchange on European level.

In addition to organised information exchange, IPPC Directive has been interpreted to rely heavily on the discussions and information exchange between regulators and operators. The regulators and operators are supposed to combine their expertise and brainstorm about the best available technique.

6.6.2 Transparency

The EPER makes comparisons of the environmental performance of the industrial installations possible for the public. Public is also informed about the permit applications and the permits are available for them. Permit conditions give hints on the environmental performance of the installation.

The introduction of the public emission register has an opportunity to support also the implementation of the Directive in longer term. Many parts of the permitting process, including the information exchange on BAT, are dependant on information provided by industry and the increasing transparency in environmental performance in general will hopefully increase the transparency in permitting.

6.7 Other Issues

The IPPC directive does not address the different characteristics of the industry sectors. The flexibility embedded in the directive allows the Member States to do so. For example, emission standards can be set for some sectors. The practical implementation has not showed special difficulties in the implementation in specific industry sectors. Instead, small and medium size enterprises (SMEs) have turned out to be a group that faces difficulties in meeting the requirements.

The European Commission has responded to this and other problems in design and implementation in the recently opened stakeholder consultation process. The Commission inquires for example about the appropriateness of the selected thresholds and the need to provide additional implementation support for SMEs. The consultation is not likely to lead to significant changes in the design of the Directive. It is more probable that some

interpretations will result. There could also be changes in the thresholds of the installations that are covered. (Gislev, personal interview, July 9, 2003) This is probably the most important potential change from the perspective of the dairy industry.

6.8 Concluding Remarks on the Design as a Driver for Eco-efficiency

The IPPC Directive takes into account the differences in the conditions of the various Member States by allowing flexibility in the permit conditions. However, due to the procedural nature of the Directive, it influences the organization of the regulatory bodies implementing it. The administrative styles in the European countries have a long history and there can be considerable barriers for change.

The design of the IPPC Directive enables in practice the permit conditions to deviate from BAT that is economically viable for the sector in question. There is a concern that the deviations towards lower environmental performance would be more common (Doppelhammer, 2000a) For example imperfect information could lead the regulators to set less stringent permit conditions especially if they have a lack of time and competence. The regulator relies in the permitting partly on the information provided by the industry and industry is known to exaggerate the costs of regulation for example in international negotiations related to environmental policies. These factors have a potential to decrease the stringency of the permit conditions.

The requirements are not determined in the directive, apart from the definition of BAT and a general statement that “a high level of protection of the environment” is to be achieved. Eventually, the stringency depends both on the BREF and the regulators. The level of the technologies should be ambitious in order for the BREF to drive improvements in the studied countries. If environmental performance of the Nordic and Dutch dairy industries is already relatively good, as the regulators believe, ambitious targets are needed to move further.

The Directive gives considerable freedom for regulators in their work. According to Bohne, the integrated approach with the excessive freedom tends to work in fair weather. In other words, when there is lack of resources, economic constraints and severe pollution problems, integrated approach is not the best solution. Whether the integrated approach works or not, depends on the legislative, administrative, economic and social conditions. (Bohne, 2001) In the studied Member States, the lack of personnel resources could cause problems in the implementation of the flexible environmental permitting.

On the other hand, the flexible design allows the dairy industry freedom in selecting their ways to improve eco-efficiency. The design of the Directive keeps the focus on clean technologies, process optimisation and good housekeeping. The environmental aspects that have to be taken into account cannot be addressed with the adoption of pollution control technologies. The requirement to monitor environmental performance not only allows the regulator to control the compliance of the plant but also supports the environmental management of the plant, if the monitoring is planned in a smart way. It can also act as a driver for eco-efficiency if it reveals opportunities. Eventually, the focus of the permitting process of course depends on the national permitting procedures, the regulator and available resources.

Some of the disadvantages of the flexible, integrated approach can be avoided, if the BREF has characteristics that bring consistency in the requirements across Europe. Level playing field cannot be expected to follow the implementation of the Directive, because the design does not have potential for it. But consistency can be increased and it is important to do it to give the industry signals that improvements are needed and that those who act will be rewarded. The role of BREF is essential also in driving the continuous improvement that is part of the design. The document must be continuously updated and reflect current BAT. Another important driver in this respect is the regular updating of permits.

7. Information Exchange on BAT

This chapter presents the information exchange process behind the BREFs and the role of the documents. The content of the BREF in the food, drink and milk processes is described, not on detailed level, but rather from the point of view, whether it is useful or not. The BREF is evaluated on how well it supports the permitting process and if it promotes eco-efficiency. The information exchange process on this BREF is also discussed, because it explains largely the content of the BREF.

7.1 Information Exchange in Brief

Exchange of information and publication of its results in the BREFs is the European Commission response to the Article 16 that states “The Commission shall organize an exchange of information between the Member States and the industries concerned on best available techniques, associated monitoring, and developments in them.” The BREFs are published for the industry sectors that need to be authorised according to the IPPC Directive. Altogether more than 30 BREFs are produced, most of them covering a certain industry sector. There are also BREFs that deal with issues that are common for all industries, for example a BREF on monitoring systems is being produced. The BREF on Economics and Cross-Media Effects gives advise on how to on weigh the cross-media¹³ affects against each other, balance the costs of a technique against its benefits and consider “economically and technically viable conditions” in the determination of BAT.

7.1.1 Objectives of the Information Exchange

The main objective of the information exchange is to support the licensing authorities in their work by providing them information on the BATs. The BREFs serve at the same time the needs of a wider audience. Companies needing a permit are recommended to use the BREFs and policy makers involved in environmental regulation and society can use them to find information on BAT (Litten, 2000b). The BREFs are expected to contribute to the reduction of technical imbalances in EU and assist in the implementation of the Directive. Even more broad, ambitious goals have been associated with the information exchange and produced BREFs, according to the European IPPC Bureau they are aimed at promoting the worldwide dissemination of the BATs (European IPPC Bureau).

7.1.2 The Role of BREFs

The authorities are obliged to consider the results of the information exchange on BAT when they determine the permit conditions. A BREF is a reference document that provides information for decision-making but it does not propose emission limit values or provide a legal interpretation of the directive. In addition to considering the information in BREFs, the authorities are to use other sources to keep themselves updated on BAT. The information in BREFs can not be exhaustive on the topic of BAT. As mentioned earlier, authorities are also to take into account the local environment, geographical location and technical characteristics of the specific installation when they determine BAT and the permit conditions that are

¹³ Cross-media effects refer to effects to the whole environment (European IPPC Bureau, 2000). One technique can have several different kind of environmental effects.

based on it. It is up to the Member States to decide how the BREFs are used and they have embraced varying approaches to their utilisation. Some countries produce their own guidelines that are based on the information in BREFs and others plan to use the original BREFs (AEA Technology Environment, 2002). The Commission provides the BREFs only in English and the Member states decide whether they translate the documents into their own language.

7.1.3 Involved Parties

Information Exchange Forum (IEF) tackles the political and strategic questions related to the information exchange. They also coordinate and assess on general level the information exchange and its results. Environment Directorate-General (Environment DG) participates in the supervision of the information exchange and provides guidance on legal issues (Braun, personal interview, August 1, 2003). European Integrated Pollution Prevention and Control Bureau (European IPPC Bureau, EIPPCB) organises the information exchange in practise and produces the BREFs based on the information that they are provided. Technical working groups (TWGs) have been established for the production of each BREF. TWGs provide information and review the draft documents. The TWGs consist of experts from Member States, EFTA countries, Accession countries, environmental NGOs and industry (European IPPC Bureau).

7.1.4 Content of the BREFs

The BREFs are prepared according to the guidelines laid down by the DG Environment and IEF. All the BREFs provide first *General information* (chapter 1) on the sector and its key environmental issues, describe the *Applied processes and techniques* (chapter 2) and *Current emission and consumption levels* (chapter 3). After that the BREF provides information on the most relevant *Techniques to consider in the determination of BAT* (chapter 4). Along with the techniques, information is provided on the associated environmental benefits (also data on consumption and emission levels if it is available), cross-media effects, information on the operation of the techniques, applicability, associated costs and economic benefits, driving force for the implementation and sources of additional information. Chapter 5, *Best available techniques* draws conclusions on which techniques can be generally considered BAT. The conclusions are based on the costs and benefits of the techniques. Chapter 5 provides also information on emission and consumption levels that are associated with the included BATs. These emission and consumption levels are called BAT levels and they should not be confused with emission limit values. Chapter 6 on *Emerging techniques* describes advanced techniques that are currently under development but may become BAT in the future. *Concluding remarks*, the last chapter deals with the information exchange process as a whole (European IPPC Bureau, 2000).

7.2 The BREF in the Food, Drink and Milk Industry

The BREF in the Food, Drink and Milk Industry is not the only BREF that contains information that is relevant for dairy industry. Also, BREFs on Cooling Systems, Monitoring Systems, Economic and Cross Media Issues under IPPC and Energy Efficiency contain information for the permitting of the dairy industry. However, the BREF in the Food, Drink and Milk Industry is the most relevant document and it provides also information on the issues that the other BREFs are focused on.

The work to produce a BREF in the food, drink and milk processes was initiated in January 2001, when the first TWG meeting took place. At the time of writing (August 2003), the members of the TWG are preparing their comments on the second draft of the BREF. The final version is supposed to be ready in 2004. The BREF covers the following sectors mentioned in the Directive (Annex I)

“6.4. (b) Treatment and processing intended for the production of food products from:

- animal raw materials (other than milk) with a finished product production capacity greater than 75 tonnes per day

- vegetable raw materials with a finished product production capacity greater than 300 tonnes per day (average value on a quarterly basis)

(c) Treatment and processing of milk, the quantity of milk received being greater than 200 tonnes per day (average value on an annual basis)”

The food, drink and milk sector is exceptionally diverse compared to the majority of the sectors that are covered by a BREF. This has presented a special challenge to the TWG responsible. Not only are there a huge variety of products but also the production of similar products varies substantially depending on the region where the production takes place (Gara-Nagy, August 4, 2003). The BREF in the Food, Drink and Milk Industry aims at covering all the different activities that belong to the categories mentioned above (European Commission, 2003b).

7.2.1 Structure of the BREF

The TWG chose to address the diverse sector mainly in a horizontal manner. In other words, the BREF includes long sections that deal with the unit processes that are common for several sub-sectors of the food and drink industry. The sections that deal with specific sub-sectors are relatively short. An option for horizontal structure would have been to choose a few sub-sectors and focus on them. These sectors would have been covered in a more detailed level and the sections that deal with common issues would have been substantially shorter. In this case the dairy industry would probably have been given more space in the document. IMPEL recommended giving priority in the BREF for the meat and milk processing industry and the breweries (Kotronarou, 2001).

Horizontal structure has some important benefits. Focusing on the unit processes that are often common for many sectors rather than looking at certain sectors more closely facilitates more equal treatment of the subsectors in permitting (van Gennip, personal interview, July 11, 2003). Authorities are not provided with substantially larger amount of information and the BAT levels on some sectors than others. Managing the sectors in the same sections has also produced conditions where different subsectors exchange information on the unit processes. Some BATs have been discovered only by some sectors although the others could also apply them (Gara-Nagy, August 4, 2003). Now the information exchange has given the industry a chance to learn about techniques that have been proved to work well in other subsectors. The horizontal structure is also believed to reduce the size of the document in cases where wide range of subsectors is covered.

On the other hand, the horizontal approach has serious limitations. Chapters 4 and 5 of the BREF in the Food, Drink and Milk Industry do not include production lines and it is

difficult to find information if one is to explore the possible BAT for a certain installation. The information on BAT for a certain production line is scattered all over the Chapters 4 and 5. Both long common sections and shorter subsector specific sections must be read to find the information. The Finnish regulators and the environmental manager of the largest Finnish dairy company considered the choices that were made on the structure of the BREF very disappointing (Enckell, personal interview, July 18, 2003, Lövdahl, telephone interview, August 25, 2003, Sahlstein, personal interview, August 22, 2003). Many interviewees considered the BREF difficult to use, even if it contained very useful information.

7.2.2 Presentation of BAT

The content of Chapters 4 and 5 is focused on management and good housekeeping rather than technology. An environmental manager of a dairy company presumed that most of the requirements of the BREF are met if the installation has ISO 14001 environmental management system. This comment may be exaggerated, but it describes the nature of the document. It is more methodological than dealing with specific technologies and large investments. Importance of the managerial aspects in the prevention of pollution is a factor favouring central role of management in the BREF. On the other hand, the permits conditions rarely address the management directly¹⁴ and thus large coverage of management issues may not be the information the authorities most urgently need.

In the second draft of the BREF, the BAT levels are presented only for the concentration of the polluting substances in wastewater. The horizontal approach may have also contributed to exclusion of BAT levels. Presentation of the BAT levels would require in many cases the management of larger entities than unit processes and a focus on one subsector at a time. The industry does generally not have data on the emission and consumption levels of the unit processes (van Gennip, personal interview, July 11, 2003).

There are also other reasons for exclusion of BAT levels. It is problematic to conclude on any figures in a BREF that aims at covering a huge diversity of activities. Even the large, well-defined sectors, such as dairy industry include such a variety of products and ways to produce them, that it is difficult to find figures that would be specific enough to give useful information and at the same time be valid for a significant share of the industry. Industry used these arguments in the information exchange process. According to a consultant interviewed for this study, wide majority of dairy processes is covered if benchmarks are set on water and energy use for pasteurized milk, UHT milk, cultured products, cheese and butter (Nilsson R., personal interview, June 23, 2003). The consultancy has been using these benchmark figures. The manufacturing processes for production of these products are homogenous enough to be benchmarked against the same figure. Also the British IPPC permit application form provides a few benchmark figures for dairy products (see Section 8.3.1 and Appendix III for more information on the application form).

Some members of the TWG were disappointed to the fact that the cross media effects were not addressed in more depth in the document. Environmental aspects are addressed rather separately from each other. An authority representant in TWG would have wanted to see more examples from real installations to clarify what kind of choices between different environmental aspects the BAT candidates have made in their processes.

¹⁴ This was the case in most of the countries investigated in this thesis.

Appendix II provides information on the issues the BREF addresses and the requirements the on dairy industry.

7.2.3 Level of Technology

The challenge associated to the BATs presented in the BREF depends eventually on the current performance of the dairy industry. The performance varies across the Europe and between installations. Thus it is difficult to make a general judgement on the level of the technologies presented in the BREF.

The interviewed regulators and company environmental managers had some perceptions on the level of the technologies presented in the BREF versus the current performance of the industry. The Dutch members of the TWG and company environmental managers considered the content of the BREF such that the Dutch operators will not be required to make substantial changes on the ground of the BREF (Kerkhof, personal interview, July 10, 2003, Petraeus, personal interview, July 8, 2003, van Gennip, personal interview, July 11, 2003). Arla's environmental manager had a similar opinion on the company's plants in Sweden and Denmark (Johannesen, telephone interview, June 9, 2003). Otherwise the Swedish companies had very little knowledge on the IPPC and the Swedish and Danish local authorities had not seen the BREF, so they could not assess whether the performance of the companies is high enough.

The Finnish representative of the TWG expected that the Finnish dairy industry would not need to make substantial improvements in order to meet the level of technology in the BREF (Enckell, personal interview, July 18, 2003). The British regulator who participates on the information exchange stated, that there are significant differences between the companies. Some would need to improve more, others less but it was not very likely that radical changes would be needed. (Maleham, personal interview, June 29, 2003)

7.2.4 Success in Covering Environmental Issues

There are differences in the coverage of the environmental aspects and issues in the document. The author of the BREF assessed that the sections on odour management and wastewater treatment, in general sections on end-of-pipe techniques cover the whole sector successfully. Another member of the TWG considered the section on waste unsatisfactory.

The European Commission has estimated that the BREFs that have been finalised are generally weak in the monitoring, energy use, noise and environmental management. Several interviewees of this study expressed that the BREF in the Food, Drink and Milk Industry addresses the environmental management profoundly. The interviewees did not admit the BREF to be weak in the other mentioned aspects. The investigation of the BREF in the context of this study revealed that the monitoring aspect is not covered profoundly. For example, there is no guidance on what should be monitored specifically in the dairy sector. In general assessing the quality of the BREF in this respect is difficult at this point of time, because changes are possible, and very few people have had a profound look in the draft document.

The opinions on the usefulness and quality of the information in the BREF varied among the regulators and company environmental managers who were interviewed. Some considered the content of the BREF very useful, whereas others would have liked to have more detailed

information. Mainly companies requested for more detailed information (Page, personal interview, July 3, 2003, Sahlstein, personal interview, August 22, 2003).

7.3 Information Exchange on the BREF in Food, Drink and Milk Industry

7.3.1 The Process, the Participants and Their Role

Food and drink industry forms the largest group within the TWG for the BREF in the Food, Drink and Milk Industry. The number of authorities involved is almost equally large. The TWG has also several members who represent the research community. (European IPPC Bureau) Technology suppliers of food industry and environmental NGOs were not represented in the practical work. According to the EIPPC web page, the TWG has more than 70 members, but in reality the number is smaller¹⁵.

The members of the TWG are supposed to take the role of experts and not represent in the first hand their country, company or industry sector. The information exchange is intended to be a technical, not a political process (Gislev, 2000). Technical nature of the process derives from the fact that the BREFs do not provide an interpretation of the Directive (Litten, 2000a). In reality several sources have criticised the TWG discussions (in relation to other BREFs) and the resulting BREFs for being strongly influenced by political interests (Ganzleben, personal interview, July 1, 2003, Nyström, personal interview, June 11, 2003) (Hey, 2000; Lohse, Sander, 2000). Due to limited resources the NGO's have had little influence in the TWGs they have participated in, whereas industry has in many cases mobilised substantial resources to influence the BREF. NGO representatives call also for improvements in the participation of industry in TWG, fore-runner industries and suppliers have to be presented in a balanced manner among the industrial members. (Lohse, Sander, 2000)

Some members of the TWG admitted that industry's lobbying has also influenced the BREF in the Food, Drink and Milk Industry (Enckell, personal interview, July 18, 2003, Gara-Nagy, August 4, 2003). Industry, Confederation of the Food and Drink Industries of the European Union (CIAA) in the forefront, lobbied for the selection of the horizontal structure. Interviewees of this study stated that the industry has also resisted the inclusion of BAT levels in the BREF. Part of the industry fears that the authorities read the BREFs in a prescriptive manner and they are not willing to deviate from the BAT levels that are presented in the BREF. In some cases, industry strived to exclude techniques that cannot be applied in the majority of installations (Gara-Nagy, August 4, 2003).

The interviews gave the impression that some of the authority members of the TWG are learning in the process far more than participating as experts who provide the group with their knowledge. The learning effects of the process can naturally be considered very positive, but if the lack of expertise is common among the authority members, there is an imbalance in the expertise among the members of the TWG. The absence of the NGOs and suppliers in the information exchange contributes further to the imbalance.

¹⁵ For example, EIPPC webpage states that there is one representative of environmental NGOs, but further inquiries revealed that there is a mistake in the web page.

There was not a formalised approach to the selection of the techniques. Economic data was rarely presented on the suggested BAT candidates but the selected techniques are already applied in some installations. This approach naturally excludes most techniques that are not affordable. The BREF on Economics and Cross-Media Effects is at the moment in draft stage. In the future it can provide advice on the selection of BAT for the BREF.

7.3.2 Future Development

The author of the BREF is expecting numerous comments to the second draft. The basic structure of the document is not going to be changed anymore. Addition of techniques to the document is possible, if the members of TWG suggest new BAT candidates. The most significant changes are expected in conclusions on what can be generally considered BAT (chapter 5) and emerging techniques (chapter 6). Concluding remarks, that will include for example recommendations on the revision of the document, are missing completely at the moment. (Braun, personal interview, August 1, 2003, Gara-Nagy, August 4, 2003)

Originally, the European Commission aimed at the revision of the BREFs every five years. The information exchange was expected to last one year and there would be four years in between before the revision would start. However, the process has turned out to take more than one year. (Gislev, personal interview, July 9, 2003). In general the revisions are now expected to take place after longer time than five years.

7.4 Concluding Remarks on the BREF as a Driver for Eco-efficiency

If the outcome of the information exchange process is successful, the BREF can be an excellent tool for supporting the implementation of the IPPC Directive. It removes information related barriers and brings consistency and clear signals on what is required. The BREF in the Food, Drink and Milk Industry has some serious shortcomings that prevent it from supporting the implementation in the best possible way.

The whole food and drink industry has a possibility to enjoy from the fruits of horizontal structure of BREF: the information exchange on BAT between the different subsectors of the food industry. The regulation of the large subsectors, for example dairy industry suffers from the chosen approach. If a different approach would have been selected, the focus of the BREF would probably have been on the production lines of the largest subsectors. More details would have been provided on these sectors and there could have been more BAT levels and a better coverage on cross-media issues. It would have been easier for the regulators and companies to find information that is relevant for them. The current BREF is considered to contain a lot of useful information, but it is difficult to find. More practical structure would have made the removal of information related barriers to eco-efficient dairy industry more efficient.

The lack of the BAT levels is a serious shortcoming, because the BAT levels are important to both regulators and dairy companies. As authorities are to set the permit conditions in the form of emission limit values rather than by requiring an investment to a specific technique, BAT levels provide them essential information. Interviewees who had knowledge of other BREFs, commented that they include more BAT levels than the BREF in the Food, Drink and Milk Industry. Both the selection of horizontal structure and missing BAT levels have been explained by the wide range of the covered activities. This implies that the attempt to

cover the whole food, drink and milk industry may have been too ambitious. The BREFs with too large coverage are subject to quality degradation (Lucas, 2000).

Without BAT levels, the BREF does not encourage consistency in the requirements across Europe and thus it fails to give clear signs that first mover advantages would be rewarded. Also, the BREF does not make it very clear what is the level of performance that is expected from the companies. Larger number of BAT levels would have helped in this.

The outcome of the information exchange and the information on the process itself implies that improvements are needed to ensure the production of practical document with ambitious BAT levels. Hopefully, the revision of the BREF does not take place very far in the future. Less frequent update would not only lead to reduced requirements on the dairy industry, but also a new, improved BREF in the Food, Drink and Milk Industry would not be seen for a long time. Improvements to the BREF and the information exchange process are discussed in the Chapter 11 of this thesis.

The use of the BREFs influences also them as the driver of eco-innovation. The approaches the studied Member States have embraced on the BREF are presented later (Sections 8.4.2 and 8.6) together with other aspects of the implementation.

8. Implementation

This Chapter presents the implementation of the IPPC Directive in the dairy industries of the studied Member States. It goes through the legal transposition, schedules for the submission of dairy industry's permit applications and the thresholds that determine whether a dairy needs an environmental permit or not. The permit application, interaction between dairies and regulators and reconsideration of permits are described shortly. The Chapter moves on to introduce the main changes in the permitting process in each country and the authorities responsible for issuing the permits. Finally, two issues that are closely connected, the input of the Member States to the implementation and the actual expectations the regulators and dairy companies have on the IPPC Directive are described.

Conclusions are drawn on whether the efforts taken to implement the Directive are adequate, when the changes are likely to take place and how significant they are. The implementation must succeed to a certain extent for the IPPC to act as a driver for any kind of change. Even more successful implementation is needed in order to focus the permitting process on eco-efficiency, not at the end of pipe. This Chapter is more focused on the extent of change that is likely to take place, whereas Chapter 9 discusses what kind of changes can be expected.

8.1 Transposition

Sweden transposed the IPPC Directive in 1999, when a major reformation of environmental legislation took place. The new Environmental Code came into force January 1st, 1999. The purpose of the Environmental Code is to promote sustainable development through more stringent, comprehensive and advanced environmental regulation. The transposition of the IPPC Directive into the Swedish law represents only part of the Code. (Swedish Environmental Protection Agency, 2003)

Finland and the **UK** introduced acts with the main purpose to implement the IPPC Directive. Finland adopted a new Environmental Protection Act that came into force in March 2000. The parts of the older legislation that dealt with the permitting of industrial installations were repealed. Some acts were repealed completely. (Silvo et al., 2002). The Pollution Prevention and Control Act came into force in the UK (England and Wales) 1st August, 2000 (Statutory Instrument 2000 No. 1973). The Integrated Pollution Control regime was thus replaced by the IPPC (Environment Agency, 2003a, 2003b).

Danish and **Dutch** legislations met most of the requirements of the IPPC Directive and as these countries had not planned substantial reformations of the environmental legislation, the IPPC was brought into force by modifying the existing legislation. Denmark issued an amendment about public participation (Andersen, personal interview, June 13, 2003) and the Netherlands issued a state order that caused a few minor changes (Teekens, telephone interview, June 26, 2003).

The European Commission is discussing with the Netherlands, Sweden and Denmark the shortcomings in the transposition of the directive into national laws. The shortcomings are related to the introduction of the BAT concept etc. The Commission does not approve of the Swedish definition (Nyström, personal interview, June 11, 2003) and the Netherlands is yet to introduce the concept of BAT (Teekens, telephone interview, June 26, 2003). The Dutch legislation includes at the moment so called ALARA principle. ALARA refers to As Low As Reasonably Achievable (Infomil, 2001). The Commission is also dissatisfied with the fact that these countries have not taken specific legislative measures to ensure that their

industrial installations comply with the Directive by October 2007 (Gislev, personal interview, July 9, 2003). The schedules for implementation are presented in Section 8.2.2 and Table 8-1.

8.2 Targeted Dairies and Schedules

8.2.1 Dairies in Need of Authorization

The IPPC Directive includes definitions that determine whether a dairy processing plant is within the scope of the directive or not.

“6.4. (b) Treatment and processing intended for the production of food products from:

- animal raw materials (other than milk) with a finished product production capacity greater than 75 tonnes per day

.....

(c) Treatment and processing of milk, the quantity of milk received being greater than 200 tonnes per day (average value on an annual basis)”

(Council Directive, 96/61/EC)

The first definition is used to determine whether a dairy is within the scope of the directive when the raw material is milk-based but not milk. Some Member States have chosen a wider scope in their own legislation. For example, if installations were covered by the previous legislation, the Member States did not want to exclude these installations. (Gislev, personal interview, July 9, 2003) Among the studied Member States, only the UK has not chosen a wider scope.

The interpretation of the Directive’s thresholds has turned out to be problematic in the UK. There has been confusion on the interpretation of ‘milk’, and what is counted as ‘animal raw material’. The interpretation of production capacity has also been a topic of many discussions. (Maleham, personal interview, June 30, 2003) It is possible that the European Commission will provide guidance on the interpretation of the thresholds (Gislev, personal interview, July 9, 2003).

The thresholds for the installations that must have an environmental permit in the studied countries are presented in the next section (8.2.2.), Table 8-1. Also approximate number of dairies covered by the IPPC Directive is presented in the Table 8-1. The figures are not precise, because some of them are a few years old and the number of dairies has been changing. In UK, the number of dairies needing a permit is uncertain due to difficulties in the interpretation of the thresholds. Exact information on the share of the dairy industry that is affected in the studied Member States was not available.

8.2.2 Application Schedules

Finland and the **UK** have taken special legislative measures to ensure that their installations comply with the Directive by the deadline of October 2007. The UK has determined time periods when the installations have to submit their applications (Statutory Instrument 2000

No. 1973) and Finland has set a deadline for the submission of the applications. This deadline is valid only for installations that are covered by the Directive, not all dairies, although otherwise the dairies of all size are within the scope of the Finnish law (Ympäristönsuojeluasetus 169/2000).

Table 8-1 The thresholds that determine whether a dairy needs an environmental permit, schedules for meeting the deadline in 2007 and number of dairies in need of authorization.

| Member State | Size limits for dairies needing a permit | Schedule* | No of dairies in need of authorization |
|-----------------|--|---|--|
| Denmark | All dairies with milk intake > 200 t/d Dairies producing cheese or powder with milk intake > 100-200 t/d ¹⁶ | Complying by October 2007, sufficient measures not planned to meet the deadline | Not available |
| Finland | All ¹⁷ | a) installations with milk intake > 200 t/d submission of the applications latest December 31 st 2003 ¹⁸ | Altogether 24 dairies ¹⁹ |
| The Netherlands | All ²⁰ | Complying by October 2007, specific measures planned to meet the deadline | Altogether 58 dairies |
| Sweden | Dairies with milk intake > 200 t/d | Complying by October 2007, specific measures planned to meet the deadline | Not available |
| The UK | a) Animal raw material other than milk, production capacity of >75 tonnes per day; AND/OR b) Milk intake > 200 t/d ²¹ | a) Submission of the applications 1st June to 31st August 2004 b) Submission of the applications 1st January to 31st March 2005 ²² | 60-70 IPPC dairies ²³ |

* It should be noted that the specific measures taken to authorize the installations before October 2007 apply only for those dairies that are within the original scope in the Directive.

When **Denmark** transposed the IPPC Directive into their national law, they introduced a rule that the environmental permits can be reevaluated eight years after they came into force (updating can take place earlier, if there have been changes in BAT or the production) (Consolidated Environmental Protection Act September 1998). The permits of IPPC

¹⁶ (Vestergaard, telephone interview September 9, 2003).

¹⁷ (Ympäristönsuojeluasetus 169/2000).

¹⁸ (Ympäristönsuojeluasetus 169/2000).

¹⁹ (Korsström, Lampi, 2001).

²⁰ (Kerkhof, personal interview, July 10, 2003).

²¹ (Statutory Instrument 2000 No. 1973).

²² (Statutory Instrument 2000 No. 1973).

²³ (Stace, personal interview, July 2, 2003).

installations have to be updated latest when ten years have passed (Lindström, Sahivirta, Pennanen, 2001). The rule came into force October 1999, so the permits that were issued before that can be updated by October 2007 and all of them must have been updated by October 2009. Although the legislation does not guarantee that the plants are authorized before the deadline in 2007, Denmark does not plan to take further measures (Andersen, personal interview, June 13, 2003).

The **Netherlands** has not so far taken any specific measures to make sure that the installations meet the requirements of the IPPC Directive by October 2007. Their position is that as the requirements of the IPPC Directive are very close to those of the Dutch legislation before the transposition, the authorities only need to check whether the permit conditions meet the current BAT. Based on this checking, the authorities decide whether the operator needs to apply for a new permit. The requirement for checking is going to be included in a Statutory Order that will most probably enter into force in the end of year 2004. The authorities would not need to check those permits that have been issued after the transposition of the Directive. (Teekens, personal interview, June 26, 2003)

Sweden is planning to introduce an ordinance that obliges the companies to take initiative by a specific date. The companies have to present a plan addressing especially those issues that differ from the previous legislation. The plan must state what the company is going to do to meet the requirements of the directive, and what they have already done. If the regulator agrees with the plan, no additional measures need to be taken. If not, the operator has to apply for a new permit. Naturally the dairies that have already been issued a permit after the transposition of the directive do not need to present a plan. Neither do those dairies that are not within the scope of the IPPC Directive. (Nyström, personal interview, June 11, 2003)

8.3 Applications, Inspections and Renewals of Permits

8.3.1 Permit Application

The permitting includes in all the studied countries negotiations between the operator and the regulator. Both the dairy company representatives and regulators agreed that the regulators do not have the time to familiarize themselves with the details on the operation of the plant. The permitting process relies on the operators giving information for the regulators what could be BAT in the installation in question. Even, if the regulator has command of BAT on the dairy sector, the operator has more profound knowledge on the details of his plant. One of the purposes of the permitting is to push the operators to increase their knowledge on the environmental performance of their own installation and consider different options to improve the environmental performance. The permit applications typically require the operators to explain what would be BAT in their plant and how they measure up in this respect. In Sweden the operators are not only asked to explain, what they are doing or plan to do to improve their environmental performance. The operator must also present alternative solutions (Nyström, personal interview, June 11, 2003).

The UK has chosen to make a specific application form for the dairy sector. More general forms were first tried, but the result was lengthy applications and the regulators had difficulties in finding the relevant information in them. Due to these problems and the fact that the sector is not familiar with environmental permitting, the specific application form was introduced. The form includes very specific questions for the operator. (Maleham,

personal interview, June 30, 2003) Denmark, Finland and the Netherlands have more general application forms (Kerkhof, personal interview, July 10, 2003) (Finnish Environment Institute, 2003a) Vestergaard, telephone interview September 9, 2003, Vroon, telephone interview, September 9, 2003). Sweden does not provide any application form, but there are guidelines on what the application should include (Bengtsson et al., 2000). The UK application form for dairy companies is presented shortly in Appendix III.

The application fees are special in the UK. The fees are substantial, and the amount depends on the environmental performance of the plant. For example, the fee is lower for dairies that have certified environmental management system. (Maleham, personal interview, June 30, 2003) This acts as a driver for the implementation of certified management systems in the UK. One of the interviewed environmental managers said that the application fee is the main driver to implement the ISO 14001 in the company and apply for certification. Another company representative remarked that if the company had not taken the decision to implement ISO 14001 earlier, they would do it now due to the application fees. The application fees supported the decision that was taken already earlier.

8.3.2 Interaction Between the Companies and Regulators

The Danish, Dutch and Swedish regulators interviewed for this study stated that, there is interaction between the regulators and the dairy operators several times a year. Operators provide regulators information on their performance and the regulators visit the plant at least once a year (van 't Hof, telephone interview, July 10, 2003, Karlström, June 19, 2003, Joost, September 3, 2003) According to another study, that covered the environmental of permitting in all industry sectors, the frequency of preventive inspections is significantly higher in the Netherlands and the UK than in Sweden and Denmark. 70% of the Dutch and 80% of the British regulators visit the plants more often than once a year, whereas their 55% of their Danish and 20% of their Swedish colleagues visit the plants more often than once a year. In this respect the enforcement of regulation is clearly weakest in Sweden. Finland was not within the scope of this European study, but according to the interviewees, the dairies and regulators are going to meet once per year or less frequently (Lövdahl, telephone interview, August 25, 2003, Sahlstein, personal interview, August 22, 2003).

8.3.3 Reconsideration of Permits

IPPC Directive requires the authorities to reconsider the permits periodically even when there have not been substantial changes in the installations or new techniques have not become available. Substantial changes and new BAT may lead to the reconsideration of the permit before the periodical reconsideration would take place. (Council Directive, 96/61/EC)

Out of the studied countries, the permits are required to be reconsidered most often in the UK. The permits of the English and Welsh dairy processing plants will be initially reconsidered within four years and thereafter within six years (Environment Agency, 2001) p.5. In Finland the permits are valid either for the time being or until certain date. The permits that are valid for the time being have to be reviewed periodically. The timing of periodical review has not been determined in the legislation. As mentioned above, in Denmark the regulators may impose new permit conditions after eight years and they are required to reconsider the permit at least every ten years. The periodical review of the permits is not obligatory in Sweden. The authorities decide after ten years, whether there is a need to reconsider the permit or not. According to the Dutch law, the authorities are

required to follow the development of techniques and the quality of the environment and change the permit conditions on these grounds when it is needed. (Lindström, Sahivirta, Pennanen, 2001).

8.4 Main Changes in Permitting

The introduction of BREF to the permitting procedures is a common change for all the studied countries. Apart from that, the IPPC Directive causes varying changes that depend on the former permitting system and guidelines that were used.

8.4.1 Changes in Permitting Process

Out of the studied Member States, **Denmark** and the **Netherlands** made the smallest changes in the permitting procedures in order to implement the directive. In Denmark, the most significant changes are related to the public participation in the permitting process and the revaluation of the permits. In the Netherlands the most significant change is related to the permit application. The application must now contain a non-technical summary. (Lindström, Sahivirta, Pennanen, 2001).

From the point of view of the dairies, the general changes in the permitting system are not so relevant in **Finland**, because large majority of them has not experienced the permitting under former regulation. The changes to the dairy industry derive directly from the Directive. The changes in the Finnish permitting system in general have relevance mainly when it comes to the competence of the authorities. The regulators who have been involved in the permitting of other sectors, have experience on sectoral permitting and permit conditions related to certain environmental issues. The transposition of the IPPC Directive caused differences mainly in regard to the following aspects:

- Energy: the new legislation gives better opportunity for a regulator to interfere with the energy use in the company, more attention to be paid on the fuels
- Wastewater: permit conditions on the quality of the wastewater are now possible even if the water is treated in a municipal treatment plant.
- Chemicals: the new legislation requires more attention to be paid on chemicals in the permitting process and the eventual permit conditions.
- Risks and accidents: more attention to be paid on the risk assessment and accident avoidance
- Raw materials: more attention to be paid on raw materials
- Monitoring: increasing importance of monitoring

(Lindström, Sahivirta, Saarinen, 2000)

The introduction of integrated, holistic approach and the importance of BAT regarding all environmental aspects are major changes in the approach. The BAT principle was part of Finnish legislation already prior to the IPPC Directive, but now its role is more important. (Lindström, Sahivirta, Saarinen, 2000)

The **Swedish** regulators have after the reformation of legislation an improved opportunity to influence the environmental performance in some aspects. The main changes consider the following environmental aspects:

- Energy: more emphasis on efficient use
- Waste: the avoidance of waste became increasingly important
- Risks and accidents: important to take measures to prevent them
- Chemicals: the role of substitution became increasingly important

Like in Finland the changes between the old and new legislation are less relevant also in Britain, because the **British** dairies did not need an authorization before. The regulators have experience mainly on regulation of air, water and soil emissions, because they are within the coverage of the IPC regime. IPPC brings the following new aspects under environmental permitting:

- Noise and vibration
- Energy efficiency
- Waste minimization
- Environmental accidents

(Environment Agency, 2003b)

8.4.2 BREF, Standards and Guidelines

The authorities in all the studied Member States emphasize, that BREF is used as a reference document that provides information. The authorities are obliged to consider it when they set the permit conditions, but as the directive states, they are to take into account also local environment, technical characteristics of the installation and geographical location. Several authorities that were interviewed for this study said, that the BREF should not be the only source of information for BAT. In some cases, information in it can be outdated and or due to compromises in the process of collection the information to the BREF, the performance level of the techniques is not high enough.

Finland and **Sweden** do not have specific standard for BAT and they are going to use mainly the BREF. There is also a Nordic report on BAT in dairy industry²⁴, but it has no official status. However, according to a Finnish regulator it had turned out to be more useful than the draft BREF (Lövdahl, telephone interview, August 25, 2003).

The **UK** has provided its own guidelines for the food and drink sector, because the BREF is not yet ready. (Maleham, personal interview, June 30, 2003) The *General Guidance for the Food and Drink Sector*²⁵ describes the standards and expectations for the techniques that must be

²⁴ See (Korsström, Lampi, 2001).

²⁵ See (Environment Agency, 2001).

considered to meet the requirements of the IPPC (Environment Agency, 2001). In addition to the BREF also these guidelines will be used later on. The application form is the primary source of specific information on dairy industry. It gives benchmark figures and states what is considered BAT in certain issues (Maleham, personal interview, June 30, 2003). At the time of writing, the draft application form included benchmark figures for water use and water emissions. The benchmark figures for emission concentration in the wastewater were lower than BAT levels in the BREF and the benchmark figures for water use were similar to the water consumption in the Nordic dairies with highest water efficiency. See Appendix III for further information on the application form, Appendix II for the BAT levels in the BREF and Table IV-1 in Appendix IV for the water consumption in the Nordic dairy industry.

The **Netherlands** provides standards on emissions limits to air²⁶ and water. Their aim is to harmonize the permit conditions across the country. (Kerkhof, personal interview, July 10, 2003) These guidelines will continue to be used on the sectors that BREFs do not cover. Because dairy industry is within the scope of a BREF, the national guidelines will not be used anymore. When the BREF is ready, the authorities and companies will be provided with a document on the differences between the BREF and the existing guidelines. (Vroon, telephone interview, September 9, 2003).

Denmark has standards on air emissions and guidance on water emissions. The air emission standards are followed closely, and deviations are rare. The status of the guideline on emissions to water is different. The eventual emission limits for dairy companies depend on the capacity of the municipal treatment plant (Vestergaard, telephone interview September 9, 2003). The existing standard and guidelines will continue to be used in addition to the BREF. According to the Environment Protection Agency, the standards set minimum limits, whereas BREF provides information on BAT (Fogh Petersen, telephone interview, September 8, 2003).

Unfortunately none of the studied Member States planned to translate the BREF. The interviews of local authorities in Denmark, Sweden and the Netherlands revealed, that there are a lot of regulators with limited English skills. Most probably the situation is similar in Finland.

8.5 Authorities

8.5.1 Institutions Issuing the Permits

The transition from sectoral to integrated approach meant in **Finland** also major changes in the institutions responsible for permitting. Finland chose to pursue the authorization of the industrial installations with single permit. Water courts that used to provide permits to industrial installations regarding discharge of effluent to watercourses were ceased and their personnel was transferred to other institutions. A new permitting authority was established. The permitting authority deals with the permits of industrial installations with significant potential impact on environment. (Silvo et al., 2002) Dairies are not within this category. The regional authorities are responsible for the permitting of dairies with intake capacity at least 60 000 t milk per year and the municipal authorities deal with the smaller ones. (Statutory Instrument 2000 No. 1973)

²⁶ See (Infomil, 2001).

IPPC Directive does not require the Member States to authorize the industrial installations with single permit. It only calls for procedural integration. The **Netherlands** chose not to alter their permitting system that is based on two permits. (Teekens, telephone interview, June 26, 2003) The water boards issue the permits considering aspects related to water and the provincial authorities give authorization regarding other environmental aspects²⁷.

Despite the fact that the **Danish** approach to environmental permitting is described as integrated (Doppelhammer, 2000b) p.247, the dairies need two permits. However, the permits are also often issued at the same time and in the case of dairies the municipalities issue both the permits regarding water and other environmental issues. Thus the permitting could be considered more integrated than in the Netherlands (Vestergaard, telephone interview September 9, 2003) Like the Netherlands, Denmark chose not to change their system.

The Environment Agency is responsible in the **UK** for the permitting of all dairies that need an authorization. For the first round of permitting, strategic permitting groups have been established. They issue the permits in a centralized manner. Strategic permitting groups will do most of the work related to the permitting process. Later on, local inspectors of the Environment Agency will take care of the permitting. Some of them participate in the strategic permitting groups, when the first permits are issued (Maleham, personal interview, June 30, 2003)

In **Sweden**, special changes were not needed in the institutions responsible for permitting, because the Sweden already had an integrated approach and their dairies had been required to have authorization. Regional authorities issue the permits for all dairy processing plants (Förordning om miljöfarlig verksamhet och hälsoskydd 1998:899)

8.5.2 Experience of the Authorities

The regulators both in Finland and the UK lack knowledge on the dairy sector, because it is new for them to issue permits for this sector. In **Finland**, there are a few regulators who have some experience on the wastewater related permitting of the dairy sector before the coverage of the permitting system was changed in the 1980's (Enckell, personal interview, July 18, 2003). However, this would not guarantee them process-oriented knowledge on earlier of current technologies. Most of the regulators have been involved in the permitting of other sectors before. Not only the dairy sector, but also the integrated permitting is new to the Finnish regulators. The possibility to consult colleagues who have expertise on other environmental aspects is hoped to help the regulators in including all the environmental aspects in the permits (Enckell, personal interview, July 18, 2003).

In the **UK**, the simultaneous permitting of the whole sector by strategic permitting groups is hoped to improve situation. Also, the continuous discussions with the companies and trade body on IPPC have brought some information for the regulators (Maleham, personal interview, June 30, 2003). The regulators who have issued permits for sectors that were covered by the IPC regime have experience on integrated permitting. In some sectors, the Environment Agency in the UK has many regulators who used to work in the industry and thus have expertise on their processes (Ganzleben, personal interview, July 1, 2003).

²⁷ Water efficiency is the concern of provincial authorities, not water boards if the company has its own groundwater source.

However, on food sector, there are a few regulators who have a background in the industry (Maleham, personal interview, June 30, 2003). Both the British and Finnish dairies' environmental managers pointed out that the authorities appear to be learning about the permitting of the sector.

Danish, Swedish and Dutch regulators have a rather long experience of the permitting of the dairy sector. The Swedish regulators have also long experience of integrated permitting. As the Netherlands and Denmark are not shifting over to a single environmental permit, there will not be significant new requirements for the authorities in that sense.

8.6 Information and Learning

The implementation of legislation demands cooperation and resources from all parties. If the authorities do not understand the content of the legislation and its practical implications, they are in danger to stick to their approach prior to the transposition of the IPPC Directive. In the same way, the utilization of BREF in the permitting process depends not only in its content but also on how familiar the people are with the document beforehand. The studied countries have invested varying resources to make the regulators and companies familiar with the new legislation and the BREF.

Because minor changes have been made to the Danish law, Denmark has not used substantial resources for implementation of the IPPC Directive. The companies are being consulted on the BREF in the food, drink and milk processes. The local authorities have not participated to this process and the Environment Protection Agency has not taken a general decision on how the BREF is introduced to the authorities. The decision will be taken separately regarding each BREF. (Fogh Petersen, telephone interview, September 8, 2003)

In **Finland** the authorities issuing the permits have attended a course that dealt with the changes brought about the Environmental Protection Act and the integrated approach in permitting (Enckell, personal interview, July 18, 2003) Finland has also established national working groups for the exchange of information. The chairman of the group is a member of Technical Working Group of the relevant BREF and participates on the information exchange on European level. The other members of the group are experts from the environmental authorities and industry. (Finnish Environment Institute, 2003b) Valio participates in the national working group for the BREF in the Food, Drink and Milk Industry. The national working groups give their contributions to the BREF by providing information on BAT and commenting the BREF drafts. The aim is also to make the industry and regulators familiar with BREF. (Enckell, personal interview, July 18, 2003)

The **Dutch** authorities issuing the environmental permits have attended workshops on IPPC and BREF and the practical applications. (van 't Hof, telephone interview, July 10, 2003) The BREFs are being incorporated to the work of the authorities by providing a document on the differences of the BREF and the existing guidelines. The industry, including the dairy companies is being consulted on the differences to see whether they need to make improvements. The same process takes place regarding the guidelines on water emissions. (Kerkhof, personal interview, July 10, 2003)

Sweden introduced new guidelines for the authorities at the time when the Environmental Code was brought into force. The guidelines deal with the forms of the permit conditions, the consultation of different parties on the permit, and the content of the permit in general.

Sweden has not been involved in the TWG for the BREF in the food, drink and milk processes (Nyström, personal interview, June 11, 2003).

The Environment Agency has in the **UK** been working for two years with the dairy industry association and companies to prepare them for the IPPC and at the same time gain knowledge on the industry. The companies have been consulted with regard to *General Guidance for the Food and Drink Sector* and the application form that the Environment Agency is working on (Maleham, personal interview, June 30, 2003).

8.7 Expectations on the New Legislation

The input the studied countries have put to the implementation of the IPPC Directive seems to reflect the expectations from the new regulation. The Finnish and British authorities that have been working with the industry for a few years on the implementation, expressed higher expectations on the IPPC Directive than the authorities in the other studied countries.

8.7.1 General Expectations on the IPPC

Although the aim of the **Finnish** Environmental Protection Act is not in general to impose stricter requirements to the industrial installations than before, there are some expectations for example on the integrated approach. The new system is expected to bring a holistic view to the permitting (Enckell, personal interview, July 18, 2003). Also, the confusion around the permitting process is expected to decrease, because the relevant legislation has been collected together and the division of tasks of between different regulatory bodies is now more clear (Lindström, Sahivirta, Saarinen, 2000).

In **UK**, the expectations are especially focused on sectors that were not within the scope of the IPC Regime. Thus food industry is one most interesting sectors, regarding the implementation of the IPPC.

A representative of the DG Environment expressed a concern on the implementation of the IPPC Directive in **Denmark**, the **Netherlands** and **Sweden** (Gislev, personal interview, July 9, 2003). The interviews conducted for this study revealed that the expectations on the IPPC Directive are low in these countries, because they already have similar systems. The changes they need to make are minor compared to many other countries. However, the Commission worries now that they will not take sufficient care even of the implementation of these minor changes. Satisfaction to the existing system can also be a barrier to the implementation of the Directive. In the Netherlands, both the authorities and company environmental managers expressed that they are content with the existing system and some said that changes are not needed.

The Danish and Swedish authorities expressed some expectations for IPPC in their country. A representative of the Danish Environment Protection Agency expected in the general the BREF based approach to bring a more holistic view on permitting, because Denmark had earlier general guidelines for different media. A representative of the Swedish Environment Protection Agency in turn expected in the long run the permitting to influence more the performance in the environmental aspects that according to the new law got a stronger role.

8.7.2 Expectations on the Influence to the Environmental Performance of the Dairy Industry

The expectations on the IPPC as a driver for improvements in environmental performance are highest in the **UK**. British regulators expect the IPPC to bring about a positive change in the environmental performance of the food industry in general and also the dairy sector. “Continuous improvement” is the key principle. Because the sector has not had permits before, the aim of the first round of permitting is mainly to find out what is going on in the industry. The operators will be required to make improvement programs within the first permits. Stricter measures will follow in the future. (Maleham, personal interview, June 30, 2003, Leberman, personal interview, April 4, 2003) The companies showed great interest to IPPC. They are working to prepare the installation for applying for the permit. Implementation of ISO 14001 is in many plants part of the preparations. The company representatives expected the Environment Agency to require them some changes, but not anything radical. (Plemper, personal interview, July 2, 2003, Lovering, personal interview, June 30, 2003, Page, personal interview, July 3, 2003) The attitude of the dairy companies and their partners varies from expected increase in costs to belief that savings will be found and the sector will benefit from permitting.

The regulators’ expectations on the results in the dairy sector are not equally high in **Finland** as in UK, because most of the smaller dairies have been ceased in the rationalization of the industry. The remaining dairies are large and the regulator, who participates in the TWG believes their environmental performance to be rather good. (Enckell, personal interview, July 18, 2003) Valio expected to be obliged to take some measures, but not very drastic ones.

Only a few people in Denmark and Sweden are aware of the IPPC, so it is too early to speak about expectations on its influence to dairy industry. The Dutch companies and regulators did not express specific expectations regarding dairy sector.

The expectations deriving from the level of technologies presented in the BREF were presented in Chapter 7.2.3.

8.8 Concluding Remarks on the Implementation

The IPPC is implemented in a larger number of dairy plants than the Directive itself requires. Out of the studied countries, Denmark, Finland, the Netherlands and Sweden have set a lower threshold than the Directive for the dairies that need to have an environmental permit. The UK and the Netherlands have the largest numbers of dairies within the scope of the Directive.

The Member States are obliged to ensure that the industrial installations meet the requirements of the Directive by 2007. However, Sweden and the Netherlands are yet to act on this and the Danish approach to the deadline does not ensure that all the installations have been authorized by 2007. Thus Denmark is not likely to experience a strong peak in the number of submitted dairy industry applications. A peak in improvements to ensure that plants are applying BAT may take place in Sweden and the Netherlands in a few years. The improvements related to the implementation of the IPPC Directive have already started in Finland and the UK, because these countries have set specific deadlines for submission of applications (see Table 8-1) and the companies have been prepared for the changes. The updating and checking of permits before the deadline can be expected to influence at least the worst performers in all countries. Even if the content of the Directive is not

implemented effectively, some changes can be expected, because more advanced practices and technologies become available as time passes.

The differences between IPPC Directive and the former **Dutch** legislation were minor and the transposition did not introduce changes in the environmental aspects to be considered. Changes in the type of permit conditions on the basis of IPPC are not likely. The Dutch authorities and regulators appeared to be content of their current environmental policy that is based on agreements with industry. The covenants are likely to continue to be a major factor influencing eco-efficiency of the sector as in practice also permit conditions rely on the plans that companies make within the covenant system. The parts of permits that are not addressed through covenants tend not to address eco-efficiency related issues.

The most significant change in the permitting process is related to the introduction of the BREF. The companies consider the content of the BREF as something that supports the adoption of environmental management and good working procedures rather than as technological guidebook. As they already have had to adopt environmental management at least to some extent because of the covenants, it is unlikely that the BREF will bring about significant changes. The authority initiated investigation on whether the companies have adopted current BAT, may lead to some improvements. However, the expectations on extent of improvements are not high.

In general, apart from adoption of BREFs, the Dutch system continues to work in the same way as before the IPPC. The system with two permits may reduce the potential for integrated solutions.

The implementation of IPPC Directive has caused little action in **Sweden**, due to already existing integrated system. Also, Sweden has not participated on the information exchange for the BREF in the Food, Drink and Milk Industry. For these reasons, the overall knowledge on the existence of BREF and the deadline to be met on the authorization of existing installations is low among the interviewed regulators and companies. If the government decides to issue an ordinance that obliges the operators to show that they are applying BAT on the aspects that did not have earlier equally strong role in the Swedish law, this may come as a surprise for the companies. Some improvements in the energy efficiency, avoidance of waste, prevention of accidents and chemical substitution can be expected connected to this. A lot depends on what kind of signals are given to the companies on what is actually required from them. Also the uncertainty on what is actually demanded on them may cause the companies to act. Overall, the Swedish choice to require the companies, not authorities to show that they are applying BAT appears a smart. Companies have to do major part of the work and they may improve their performance even if they regulator would not have eventually required it.

The Swedish Environment Protection Agency is hoping to see improvements in the longer term in the focus of the permits. It is hoped that the consideration of the aspects that got more emphasis in the new legislation will be improved. These hopes are more likely to come true if action will be taken to influence the regulators. The adoption of BREF in the Food, Drink and Milk Industry as a part of the permitting process is probably less likely in Sweden than in the other countries, because they have not participated to the information exchange. Thus more attention should be paid to the eventual introduction of the document for both regulators and dairies to use it.

The situation in **Denmark** is much the same as in Sweden and the Netherlands. Little resources have been addressed to the implementation, because the changes in the legislation are minor. However, the situation regarding the BREF is better than in Sweden, because Denmark participates in the information exchange. Environment Protection Agency hopes the BREFs to give a more integrated approach to permitting. The requirement to reconsider the permits every 8-10 years and the introduction of BREFs are the most significant changes. More frequent updating is likely to have a positive influence in the long term. Similar peak of permit updates before 2007 is not expected as in the other countries, because Denmark has not taken sufficient measures to ensure that the plants comply with the legislation before 2007.

Like the Netherlands, Denmark continues to apply the system with two permits, but those permits are issued by the same authority and often at the same time. Existing emission standards will be used in addition to the BREF and this may reduce slightly the potential for integrated solutions.

In **Finland** the dairy industry needs to apply for its first environmental permits and the separate regulatory bodies for water and other environmental issues were combined. This means significant changes in organizational level. Among the regulators there is both lack of knowledge on the sector and lack of experience and knowledge on dealing with all the environmental aspects simultaneously. Both the interviewed company representative and regulator expressed that the situation represents a great challenge to the regulators. Due to the lack of competence at this point and the good impression the regulators have on the environmental performance of the dairy industry, major improvements are not expected on a large scale. Involvement of the regulators and companies in the national group for information exchange are likely to increase the adoption of BREF. Unfortunately both parties are disappointed to the document.

The expectations on the IPPC Directive's influence on the environmental performance of the dairy industry were highest in the UK. The implementation of the Directive acts as a driver for the adoption of accredited environmental management systems and supports the overall change that seems to be taking place in the way the companies see the environmental issues. It appears to have brought environmental issues higher in the agenda of the companies. **UK** is doing nationally what the BREF is lacking, setting benchmark figures on the performance of the industry. The continuous interaction with the companies for some years have made it possible for them to prepare for the changes that are expected. They are building the organizational capacity to improve their environmental performance and collect the information that is required to apply for the permit. Required improvement programs, combined to frequent update of the permits are likely to support the continuous improvement of the industry.

Like the Finnish regulators, the British regulators do not have previous knowledge on the dairy sector. The interaction of regulators in strategic permit groups is likely to decrease problems connected to lack of knowledge. The issuing of the first permits is expected to be more characterized by increasing awareness on environmental issues and increase of knowledge in both parties, but some improvements will be needed already now. The improvement programs that are part of the permits and frequent updating of the permits are likely to drive companies towards improvements.

9. Eco-efficiency in the Permits

To find out what kind of permit conditions could be set for dairies a few permits that have been issued to dairy plants after transposition of the IPPC Directive, were studied from each country. The number of permits issued after the transposition is two in both Finland and the UK. Corresponding figures were not available in the other countries. In addition to the permits of dairy plants, literature and interviews gave information on permit conditions that could be expected. The focus of this chapter is on permit conditions related to energy, water and raw material efficiency and chemical use and substitution.

9.1 Energy Efficiency

9.1.1 Environmental Permits

The regulation of energy efficiency is new to Finland, Sweden and the UK and it is considered a problematic area. Assessments of energy efficiency require high competence and authorities often lack it on this issue. Few permits of any type of industry have so far considered energy efficiency. According to a study on energy efficiency in environmental permits, majority of consulted European authorities consider limit values on energy efficiency inappropriate. However, Finland, Sweden, the Netherlands and the UK expressed, that they could set binding permit conditions on energy efficiency. (Finnish Environment Institute, 2002)

Instead of using binding permit conditions on energy efficiency, the issue can be taken into account in other ways in the permitting procedures. In Finland the applicant must present in the permit application a plan to increase energy efficiency. Also in UK, energy efficiency implementation plan must be attached to the permit. (Finnish Environment Institute, 2002) Dutch authorities require energy plans with energy consumption above specific amount (Kerkhof, personal interview, July 10, 2003). There are examples on Finnish, Swedish and Dutch authorities requiring the operators to pursue investigations on how to improve energy efficiency and make plans on how they are going to do it²⁸ (Teekens, telephone interview, June 26, 2003)(Finnish Environment Institute, 2002). Swedish authorities have also obliged companies to buy more energy efficient equipment, find environmentally sound fuel substitutes and even set a target figure for reduction of energy use²⁹ (Finnish Environment Institute, 2002).

9.1.2 Other Policy Instruments

Several countries used other policy instruments to influence industry's energy efficiency. All the studied countries have adopted energy related taxes. British dairies are committed to increase their energy efficiency within the Climate Change Levy, all the Dutch dairies have joined covenant on energy and the Finnish dairy company that controls majority of the milk supply has also joined voluntary agreement, Energy Conservation Programme. In Denmark, voluntary energy saving agreement covers production of cheese and milk, but not the whole dairy sector. British and Finnish authorities saw that these policy instruments decrease the

²⁸ These permits were not issued to dairy plants or no information was available on the type of plant.

²⁹ These permits were not issued to dairy plants or no information was available on the type of plant.

need to influence the energy efficiency through permits (Maleham, personal interview, June 29, 2003, Enckell, personal interview, July 18, 2003).

The EU took very recently a decision to pursue a greenhouse gas emission allowance trading. The directive is likely to be adopted in October 2003 and come into force January 2005. Before the greenhouse gas emission allowance trading directive comes into force, energy production at a dairy plant is addressed within the environmental permit. Later on, boilers with capacity larger than 20MWh will not be included in the environmental permit. They fall within the scope of the emission trading directive (Gislev, personal interview, July 9, 2003) However, boilers with larger capacity than 20 MWh are not likely to be common in dairy industry (Nilsson R., personal interview, June 23, 2003).

9.2 Eco-efficiency in Environmental Permits of Dairy Industry

A few permits are studied in this thesis and as the BREF is still in a draft state, minority of regulators who issued the investigated permits used it. Thus the investigation of actual permits is supported by authorities' opinions and priorities considering dairy industry's permits in this section. The investigation of the permits follows in the next section.

9.2.1 Energy

The authorities who were interviewed for this study did not mention energy among the most important issues to be addressed in the permits of the dairy industry. Swedish and Finnish regulators who had issued permits for dairy industry stated that it is highly unlikely to address energy efficiency of dairy industry through binding limit values (Edberg, personal interview, June 11, 2003, Lövdahl, telephone interview, August 25, 2003). A Danish regulator mentioned having set a permit condition that obliges a dairy to use gas as a fuel (Joost, September 3, 2003). In general, investigations on how to increase energy efficiency were seen as relevant permit conditions for dairy industry, but their use was not common.

9.2.2 Water

The regulation of water efficiency was associated with health issues. A Finnish regulator was reluctant to interfere with water use, because cleaning is crucial for food safety reasons (Lövdahl, telephone interview, August 25, 2003) In Finland, water use is regulated by agreements between the company and water provider (Enckell, personal interview, July 18, 2003, Lövdahl, telephone interview, August 25, 2003). Unlike Finnish authorities, the British authorities plan to influence water efficiency of dairy industry through the environmental permits. British authorities mentioned for example optimisation of Cleaning In Place (CIP) systems as an important issue.

Like energy efficiency also water efficiency is addressed with other means than binding limit values. At least the UK and the Netherlands require plans to improve water efficiency as attachments to the permit application (in the Netherlands, the plan is needed if water use exceeds certain limit) (Kerkhof, personal interview, July 10, 2003, Maleham, personal interview, June 29, 2003). Requirements to investigate means to reduce water efficiency are also possible.

9.2.3 Wastewater and Raw Materials

In Finland and the UK, where environmental permits are new to dairy industry, the authorities wished mainly to influence raw material efficiency and wastewater (Enckell, personal interview, July 18, 2003, Lövdahl, telephone interview, August 25, 2003, Maleham, personal interview, June 29, 2003) Wastewater was also priority for the Swedish and Danish authorities (Edberg, personal interview, June 11, 2003, Joost, September 3, 2003). In addition to regular discharges of wastewater, the British authorities were also concerned about accidents that have led to the discharge of waters with high BOD to recipients. (Maleham, personal interview, June 29, 2003)

Interviewees from both dairies and regulatory bodies mentioned the conflict between environmental considerations and the interests of the operators of municipal wastewater treatments plants. Treatment plants are often dependant on the wastewater from the dairies both regarding their income and fluent operation of the wastewater treatment. In some cases, the treatment plant operators do not encourage the dairies to decrease water emissions.

9.2.4 Chemicals

Especially Finnish and Swedish regulators expressed that permit conditions could be set on chemical substitution. Otherwise the regulators were mainly concerned with the storing and safe use of chemicals.

9.2.5 Prescriptive versus Target Based Permit Conditions

As mentioned before, the IPPC Directive emphasizes the importance of setting the permit conditions in a form of emission limit values rather than requiring an investment to specific equipment. Leaving freedom to the companies on how to reduce pollution is believed to encourage innovation and learning and lead to better consideration of cross media effects. Finland and the UK emphasized the importance of this approach and they expressed that this is a general principle used in permitting. Dutch dairy processing companies had experienced that the form of permit conditions in the Netherlands depend on the regulator. The regulators have their personal ways of working and some of them rely on emission limit values while others give permit conditions requiring an investment to specific equipment. In general the Dutch dairy companies saw, that there are too large differences between the permit conditions of their individual installations.

9.3 Investigated Dairy Plant Permits

The investigated permits are listed in Appendix I and Appendixes V and VI provide further details on them. It should be noted that the studied British permits had been issued to new installations while the other installations were existing installations. The Dutch permitting system gives a possibility to issue so called “framework permits” to companies who are advanced in environmental issues. This type of permit has less focus on exact measures to be taken and the company is given more freedom to choose what issues and how they wish to improve (van ‘t Hof, telephone interview, July 10, 2003). Because of this the information in studied Dutch permits was rather vague.

It should be noted that some of issues that are missing from the permits are already within the scope of other legislation or another agreement. Missing permit conditions may indicate, that the issue is dealt with in another way. For example, if the permit does not require the

company to monitor its chemical use, this may still be required in other legislation and the company is forced to do it. Also, if there are not permit conditions on the emission concentrations in the wastewater, this is may be set in an agreement between the dairy and the treatment plant.

9.3.1 Type of Permit Conditions

The **energy** related permit conditions were focused on monitoring of energy use and emission limit values for air emissions (See Appendix V for the type of permit conditions). The Netherlands relied on the measures that the companies have committed themselves to within the covenant. The studied British permits were more advanced regarding energy than the others. They required the companies to carry out an energy efficiency plan and one of the permits contained an obligation to investigate the costs and benefits of combined heat and power. Another British permit set a limit value for the annual amount of carbon dioxide emissions³⁰. It was the only permit condition that clearly restricts the energy use if the limit value is stringent enough. The limit value addresses only the consumption of energy that is produced at the site and electricity consumption is not affected. The British and Swedish way of setting the air emission limit values per MJ fuel implies that the regulators wish to influence the type of fuel rather than energy efficiency.

None of the studied permits limited **water** use directly. However, UK and Sweden had set limitations on the amount of wastewater - Finland only required the monitoring of amount of wastewater. If the limit values are stringent enough, the limit value on amount of wastewater forces the companies to look for opportunities to reduce water use. One of the Swedish permits required the company to investigate possibilities to reduce the amount of wastewater.

All the countries had set emission limit values on BOD, COD or suspended solids. All these conditions restrict the amount of **raw material** in wastewater. British permits required monitoring or raw material efficiency. Finnish and Swedish permits forbade the operators to get rid of nonconforming products by discharging it to the sewage system. Finnish permits required also plans on utilization of product waste or reduction on the amount of landfill waste.

The permit conditions on **chemicals** were focused on storage of chemicals and monitoring of their use. One Finnish permit required the operator to investigate opportunities to reduce ammonium use.

Apart from one monitoring request, both the limit values and monitoring requirements were set in units that are not focused on eco-efficiency. Eco-efficiency is calculated as output per environmental pressures. In practice this means measuring environmental impacts for example per amount of production. By contrast, the studied permits were focused on environmental impacts per day or year and even concentrations were used. The permits are valid for a specific amount of production and in practice the amount of production is often lower than this upper limit in the permit. Thus limit values per time become easily less stringent.

³⁰ It is possible to reduce CO₂ emissions to certain extent with the choice of fuel. Pollution control technologies are not used to reduce them.

Also, the monitoring requirements considered the consumption at the whole plant. This does not provide an adequate basis for control over the processes and consumption of resources (Nilsson R., personal interview, June 23, 2003). To reveal the points of large consumption and possibly also the points where consumption could be decreased the monitoring should be more specific. Consumption of resources takes place in processes that are intended for the production of specific products and at best the monitoring follows these processes and reveals consumption related to the products.

9.3.2 Stringency of the Limit Values

To find the level of challenge that is connected to the limit values in the investigated permits, some comparisons were made (See Appendix VI for the limit values). Limit values for quantity of wastewater, BOD and COD were compared. The limit values in permits were compared with figures from the following sources:

Nordic BAT report³¹

Comparison with the lowest figures for water consumption and water emissions (See Appendix IV, Tables IV-2 and IV-2)

Environmental review project at a Swedish dairy. One of the aims of this project was to find opportunities to resource savings.

Comparison with

- a) *the dairy's permit conditions. The permit was old and the conditions were not demanding*
- b) *water consumption and emissions figures that can be reached if revealed opportunities are used*

There is a substantial difference (even more than 100%) between the permit conditions and the possible emission and consumption levels).

British permit application form for the dairies

Comparison with benchmark figures³² (See Appendix III)

The comparisons revealed that BOD and COD limit values in the British permits were stringent. They were on the same level as the emissions in the Nordic dairies with the best environmental performance and/or similar to the challenging benchmark figures in the British permit application form. Also, the limit value for the quantity of wastewater was stringent in the other British permit. Apart from that, the limit values cannot be considered challenging. They were close to the permit conditions in the old permit of a Swedish dairy. The environmental review of this dairy had proved these permit conditions to be very lax.

³¹ See (Korsström, Lampi, 2001).

³² The application form was at draft state. It is possible that the figures in final application form are different.

9.4 Concluding Remarks on the Permit Conditions as a Driver for Eco-efficiency

Binding conditions on **energy** efficiency in the permits of dairy industry are not likely to be seen in the next years, because the regulators do not have the required know-how or willingness to address energy efficiency this way. Energy plans, investigations on how to improve energy efficiency and monitoring are seen as more appropriate means to increase energy efficiency within the environmental permits. Other policy instruments that promote on energy savings reduce the need to address energy efficiency in the permits and the interviewed authorities did not consider energy efficiency to be among the most important aspects that should be addressed in the permits of dairy industry. Based on the regulator's preferences and the studied permits, regulators are not likely to put much effort on influencing dairy industry's energy efficiency.

Water efficiency was addressed in the studied permits indirectly through limit values for quantity of wastewater. However, with the exception of one British permit, these values are not likely to act as a driver for improvements. Not surprisingly, the UK was the only country that expressed clearly that increasing water efficiency in dairies is an important goal. Unless, the regulators embrace a more demanding attitude, the environmental permits will not act as a driver for water efficiency in the Nordic countries and the Netherlands.

Raw material efficiency and related **wastewater** issues were generally seen as the most important aspect that the authorities wanted to influence in dairy industry. Despite of that the BOD and COD emission limit values in the Danish, Finnish and Swedish permits were not stringent. The use of softer measures than binding limit values to influence raw material efficiency may however lead to improvements.

Finnish and Swedish regulators were interested in addressing **chemical** substitution within the permits of dairy industry, but no such conditions were found in the studied permits. Whether there was a need for substitution, was not investigated. This limits the conclusions regarding to chemical substitution.

Among the investigated permits, the Danish ones appeared weakest. They had very few limit values or any other type of permit conditions. Dutch permits relied heavily on what the companies have committed themselves to within the covenants and the British and Swedish permits had a few more advanced, less end-of-pipe focused conditions.

Overall, the permit conditions were focused at the end-of-pipe and issued limit values were not challenging. The monitoring and limit values were not set in such way that it would draw attention to environmental impacts per production. Unless the adoption of the BREF when it becomes ready, or something else within the implementation process changes the course of action, the permits might not act as a significant driver for eco-efficiency apart from the UK. In addition to the adoption of BREF, the use of softer measures, for example plans and investigation requirements, is an uncertainty factor. The extent of their influence to eco-efficiency is not clear.

Attention should be paid to the fact that a very limited amount of permits was investigated in this study. This influences the validity of conclusions. However, the guidance for permitting is provided on national level, the regulators are in touch with each other and in some countries external bodies investigate the permits to ensure consistency. Consequently, there is

no reason to believe that an investigation of larger number of permits would have given a completely different picture of the situation.

10. Analysis

This Chapter provides the final answers to the research questions that were guiding the study and leads way for the conclusions in the next Chapter. Preliminary answers for the two first research questions were given already in Chapter 4, where models on characteristics of permitting process that acts as a driver for eco-efficiency, and factors that influence the permitting process were presented. This Chapter presents the final, improved Models for studying IPPC Directive from the point of view of eco-efficiency. During the course of the study, the hotspots of the implementation and most important characteristics of the permitting process regarding eco-efficiency have been identified and they are discussed. Finally, the IPPC Directive and its implementation in British, Danish, Dutch, Finnish and Swedish dairy industry is analysed from the point of view of eco-efficiency.

10.1 Ideal Permitting Process within the IPPC

Based on the knowledge gained during the study, an ideal permitting process within IPPC is described here. The description shows how the permitting should progress especially in the case of integral, flexible legislation like IPPC. The ideal process provides basis for understanding, why certain factors are the “hotspots” in the implementation and permitting process (Sections 10.2 and 10.3).

10.1.1 Beginning of the Permitting Process

In the ideal permitting process, both the regulator and the company expect right from the beginning that improvements will be required unless the company is a pioneer in the environmental field. The signals from the authorities and ambitious level of the BREF have prepared the company for this. BAT levels in the BREF provide a basis for the discussions and create some “rules for the game”. Transparency in the permitting process is the aim of both parties. Business benefits are kept in mind to find solutions that are favourable for the company, but the environmental impacts are the main concern for the regulator.

The company meets a highly competent regulator, who is able to assess critically the information provided by the company and see where opportunities could be available to enhance eco-efficiency. The regulator requires the company to find out more about the possible opportunities. Based on information that the company has found, or for example BREF, the regulator and operator discuss the possible solutions for solving the problems and meeting targets. The discussions are focused on process and it is kept in mind that good working practices and optimal operation can often be the solutions.

10.1.2 Content of the Permit

Flexibility is allowed to the company to deviate from the BAT levels in the BREF, as long as it does not decrease the level of the environmental performance as a whole. The company is provided enough time to develop its solutions, but not so much that it would slow down the progress. Limit values can be set both per amount of production and as absolute limits. Absolute limits guarantee that emissions and consumption do not increase above certain limit and relative values focus the attention on the process and prevent the company from wasting resources if the amount of production is small.

Where emission limit values cannot be set, the regulator obliges the company to monitor the environmental performance in such way, that it supports the work of the company on environmental issues and may reveal opportunities. If relative values cannot be set as limits among the permit conditions, they can at least be monitored. Permit conditions that force the company to invest on equipment are in general avoided. Improvement programs are required especially from companies whose eco-efficiency is low.

10.1.3 Follow-up

After the permit has been issued, the regulator follows the performance of the company regularly and possible problems are discussed. The permit is updated in regular intervals to keep the permit conditions on such level, that the company must strive for continuous improvement.

10.2 Model 1 – Improvements and Hotspots

Model 1 provided a useful framework for studying the IPPC Directive as a driver for eco-efficiency and thus only small improvements were made. Signals on required improvements in the near future and long term have been combined and consistent requirements added to the model. Consistency of requirements is partly contradictory to flexibility, but it is important to include both of them in the model, because balance between them is essential. Consistency helps the companies to take action, because there are clear signals on what is required. It is also the basis for the realisation of first mover advantages.

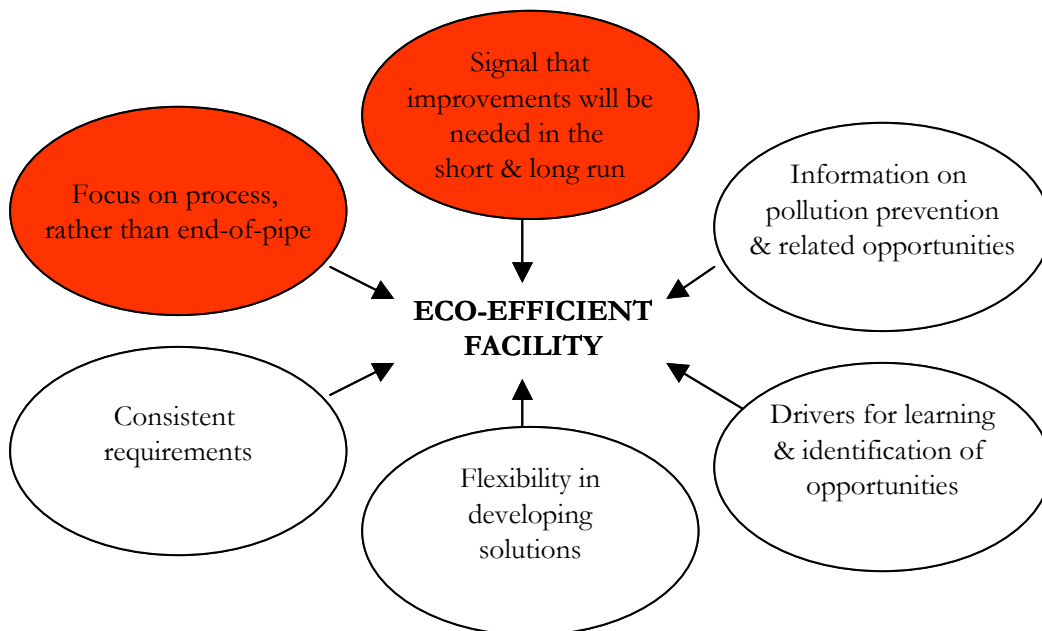


Figure 10-1 Final Model 1 – Characteristics the permitting process should have in order to drive improvements in eco-efficiency

Based on the knowledge gained in carrying out this study, two of the characteristics of the permitting process that drives eco-efficiency are more important than the others and they also turned out to be problematic areas in the practice. The companies and regulators must receive **signals that improvements will be required** and that they are possible. Without

these signals there is no drive for any kind of change. The second issue is that the permitting process has to **focus on the manufacturing process**. Otherwise the permitting does not act as a driver for resource use efficiency. If only emissions are discussed in the permitting process, and the permit conditions are set solely on emissions, the whole process directs the company's attention towards emissions. Understanding on the sources and causes of emissions is not increased in the process. Also identification of opportunities to save energy or water does not take place within the permitting. Consequently, it becomes less likely that the company would try to solve the problems with process-integrated measures.

10.3 Model 2 – Improvements and Hotspots

A few things were added to Model 2, to make it more complete. European industry's receptivity for the environmental issues in general and more specifically for regulation and IPPC Directive was added, because its influence to the BREF is crucial. The BREF cannot be an ambitious, useful document without the cooperation of the industry and their willingness to change. "Conclusions on the importance of the IPPC on national level" were added, because that explains the implementation process in the Member States. The conclusions on the importance of the Directive lead to a decision on the amount of resources directed to the implementation. This is a political decision influenced by many factors.

In addition to the impressions that had been gathered during the course of the study, the hotspots of the Model 1 provided guidance in finding the most important factors influencing the permitting process. The factors that influence especially the hotspots of Model 1 were given priority.

Design of the IPPC Directive and the also **former regulation** are obvious hotspots of the Model 2, because in some respects, the studied Member States made only the changes that they were absolutely forced to do and otherwise continued to follow their old procedures. For example, the Netherlands continues to follow the popular covenant based approach that supports the permitting. It influences IPPC as a driver for eco-efficiency, because the permits conditions are in many cases based on plans made within the covenants. The **implementation in the regulatory body** is a hotspot, because if it fails change is not likely to take place. Although the design of IPPC supports the process focus well, many regulators are still focused on end-of-pipe aspects. Input is needed to change their procedures.

The description of an ideal permitting process above reveals how crucial **regulator's competence** and **resources** are. The generous amount of freedom the regulators are guaranteed by the design of the directive leads to positive outcome only if it is used wisely. Adequate resources can help the regulator to increase their competence by exchanging information with colleagues and gaining it from other sources. High competence and process related knowledge is required because without that the regulators may limit the permitting process to the end-of-pipe. For example, lack of experience in energy issues is one of the reasons for not addressing energy efficiency in the permits.

The **BREF** in the Food, Drink and Milk Industry provides information on BATs and implies what aspects should be the focus of permitting process. The BREF was not chosen to be hotspot not because of what it is today, but also because of the potential the approach has. A BREF can be a lot more than a source of information and collection of best available techniques, if the information exchange process is a successful one. It has a potential to harmonize the requirements to certain extent and give clear signals on ambitious targets that

are not detailed in the Directive. In the case of the BREF in the Food, Drink and Milk Industry, the industry’s receptivity to IPPC played a major role regarding the usefulness of the document. Thus the **receptivity of the European industry sector** is fourth critical area in the permitting process.

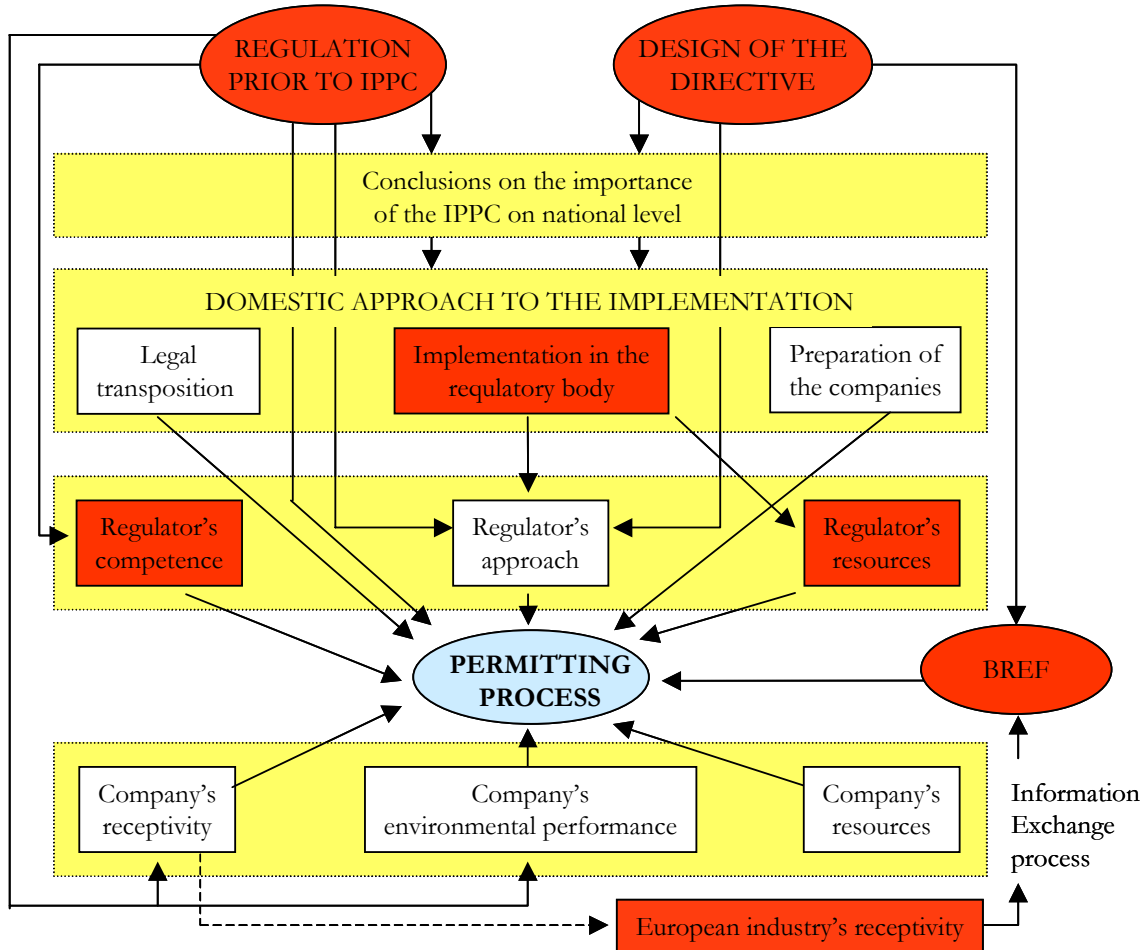


Figure 10-2 Final Model 2 - Factors influencing the permitting process in the case of the IPPC Directive

10.4 Analysis on the IPPC as a Driver for Eco-efficiency in Dairy Industry

10.4.1 Focus on Process

The design of the IPPC Directive has a sound focus on the process, and it encourages clearly process optimisation and adoption of good housekeeping practices and clean technologies. The flexibility embedded in the Directive creates favourable conditions for pollution prevention. The BREF does provide useful information on techniques to improve water and energy efficiency and minimise product losses, and more space is given in the document for prevention at source than end-of-pipe issues. But the sections specific for dairy industry are short and there are no BAT levels on efficient use of resources. The British decision to set dairy specific benchmark figures provides on the national level support that the BREF fails to give and it is likely to increase the focus on process in the UK.

Eventually it is of course the regulators, who determine the focus of the permitting process. The lack of personnel within the regulatory bodies decreases the possibilities of the regulators to familiarize themselves with the process and its operation in Denmark, the Netherlands, Sweden and the UK³³. Unless the implementation of the IPPC Directive is improved in Denmark, Sweden and the Netherlands, IPPC is not likely to change the focus of the dairy industry's permits from what it was earlier. The investigated environmental permits that have been issued for the British, Danish, Dutch, Finnish and Swedish dairy industry after the transposition of the Directive do not indicate the focus on the permitting process to be in the manufacturing process. There are few permit conditions that have any implications on resource efficiency. The softer parts of the permitting process, for example requirements to explain whether the company has adopted BAT, and obligations to investigate whether there are opportunities for improvements have more emphasis on resource efficiency. However, the BREF was not used when most of these permits were issued and if it is adopted successfully as a part of the permitting process, it may draw increasing attention to the process.

10.4.2 Signal that Improvements Will Be Needed in the Short and Long Run

According to the definition of BAT, the dairies may be obliged to achieve a level of environmental performance that can be reached with commonly available technologies that are affordable for majority of European companies. In practice, the IPPC Directive relies heavily on the BREFs on the level of requirements. Eventually the BREF is expected to set the level of ambition. The BREF in the Food, Drink and Milk Industry does not do this clearly, because the BAT levels on eco-efficiency are missing. For the studied dairy industries, the level of technologies presented in the BREF is not such that it would imply substantial changes in the wide majority of installations. Installations with lower than average performance compared to other plants in their country, should be prepared for changes.

Apart from the UK, the authorities have not given clear messages to the companies that they have to improve their performance and the companies do not see a need for substantial changes. In Finland the regulators have required some improvements but they have mostly been relate to end-of-pipe issues. For example Sweden has not yet taken a position regarding the implementation of the IPPC in the food and drink industry, partly due to the fact that they have not participated to the BREF. They still have an opportunity to choose whether they approach the industry with a specific message. The level of ambition regarding the requirements on the dairy industry depends partly on how up to date the BREF is. The decision on when the BREF will be updated is yet to be taken, but it appears likely that more than 5 years will pass before this is done.

10.4.3 Consistent Requirements

Due to the design of the Directive, IPPC does not have a potential to harmonize the permit conditions across Europe and thus create a level playing field. If provided with adequate BAT levels, the BREF could have improved the situation significantly. Even now, the BREF is likely to add the consistency in the requirements, but the BREF based approach has potential for more. On national level, the permit conditions are likely to be most similar for

³³ No information was available on personnel resources in Finland.

the British dairy industry, due to the determined benchmark figures and indicative BATs in the application form, and increased communication between the regulators in the strategic permitting groups. Denmark uses emission standards on air emissions but their influence on energy efficiency is not straightforward and it is unlikely that they would affect significantly the consistency of requirements on eco-efficiency. The permits are not easily available in the Netherlands, Sweden and Denmark and this may limit the consistency in requirements, because the regulators cannot easily access permits issued in other parts of the country.

10.4.4 Flexibility in Developing Solutions

Within the IPPC, a decision was taken to promote flexibility that creates favourable conditions for pollution prevention instead of pollution control technologies. The extent of flexibility the Directive provides for taking into account local conditions, technology applied in the installation and geographical location is sufficient and perhaps even excessive. The IPPC guarantees a lot of flexibility for the Member States and little consistency. Whether the flexibility is used to guarantee a high level of protection for the environment, depends on the regulator. Case specific decision-making tends to improve the outcome of regulation if the regulator is competent and has sufficient resources available. The lack of resources within the regulatory bodies in the studied countries implies, that the flexibility may not lead to optimal outcome.

10.4.5 Information on Pollution Prevention and Opportunities

The BREF provides the companies with information pollution prevention and on opportunities to increase eco-efficiency, but the information is difficult to find and the dairy specific, detailed information that some companies are missing, is not available. On the other hand, part of the information the companies are missing is so specific, that it should not be provided in a BREF. Competent regulator can also be a source of information on opportunities, but taking into account the lack of resources within the regulatory bodies, this is not likely to be very common. The BREF process has given an opportunity for learning for many regulators.

10.4.6 Drivers for Learning and Identification of Opportunities

Whether the permitting process encourages the companies to find information about opportunities and seek them in their own process, depends largely on national procedures on the information required in the permit application and the regulator who issues the permit. Permit conditions that require the dairies to investigate specific issues provide an opportunity for learning. Obligations to investigate a specific issue are used in the permitting of dairy industries in all studied countries. Early contacts with the dairies and their preparation to requirements have provided the Finnish and British companies with time to learn.

11. Conclusions and Recommendations

11.1 IPPC as a Driver for Studied Dairy Industries' Eco-efficiency

11.1.1 Common Impressions

Dairy industry's most important environmental aspects, energy, water and raw material use and related wastewater issues are all directly connected to the economic performance. Thus improved environmental performance has a possibility to yield savings and increase eco-efficiency. The estimates on the potential for improved eco-efficiency within the dairy industry vary, but there are implications that the potential is more substantial than the environmental authorities and dairy companies believe. Pollution prevention focused regulation like IPPC could encourage the companies to find the opportunities.

Flexible, integrated type of environmental permitting that IPPC represents, requires adequate resources in the implementation to lead to optimal outcome. Lack of resources within the regulatory bodies and a failure to set clear, ambitious targets on the European level do not indicate the best possible result. Regulation of eco-efficiency is more favourable than mere control over emissions for both the protection of the environment and economic performance of the companies. However, it is inherently more difficult than control over emissions, because regulators with higher competence are needed. It seems that so far the IPPC has not managed to move the focus of studied dairy industries' permitting towards resource efficiency. Some changes are however, yet to take place in the regulators daily work and surprises are still possible. Many regulators see binding limit values to restrict the use of resources as inappropriate, but there are not equally obvious reasons for example to the absence of permit conditions on monitoring of eco-efficiency.

There is likely to be an increase in improvements in the environmental performance and eco-efficiency, when the Member States ensure that the dairy industry meets the requirements before the deadline in 2007. Dairy plants that have average environmental performance in the country where they are located are not likely to be heavily influenced but worst performers should be prepared for changes. If the implementation is not improved, significant improvements in the eco-efficiency of studied dairy industries are not likely to be seen in the near future. There are of course differences between countries and the British dairy industry has a potential to be an exception among the studied industries.

11.1.2 British, Danish, Dutch, Finnish and Swedish Dairy Industry

The potential for increasing eco-efficiency as a consequence of the implementation of the IPPC Directive is highest in the **British** dairy industry. The reasons lie both in stronger implementation and the previously missing regulation. The improvements are likely to be divided between several years, because the aim of first permitting is mainly to set the environmental issues higher in the agenda of the companies and prepare both regulators and companies for later improvements. Improvements are already being made and are likely to continue from the first permitting in 2004-2005 to the second round of permitting in 2008-2010. The peak of improvements may come as late as after the second round of permitting. Improvements are most likely to be seen in water and raw material efficiency because these are considered the priorities by the Environment Agency.

In the **Netherlands**, the likelihood of the IPPC to drive companies to improve their eco-efficiency is lowest. Eco-efficiency related issues will continue to be addressed mainly within the covenants. The review of the permits that have been issued before transposition of the IPPC is unlikely to lead to significant changes in eco-efficiency. Both the role of the permits as a safety net that supports the covenants and the fact that IPPC did not add any new environmental aspects to permitting are the reasons behind this. The timing of the review is yet to be decided but is unlikely that the reviews could start before 2005.

In **Sweden**, a potential for improvements in eco-efficiency lie in the review of adoption of BAT. Uncertainty on what is the actual level of requirements and appropriate signals from authorities may drive the companies to act, because the initiative is on them. The improvements in the eco-efficiency may start as soon as the companies have been given information on their responsibilities. Improvements can be expected on areas that used to have less significant status in the legislation: energy efficiency, waste avoidance, risks and chemical substitution. Out of the studied countries, Sweden appears to be the only one where IPPC is likely to influence energy efficiency.

In **Finland**, equally significant improvements in eco-efficiency cannot be expected as in the UK, although the Finnish dairies will also be issued their first environmental permits. Due to positive impression on the industry's environmental performance, the motivation of the regulators to drive improvements is lower than in the UK. The issued permits concentrate on setting permit conditions that influence the end-of-pipe although the authorities wish to increase raw material efficiency. The possible improvements in eco-efficiency are mostly likely to be related to raw materials, because this aspect is high on the regulators' agenda.

The more frequent updating of the permits is likely to improve the role of the regulation as a driver for eco-efficiency in the long term in **Denmark**. Since the other changes made in the legislation are minor and the implementation has been vague, the type of permit conditions that are used is not likely to change. They continue to be focused on issues that can be solved at the end of pipe. A peak in the improvements in environmental performance of dairy industry is unlikely, because Denmark is not planning to take adequate measures to ensure that the dairy industry meets the requirements by October 2007.

11.1.3 Validity of the Conclusions

In Denmark, the Netherlands and Sweden, the adoption of BREF as a part of the permitting process is perhaps the most significant IPPC related change in the daily work of the regulators. As the document has not yet been finished, in a way the first permits that have been issued after the transposition cannot be considered "real IPPC permits". In Finland and the UK the situation is different, because the Finnish regulators have taken the draft BREF into consideration and the UK has its own guidelines. The implementation of the IPPC is in a more advanced state in Finland and the UK also in other respects. Due to these factors, the conclusions of this study are more uncertain regarding Denmark, the Netherlands and Sweden than Finland and the UK.

As mentioned within the limitations of the study (Section 2.5), the interviewees included mainly people who participate to the implementation of the IPPC Directive in EU, national or company level, not local regulators and dairy plant employees, who are involved in the permitting of individual dairy plants. This obviously limits the reliability of the study as well as the shortcomings of an interview as a research method (See Section 2.5). The interviewees of this study came from several European countries and were part of different type of

organizations. The interpretation of the interviews provided a great challenge in this sense. If another interviewer had conducted the interviews, the outcome of the study could have been slightly different. For example, an interviewer with more experience on topics relevant for this study or different cultural background may have got more information from the companies and regulators in some of the studied countries.

The study shows, that the IPPC Directive has been implemented in very different ways in the Member States and the conditions prior to the implementation also differ substantially. The Directive may have an entirely different role as a driver for eco-efficiency in other European countries and industries. Consequently, care must be taken if the results of this study are used while assessing the role of the IPPC in other countries and industries.

11.2 Recommendations on the Implementation of the IPPC Directive

The implementation of the IPPC Directive has started some years ago and permits have already been issued for dairy companies. However, the Member States can still improve the implementation in many ways to make the IPPC a stronger driver for eco-efficiency. If improvements are not possible before 2007, they can be carried out before the second IPPC permits will be issued.

11.2.1 Facilitating Eco-efficiency Related Permitting

The British, Danish, Dutch and Swedish regulatory bodies all suffer from lack of personnel³⁴. Increase of personnel resources in the implementation is an obvious, but not easily available way to improve the outcome of the Directive. Most of the measures to improve implementation require at least some increase in resources. Following measures could be used in most of the studied countries to improve the permitting on local level:

- Add personnel resources
- At least partial translation of the BREF in the Food, Drink and Milk Industry
- Improved availability of the permits and related documents
- Set eco-efficiency related benchmarks and targets on national level
- Add competence on energy

Limited English skills are likely to act as a barrier for the use of BREF. Another information related barrier is the difficult access to the permits. For example in Sweden, the permits can be accessed only by contacting individual regulators. Consistent permit conditions are difficult to achieve in these conditions and opportunities for learning from colleagues are lower.

Discussions with industry to set dairy specific benchmarks on resource use would bring the regulators and industry together to discuss eco-efficiency and provide targets, if the BREF

³⁴ The research carried out by (Bohne, 2001) did not cover Finland.

fails to set them also in the future. These discussions and resulted benchmarks may be more useful in Sweden and the Netherlands than in Finland and Denmark, where one company controls wide majority of the dairy production. Limited number of regulated dairies may also be a barrier for benchmarking in some countries.

Regulatory bodies tend to lack competence on energy efficiency. To be able to find appropriate procedures and approach and support the local regulators, the regulatory bodies could consider for example hiring experts from this field or networking increasingly with other institutions that have more competence on energy.

11.2.2 Content of the Dairy Industry's Permits

The role of eco-efficiency in the permits could be improved even without significant changes in the competence of the regulators. If binding limit values appear inappropriate, the use of softer measures as permit conditions can be increased:

- Increasing number of investigations on energy, water and raw material efficiency
- Monitoring of eco-efficiency on level that is detailed enough
- Increasing use of improvement programs

Improvement programs and investigations on opportunities force the industry to plan their activities and increase knowledge. Monitoring supports management. All three provide the regulator with incentives to set more demanding permit conditions later on. Increasing use of this type of permit conditions may require increase in resources used for the enforcement of the IPPC Directive. Follow-up and frequent contacts are necessary to ensure that softer measures yield results. Research on the influence of the softer instruments to the eco-efficiency would be most interesting and provide information on the best ways to use them. In Sweden the requirements to investigate opportunities to improve performance have not always led to an optimal result. They cause a delay in the enforcement of permit conditions and due to lack of resources, there has not always been adequate control to ensure that the investigations lead to action (Gustafsson, personal interview, September 9, 2003).

11.2.3 Country Specific Recommendations

Some of the suggested improvements are country specific, because the studied Member States have neglected certain aspects of implementation or could improve their implementation with specific measures.

- Finland: Increase the networking of regulators and invest resources to improve the knowledge on the dairy sector
- Netherlands: Consider the possibility of companies taking initiative in ensuring that BAT has been adopted
- Sweden and Denmark: Choose an appropriate way to introduce the BREF to the regulators

- Sweden: Give clear signals to companies and regulators that ambitious level of performance is expected when the companies have to prove that they have adopted BAT

Limited knowledge on the dairy sector and integrated permitting create problems in Finland. To improve the situation, increasing contacts between regulators and possibilities for the regulators to increase their sector specific knowledge are recommended. The Netherlands is recommended to consider similar approach in the review of permits as Sweden. The workload of the authorities could be decreased and the companies might end up taking action even if the regulators would not eventually have required it.

Swedish and Danish are not yet familiar with the BREFs. The way the documents are introduced to them has a potential to influence the acceptance of the BREF as part of permitting process. Guidance on the use of the document and exploration of the BREF with colleagues could prepare the regulators for the utilisation of the document. Sweden can still take action also in another matter. If the Swedish regulators and dairies are given signals that improvements in the aspects that have now stronger role in the legislation are expected, the review on adoption of BAT has more potential to bring about improvements in eco-efficiency.

11.3 Recommendations on the Information Exchange on BAT for Dairy Industry

11.3.1 Scope and Content of the BREF

The production of the BREF in the food, drink and milk processes is a very challenging task, because the covered industry is the largest one in Europe. The sector is not only large but also heterogeneous. The outcome implies that the challenge has been too big. For example pollution prevention guidelines are usually not provided for the whole food and drink industry but for specific subsectors, such as dairy industry. The opportunity for information exchange between subsectors is from the point of view of eco-efficiency, the only significant factor favoring the wide scope. Due to the few advantages of the current approach, the opportunity to provide several BREFs for food industry should be considered. Dairy industry is the second largest subsector within the food industry and it could be covered within its own BREF. Thus the first recommendation on the BREF is to:

- Provide dairy specific BREF

IMPEL is planning a research on the use of the BREFs. This study could provide information for the decision on whether to divide the BREF into smaller entities. Also, research on the usefulness of the information exchange between subsectors could be carried out. At the moment there is limited information on its extent and significance. If a decision was taken to produce a dairy specific BREF, the following issues are suggested to be included or taken into account:

- Include BAT levels on energy, water and raw material efficiency for the main products groups (e.g pasteurized milk, UHT milk, cultured products, cheese and butter)
- Provide indicative BAT on monitoring

- Address also production lines to be able to considered cross-media impacts from holistic perspective
- Focus on good housekeeping, operation and clean technologies

The dairy specific BREF would provide more details that the dairy companies are interested in and a document where relevant information is easier to find. Agreement on BAT levels would become more feasible within one sector. Benchmarks on the issues listed above are already in use in a consultancy (Nilsson R., personal interview, June 23). This shows that it is feasible to provide them. Dairy specific BREF could also address more specifically monitoring of eco-efficiency. Indicative BAT could be provided on monitoring. The document could deal with larger entities than unit processes and thus address considerations on cross-media issues. Finally, production of dairy specific BREF would include the active involvement of larger number of dairy companies and increase their opportunities for learning.

A recommendation is made also on the focus of the BREF, a lot of space is given for management in the Chapter on BATs (Chapter 5) in the current BREF in the Food, Drink and Milk Industry. The information on managements is available from many sources whereas the access to more specific and technical information is limited or the information is more difficult to find. The efforts of the TWG should be focused on the most important issues.

In addition to the scope of the BREF and removal of common management practices from the BREFs, a few other issues could be reconsidered on the European level:

- Require inclusion of appropriate BAT levels in the BREFs
- Frequent update of the BREF

The Guidelines on the content of the BREFs could be more demanding. For example the requirements on the inclusion of BAT levels could be strengthened. Also, if the BREFs are not updated every five years like was originally planned, they should be updated at least every 6-7 years. Less frequent update is likely to decrease the level of performance that is required from the industry.

11.3.2 Information Exchange Process

The current BREF in the Food, Drink and Milk Industry reflects not only the difficulties in covering the large sector but also the composition of the Technical Working Group. The participation of the industry in the process is both a strength and weakness. The industry is definitely needed because they have the expertise on the manufacturing processes, but at the same time, their motivation to produce an ambitious BREF is questionable. Information on BAT is useful for industry, but even proactive companies may not wish the information to be used in the regulatory processes, because they may prefer not to have outsiders setting limitations on their activities.

Food and drink industry dominated the TWG on food, drink and milk industry and NGOs and suppliers were not present. Food and drink industry supported the exclusion of the suppliers, because it is in the suppliers' interest to sell their equipment. However, the process is in every case influenced by different interests and having contradictory interests could make the outcome more balanced. The unequal participation in the TWG for BREF n the

food, drink and milk processes implies a need to control the composition of the group. Following suggestions are made to improve the composition of the TWG

- Guarantee balanced participation to the TWG: industry, authorities, NGOs, suppliers and other experts
- Involve companies who are pioneers in environmental issues

Companies who are pioneers in environmental issues are likely to have experience of the adoption of advanced BAT and thus the document would be more up to date. It is also in the interest of these companies to raise the general level of performance within the industry. Another way to influence the problems created by the participation of industry is to increase the transparency among the industry in longer term. European Pollutant Emission Register will hopefully contribute to this. It is important that the information in EPER is in such form that it is understandable for users. Inclusion of some eco-efficiency related parameters in EPER could be considered, but confidentiality could be a barrier for this. For example the food British industry is often very secretive about their processes and they have been found out to be unwilling to provide information (Leberman, personal interview, April 4, 2003). Easy, preferably electronic access to permits could also improve transparency. Following suggestion is thus made:

- Increase transparency on environmental issues

11.4 Recommendations for the Companies

The dairies have a key role in the environmental permitting and they have a chance to influence the focus of the permit. The earlier the company starts to prepare for the permitting, the better are the chances to influence it. As seen above, the regulators have a tendency to look at the end-of-pipe issues, but operators have a chance to shift the focus of the permitting process more towards eco-efficiency. The operator can bring to the permitting the expertise the regulators lack on the manufacturing process. If the regulator meets a company that is committed to improving environmental performance and eco-efficiency, he or she is more likely to listen to the company's wishes regarding permit conditions. That way permit conditions that support the other work that is done in the dairy to improve the environmental performance can be set, and the permitting process has a potential to yield savings to the company. The company can avoid wasting time and money on something that is only done to comply with the legislation and provides no additional value. In stead, the permitting can be used to find the existing opportunities for savings in resource use. Thus following recommendations are made for the dairy companies:

- Start preparing for the environmental permitting early
- Draw more attention to the manufacturing process in order to avoid requirements that have no added value for the company
- Try to influence the permitting process in such way that it supports other work that is done to improve environmental performance

11.5 Further Research

At this stage of the implementation, the influence of the IPPC Directive on dairy industry is still uncertain and different scenarios of the outcome can be presented. For example, despite the good start, the implementation in the UK may not lead to significant improvements if the regulators do not set challenging permit conditions. Or, the Sweden may improve the implementation of the IPPC and require the dairies to improve their eco-efficiency considerably in the review on adoption of BAT. The BREF is perhaps the most interesting starting point for speculations, because it has not been finalised. The adoption of the BREF as the permitting process could focus the regulators mind on the improvements in the manufacturing process and lead after all to shift in the focus of the permits. And if the BREF is improved substantially in the up-date of the document, the IPPC has potential to become an important driver for eco-efficiency in the studied industries.

Important progress in the implementation of the IPPC Directive in the dairy industry will be made when the finalised BREF is adopted as a part of the permitting. A study on the outcome of the IPPC Directive after the adoption of the BREF would provide a clearer picture on the IPPC Directive as a driver for eco-efficiency in the dairy industry. This study has focused on the measures the authorities have taken and are planning to take in the implementation. The next step would be to study the dairy companies' respond to these measures. Larger number of permits could be investigated, and questioning the companies on their respond to the permitting could support the investigation of the permits.

11.6 Discussion – Environmental Permitting as a Driver for Eco-efficiency in EU

There are doubts among researchers and policy makers on the appropriateness of the environmental permitting as a driver for eco-efficiency. The practical implementation of the IPPC Directive is far from ideal and the focus of the environmental permitting still appears to be at the end of pipe. If the IPPC Directive has not so far managed to move the focus of environmental permitting to process integrated measures in the studied industries and forcefully drive the adoption of eco-efficient practices, is it possible at all?

Although this thesis concludes that the IPPC is not likely to act as a driver for most of the studied countries, the situation may be different in other parts of the Europe. A majority of the studied countries are considered to have had environmental issues higher in the agenda than most EU Member States. Existing policies may have led to the limited amount of attention the IPPC has got in these countries. Consequently, this study does not prove, that the IPPC Directive does not act as a significant driver for eco-efficiency in Europe.

There are also measures that can be considered to improve the approach of the IPPC Directive to make it more successful in practice. If the personnel resources cannot be increased to ensure that the regulators use wisely the flexibility provided by the design of the IPPC Directive, another option is to reduce this flexibility. The personnel resources on permitting would not need to be increased in this case, but significant increase in resources on another level would have to take place. Reduction of regulators' flexibility would mean approach based on standards. For example Ashford recommends permits that are based on technology forcing standards as a driver for eco-efficiency (Ashford, 2002). Standards could bring consistent, challenging requirements that would force the companies to make changes. Bohne suggests standards that are semi-binding (Bohne, 2001). Regulators could allow deviations from the standards in specific cases.

There are large differences in the environmental performance between the industrial installations across Europe and it would be difficult to find requirements that are ambitious enough but do not harm the competitiveness of the European industry. Standard based approach may not work in EU for these reasons, although it could be a good solution somewhere else. Also, standards are sometimes not favourable to pollution prevention at source. As explained earlier in this thesis, emission standards encourage in some cases the companies to invest in pollution control technologies instead of taking process integrated measures.

Semi-binding standards or semi-binding role of the BREF could improve the IPPC as a driver for eco-efficiency. This would mean an increase in resources that are put into the preparation of BREF or the standards and also most probably more lobbying efforts from the industry. Due to the differences between Member States, environmental regulation in EU is in many respects more challenging than within one country. The current BREF in the Food, Drink and Milk Industry includes only BAT levels for emissions to water, because agreeing on larger number of BAT levels was too difficult. This suggests that agreeing on standards would be an enormous effort in EU. It would be difficult to find an appropriate level of performance. Due to the large differences between installations, a level that most installations would already have achieved may be selected. In this case the regulation would not act as a real driver for eco-efficiency in Europe. However, I would like to suggest the reconsideration of the role of the BREF. Perhaps its role could be strengthened, without making radical changes.

It is necessarily not a problem if the environmental permits act as a driver for laggards and safety net that ensures a certain level of the environmental performance. If other policy instruments are used successfully to drive more proactive, process orientated measures, there may not be a need to use the permits in this purpose. The use of policy instruments has to be well integrated so that they support each other.

Abbreviations

| | |
|--------------------------------|--|
| BAT | Best Available Technique |
| BOD | Biological Oxygen Demand |
| BREF | Best Available Technique Reference Document |
| CIP | Automated Cleaning In Place |
| COD | Chemical Oxygen Demand |
| DG Environment | Directorate General Environment |
| DG Enterprise | Directorate General Enterprise |
| ELV | Emission Limit Value |
| EPER | European Pollutant Emission Register |
| EQS | Environmental Quality Standard |
| European IPPC Bureau Bureau | European Integrated Pollution Prevention and Control |
| IMPEL | European Union Network for the Implementation and Enforcement of Environmental Law |
| IPPC | Integrated Pollution Prevention and Control |
| NEPP | Dutch National Environmental Policy Plan |
| SS | Suspended solids |
| TSS | Total Suspended Solids |
| TWG | Technical Working Group |
| UNEP | United Nations Environment Programme |
| WBCSD | World Business Council for Sustainable Development |

Definitions

BAT level

“Emission and/or consumption levels that are associated with the use of BAT”
(European IPPC Bureau)

Best Available Technique

‘Best’ = “ most effective in achieving a high general level of protection of the environment as a whole”

‘Available Techniques’ = “those developed on a scale which allows implementation in the relevant industrial sector, under economically and technically viable conditions, taking into consideration the costs and advantages, (...), as long as they are reasonably accessible to the operator”

“Techniques shall include both the technology used and the way in which the installation is designed, built, maintained, operated and decommissioned³⁵”

(Council Directive, 96/61/EC)

Cross-media effect

“Potential effects due to implementing the technique in various environmental compartments” (European IPPC Bureau, 2000)

Eco-efficiency

“Creating more goods and services with ever less use of resources, waste and pollution” (WBCSD, 2000) p.4

Permitting process

Everything that is connected to the environmental permit from company perspective. It starts from the point when a company gets the information related to the environmental permitting. For example, interaction with the regulators before and after the permit has been issued, collection of information in order to get the permit or meet its conditions and the permit conditions are part of the permitting process.

³⁵ Design, building and decommissioning are not within the scope of the thesis.

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Interviews

Companies:

| | |
|-------------|--|
| Denmark | Johannesen (June 9, 2003). Telephone interview. |
| Finland | Sahlstein, (August 22, 2003). Personal interview. |
| Netherlands | Petraeus (July 8, 2003). Personal interview. van Gennip (July 11, 2003). Personal interview. |
| Sweden | Zanders (June 23, 2003). Telephone interview. |
| UK | Page (July 3, 2003). Personal interview. Lovering (June 30, 2003). Personal interview. Plemper (July 2, 2003). Personal interview. |

Authorities:

| | |
|-------------|--|
| Denmark | Andersen (June 13, 2003). Personal interview. Fogh Petersen (September 8, 2003). Personal interview. Vestergaard (September 9, 2003). Personal interview. |
| Finland | Enckell (July 18, 2003). Personal interview. Lövdahl (August 25, 2003). Telephone interview. |
| Netherlands | Teekens (June 26, 2003). Personal interview. Kerkhof (July 10, 2003). Personal interview. van 't Hof (July 10, 2003). Personal interview. Vroon (September 9, 2003). Telephone interview. |
| Sweden | Nyström (June 11, 2003). Telephone interview. Edberg (June 11, 2003). Personal interview. Karlström (June 16, 2003). Personal interview. Nilsson, M. (June 16, 2003). Personal interview. |
| UK | Maleham (June 29, 2003). Personal interview. |

Dairy Industry Trade Bodies:

UK Stace (July 2, 2003). Personal interview.

Researchers:

Oxford University Ganzleben (July 1, 2003). Personal interview.

Consultants:

Imprescon Partners Lampi (July 21, 2003). Personal interview.

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EU:

DG Enterprise Hager (July 9, 2003). Personal interview.

DG Environment Braun (August 1, 2003). Personal interview.

Gislev (July 9, 2003). Personal interview.

IPPC Bureau Gara-Nagy (August 4, 2003). Telephone interview.

Appendix I Investigated Permits

- 2 British environmental permits*
- 1 Danish water permit
- 2 Danish environmental permits (other aspects than wastewater)
- 2 Finnish environmental permits*
- 2 Swedish environmental permits*
- 3 Dutch environmental permits (other aspects than water)

*All environmental aspects are integrated to environmental permits in Finland, Sweden and the UK

Appendix II The BREF in the Food, Drink and Milk Industry

This Appendix describes the BREF from the point of view of eco-efficient dairy industry. The level of challenge associated to the included techniques is not addressed, but the Appendix presents the issues the BREF is concerned with and amount of space the dairy industry has got in the second draft of BREF. Also some examples of requirements are mentioned. However, this Appendix does not provide a full list on requirements for dairy industry. Large parts of the requirements for dairies are mentioned in the common sections of the BREF. This Appendix is focused on dairy specific BATs.

Chapter 4 - Techniques to Consider in the Determination of BAT

Chapter four contains regarding to eco-efficiency sections on raw material use, waste minimisation, water managements and energy efficiency. There are dairy specific sections for

- Water management
- CIP
- Combined heat and power
- Using ultra filtration for standardisation of cheese milk
- Utilisation of heat from warm whey for preheating of cheese milk
- Partial homogenisation of market milk

Dairy case studied are provided on the following issues:

- Effluent reduction at a dairy
- Joint and separate operation for pre-evaporation and evaporation of milk and whey
- UHT treatment of milk (heat pumps)
- Energy efficient drying in milk powder manufacturing

Chapter 5 – Best Available Techniques

Regarding resource efficiency, chapter 5 includes common sections on waste minimisation, water management, cleaning and energy efficiency. In the beginning of the sections, some BATs considering management are first described and after that follow the BATs on housekeeping, operating practices and process optimisation etc.

Within these common sections, especially following issues are listed as BAT for dairies:

- Cleaning

Large dairy plants recommended to use several small CIP systems or decentralised cleaning stations

- Energy efficiency

Using combined heat and power generation (at the same time it is pointed out that its adoption depends on local costs for electricity)

Use higher temperatures to shorten ripening times

Use the warm heat of warm whey for preheating of cheese milk

Using pre-evaporation step in the evaporation of milk and whey

Use a partial homogenisation of milk

The only resource efficiency related BAT levels in the BREF consider water emissions (European Commission, 2003b) p.593.

Table II-1 BAT levels for concentration of BOD₅, COD, TSS, total nitrogen and total phosphorus

| Parameter | Concentration |
|------------------|---------------|
| BOD ₅ | <50 |
| COD | <250 |
| TSS | <50 |
| Total nitrogen | <10 |
| Total phosphorus | <5 |

After the common section, 2 entire pages are reserved for BATs in dairy industry. These pages provide a list on BATs specific for dairy industry. Most of the listed BATs are related to water and raw material efficiency. Also energy efficiency is addressed. End-of-pipe aspects gave got very little space on these 2 pages.

Following BATs are listed on energy efficiency:

- Powdered milk: run evaporators to get the highest possible concentration
- Use integrated fluidised bed dryers
- Use mechanical vapour recompression or thermal recompression
- Optimise process engineering to reduce energy for heating and refrigeration

Among others, following measures are listed as BATs regarding water and raw material efficiency:

- Reduction of water pollution and consumption
- Avoid milk spillage when connecting pipes and hoses
- Install piped at a slightly steep angel to promote self-draining
- Equip tanks with level controls to avoid overflow and to optimise the accuracy of filling operations

Appendix III British Permit Application Form for Dairies

The description below is based on a draft version of the application form.

The application form has approximately 90 pages. It presents indicative BATs, provides some benchmark figures and asks specific questions from the applicant. The companies are required to present a justification if their operation deviates from the indicative BAT.

Regarding eco-efficiency, it contains sections on in process control, management, raw materials, energy and monitoring. Management issues are included both separately and within the sections on specific environmental aspects. On each area, first some questions are made on management and/or working procedures. They are followed by more technology related, specific questions.

Management

Regarding management, the application covers *Operations and maintenance, Competence and training, Accidents/incidents/non-conformance* and *Organisation*. The questions on this section deal with procedures, policies, audits etc.

Raw materials

The section on **raw materials** covers for example chemicals, water and milk. Regarding chemicals, for example their fate is required to be explained.

Waste minimisation section requires the identification of lines and operations where product losses take place (e.g. cleaning, filling/packaging, homogenisation/separator, centrifugation, churning, cheese folding and pressing). There are some indicative BAT requirements for example for pasteurisation. Several questions are asked on cleaning and CIP. A few benchmark figures are provided. Following benchmarks are provided:

| Activity | Effluent: milk ratio | % COD loss to effluent | kg COD/t milk |
|---------------------------------------|----------------------|------------------------|---------------|
| Liquid milk and cream: new plant | < 1:1 | | |
| Liquid milk and cream: existing plant | < 1,5:1 | 0,7% | 2,5* |
| Cheese and whey: existing plant | 0,89:1 | 0,8% | |

*creamery

The section on **water use** requires the dairies for example to present the break down of water consumption into manual cleaning, CIP, boiler make up water and vehicle cleaning. Following benchmarks are provided:

| Activity | Litre water/ litre processed milk |
|---------------------------------------|-----------------------------------|
| Liquid milk and cream: new plant | < 0,6 |
| Liquid milk and cream: existing plant | < 1,5 |
| Cheese and whey: existing plant | < 1,2 |

Energy

The section on energy includes a specific tool for calculation of energy consumption. Operating, maintenance and housekeeping measures in specific parts of process are required. Also some physical measures are required in order to improve energy efficiency. Finally the applicant is required to list opportunities for energy saving. These are measures that the applicant has not yet taken.

Monitoring

The applicant is required to describe the monitoring on the following process variables:

- product loss
- water use (whole installation and specific points)
- energy use (whole installation and specific points)
- refrigerants
- cleaning

Emissions to water

Following benchmarks figures on emissions to surface water and sewer are presented:

| Substance | Activity | mg/l |
|----------------------|--------------------------|-------|
| BOD (new plant) | Effluent treatment plant | 10-20 |
| BOD (existing plant) | | 15-20 |
| Suspended solids | | 25 |
| P | | 2 |

In addition to these issues, the permit application is concerned with for example air emissions, noise, odour, waste disposal etc. This appendix provides a very limited description of the application.

Appendix IV Water Use, Wastewater Discharge and Water Emissions in the Nordic Dairy Industry

The water use in Nordic dairy industry (Table IV-1) gave an impression on the level of challenge related to the benchmark figures in the British permit application form. See section 8.4.2.

The figure in Tables IV-2 and IV-3 were used in judging the challenge associated to limit values in investigated permits. See Section 9.3.2

Water Use

Table IV-1 Water use in Nordic dairies (litres/litre processed milk) (Korsström, Lampi, 2001) p. 71

| Product range | Denmark | Finland | Sweden |
|---------------------------------------|-------------------|------------------|-------------------|
| Market milk & cultured products | 0.60-0.97 (3) | 1.2 - 2.9 (8) | 0.96 - 2.8 (8) |
| Cheese, whey | 1.2 - 1.7 (5) | 2.0 - 3.1 (2) | 2.0 - 2.5 (4) |
| Powder, cheese and/or liquid products | 0.69 - 1.9 (3) | 1.4 - 4.6 (2) | 1.7 - 4.0 (7) |

Wastewater Discharge

The lower discharge levels were used in the comparison in Section 9.3.2. The number in brackets refers to the number of plants included.

Table IV-2 Wastewater discharges in Nordic dairies (litres/litre processed milk) (Korsström, Lampi, 2001) p. 73

| Product range | Denmark | Finland | Sweden |
|---------------------------------------|--------------------|------------------|-------------------|
| Market milk & Cultured products | 0.83 - 0.94 (3) | 1.2 - 2.4 (8) | 0.86 - 2.5 (7) |
| Cheese, whey | 0.77 - 1.4 (5) | 1.5 - 3.2 (2) | 1.4 - 2.0 (4) |
| Powder, cheese and/or liquid products | 0.75 - 1.5 (3) | 1.9 - 3.9 (2) | 1.2 - 4.3 (7) |

Water Emissions

Table IV-3 BOD and COD levels in wastewater discharges of Nordic dairies. (Korsström, Lampi, 2001) p.72

| Product | BOD ₅ (mg/l product) | BOD ₇ (mg/l product) | COD (mg/l product) |
|--------------------------|---------------------------------|---------------------------------|--------------------|
| Cream, 40% fat | 400 000 | 450 000 | |
| Whole milk, 4% fat | 120 000 | 135 000 | 220 000 |
| Skim milk, 0,05% fat | 70 000 | 80 000 | 100 000 |
| Whey, 0,05% fat | 40 000 | 45 000 | 70 000 |
| Whey concentrate, 60% DM | 400 000 | 450 000 | |

Appendix V Investigated Permits – Type of Permit Conditions

Permitting conditions that are related to energy, water, raw materials and chemicals are presented in this Appendix.

Energy

Table IV-1 Energy related permit conditions

| | |
|-------------|---|
| Denmark | Monitoring of energy use (1 permit) |
| Finland | Monitoring of energy use and air emissions* |
| Netherlands | The companies have to take the measures they have committed themselves to within the covenant on energy Monitoring of energy efficiency (1 permit) |
| Sweden | Limit values for air emissions* (per MJ fuel) |
| UK | Limit values for air emissions* (per MJ fuel) Limit value for CO ₂ t/yr (1 permit) Monitoring of energy use (1 permit) Energy efficiency plan Assessment on the costs and benefits of CHP (1 permit) |

*Air emissions refer in this table to other energy-related emissions than CO₂

Water use

Table IV-2 Water use related permit conditions

| | |
|-------------|---|
| Denmark | Limit value for amount of wastewater (maximum daily flow, hourly flow) |
| Finland | Monitoring of water use and amount of wastewater. |
| Netherlands | |
| Sweden | Limit value for amount of wastewater (maximum daily flow) A requirement to investigate opportunities to reduce amount of wastewater (1 permit) |
| UK | Limit value for amount of wastewater (maximum daily flow) |

Raw Materials

Table IV-3 Raw material use related permit conditions

| | |
|-------------|---|
| Denmark | Limit value on COD (kg/d) in wastewater Monitoring of total-N and total-P |
| Finland | Non-confirming products not to be lead to sewage Plan on utilization of waste products (1 permit) Limit values on SS (mg/l and kg/d) (1 permit) and BOD (mg/l and kg/d) (1 permit) in wastewater Plan to reduce the amount of landfill waste (1 permit). |
| Netherlands | |
| Sweden | A requirement to investigate opportunities to reduce amount of water emissions (1 permit) Limit values on BOD, P (1 permit), N (1 permit), fat (1 permit) (kg/d) Alarms etc to protect leakages and spillages |
| UK | Monitoring of raw material efficiency Limit values on BOD, COD, SS, ammonia (1 permit) and total hydrocarbons (per l) in wastewater |

Chemicals

Table IV-4 Chemical related permit conditions

| | |
|-------------|---|
| Denmark | Storing of chemicals and monitoring of their use |
| Finland | Storing of chemicals and monitoring of their use An investigation on whether the amount of NH ₃ can be reduced (1 permit) |
| Netherlands | Storing and registration of chemicals |
| Sweden | Storing and registration of chemicals |
| UK | Monitoring the chemical use No chlorine in the discharge (1 permit) |

Appendix VI Investigated Permits – Limit Values

Some of the investigated permits did not include limit values that have implications to resource efficiency. Those permits are not listed here.

| Permit DENMARK 1 | | |
|---|-------------------|-----------------------|
| Operation 24h/d, 12 h break every weak | | |
| Products | Production | |
| Cultured milk products | 92 000 000 | l/a |
| Raw materials | | |
| Milk | 106 000 000 | l/a |
| Limit Values | | |
| Wastewater | 700 | m3/d |
| Wastewater | 35 | m3/h |
| COD | 2200 | kg/d |
| COD | 1500 | kg/d (weekly average) |

| Permit FINLAND 1 | | | | |
|-------------------------------------|--------------|------|-------------|-----|
| Operation 3 shifts/d, 365 d/year | | | | |
| Products | 2001 | | 2005 | |
| Butter & margarin | | | | |
| Milk powder | | | | |
| Fresh products | | | | |
| Total | 166 400 | t/a | 100 000 | t/a |
| Raw materials | 2 001 | | | |
| Milk | 310 343 620 | l/a | | |
| Cream | 86 997 971 | l/a | | |
| Fat free milk | 30 831 | l/a | | |
| Other milk nased ingredients | 1 044 735 | l/a | | |
| Vegetable oils | 4 184 957 | l/a | | |
| Total | 402 602 114 | l/a | | |
| Limit Values | | | | |
| SS | 600 | mg/l | | |
| SS | 1300 | kg/d | | |

| Permit | | FINLAND 2 | |
|---|-------------|-----------|-----------------|
| Operation | | | |
| usually 2 shifts/day, summertime 3 shifts/d, | | | |
| UHT factor closed every week from Saturday 6 am to Sunday 10 pm | | | |
| Products: UHT | 2001 | | Capacity |
| Milk | 8 822 | t/a | |
| Light cream | 7 436 | t/a | |
| Thick cream | 2 128 | t/a | |
| Milk powder for babies | 6 241 | t/a | |
| Baby food | 1 008 | t/a | |
| Porridge | 5 820 | t/a | |
| Ingredients for ice cream | 1 272 | t/a | |
| Total | 32 727 | t/a | 59 000 t/a |
| Products: Ice cream | 2001 | | Capacity |
| Ice cream | 17 982 | t/a | 74 000 t/a |
| Raw materials (UHT & ice cream) | 2001 | | |
| Liquid milk-based ingredients | 31 950 | t/a | |
| Other milk based ingredients (powder, butter) | 1 457 | t/a | |
| Jams, juice concentrates etc | 1 060 | t/a | |
| Grain | 994 | t/a | |
| Sugar etc | 2 684 | t/a | |
| - | 921 | t/a | |
| Vegetable oils | 507 | t/a | |
| Vegetables | 231 | t/a | |
| Other ingredients, additives etc | 1 152 | t/a | |
| Limit Values | | | |
| BOD ₇ | 1 800 | kg/d | |

| Permit | | SWEDEN 1 | |
|---|-------------------|------------------------------------|--|
| Operation normally 3 shifts/d, 7d/week | | | |
| Products | Production | | |
| Cheese 1 | 15 000 | t/a | |
| Cheese 2 | 20 000 | t/a | |
| Total (upper limit) | 35 000 | t/a | |
| Raw materials | | | |
| Milk | 440 000 | t/a | |
| Limit Values | | | |
| NO ₂ | 100 | mg/MJ fuel | |
| Dust | 10 | mg/Nm ³ dry gas | |
| BOD ₇ | 2000 | kg/d (yearly average) | |
| BOD ₇ | 1700 | kg/d (monthly average) | |
| BOD ₇ | 2800 | kg/d (any single day) | |
| Wastewater | 2000 | m ³ /d (yearly average) | |
| Wastewater | 2700 | m ³ /d (any single day) | |

| Permit | | SWEDEN 2 | |
|--|--------------------|------------------------------------|--|
| Operation 1-3 shifts/d depending on the department and the weekday, 356 d/a | | | |
| Products | | | |
| Consumer milk products | | | |
| Fresh cheese | | | |
| Creme Fraiche | | | |
| Raw materials | Upper limit | | |
| Milk | | | |
| Cream | | | |
| Total | 75 000 | t/a | |
| Limit Values | | | |
| NO ₂ | 100 | mg/MJ fuel | |
| S | 24 | mg/MJ fuel | |
| Fat | 160 | kg/d (any single day) | |
| BOD ₇ | 900 | kg/d (yearly average) | |
| N | 50 | kg/d (yearly average) | |
| BOD ₇ | 1300 | kg/d (any single day) | |
| Wastewater | 600 | m ³ /d (yearly average) | |
| Wastewater | 800 | m ³ /d (any single day) | |

| Permit | | UK 1 | |
|---|--|---|--|
| Operation 24 h/d, 6 d/week (apart from shutdown periods) | | | |
| Products Milk Cream | | | |
| Raw material Milk | | Capacity 1 600 000 l/d | |
| Limit Values NO ₂ (3 emission points) CO (3 emission points) CO ₂ SS COD (from acidified dichromate) COD (from acidified dichromate) Total hydrocarbons Wastewater | | 80 ,80, 80 mg/m ³ 65, 65, 65 mg/m ³ 5 500 t/a 500 mg/l 3000 mg/l 1530 kg/d 10 mg/l 840 m ³ /d | |

| Permit | | UK 2 | |
|---|--|---|--|
| Operation 20 h/d, 350 d/year | | | |
| Raw material Milk | | Capacity 850 MI/a | |
| Limit Values CO (2 emission points) Nox (2 emission points) Particulates BOD SS Ammonia (as N) Wastewater | | 60, 60 mg/m ³ 104, 140 mg/m ³ 50 mg/Nm ³ 10 mg/l 25 mg/l 3 mg/l 1500 m ³ /d | |