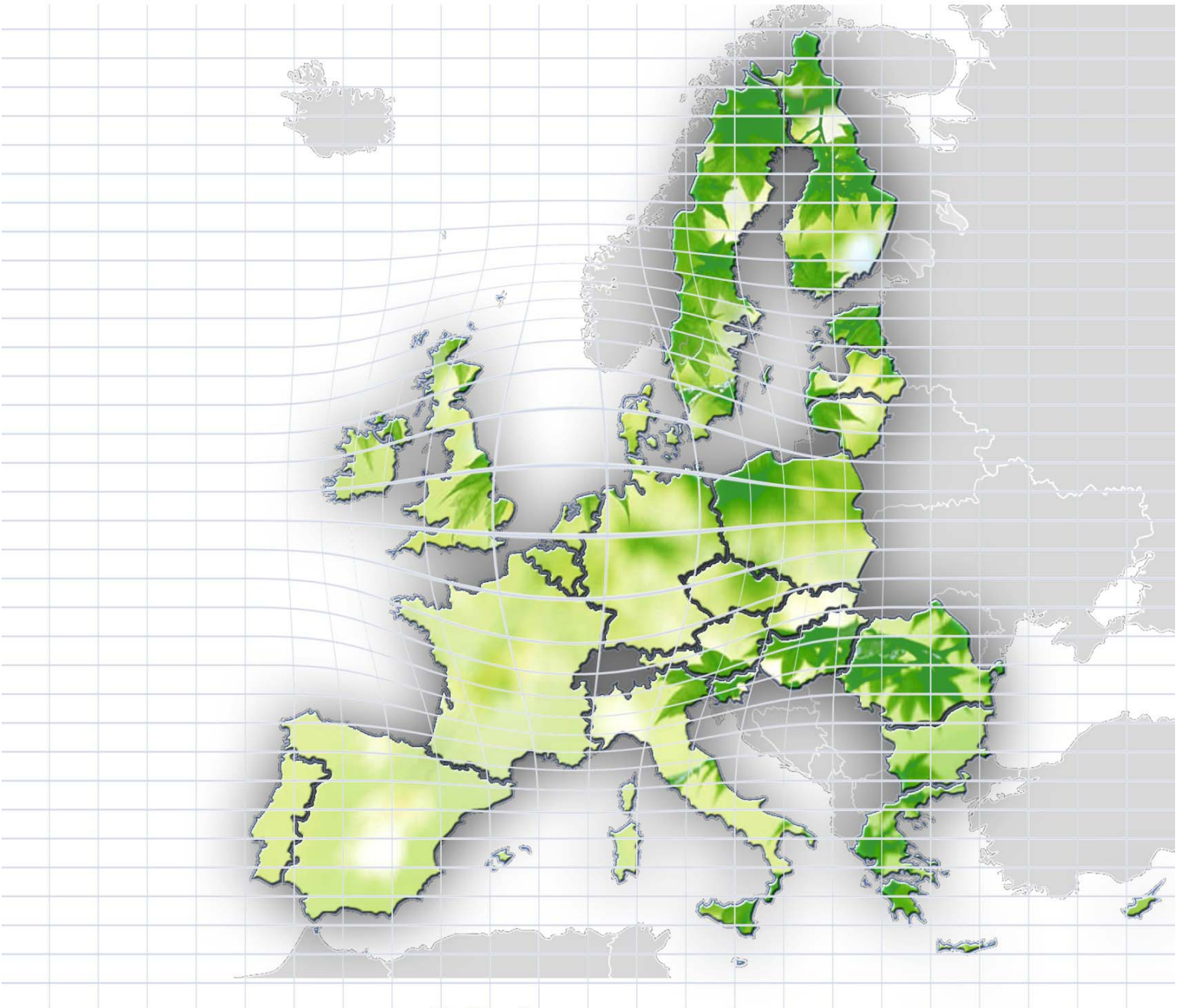
SMEs and the environment in the European Union



Main report

PLANET

TEKNOLOGISK INSTITUT

Title:

SMEs and the environment in the European Union

This report has been prepared in 2010 for the European Commission, DG Enterprise and Industry under the Competitiveness and Innovation Programme 2007-2013.

Abstract:

Reducing the environmental impact is a challenge to small and medium sized companies (SMEs) all over Europe. The pressure on SMEs for products and processes with a lower environmental impact will increase from the market place as well as environmental legislation in the coming years. This challenges SMEs as more than 99% of the companies in Europe are SMEs employing almost 70% of the European workforce and producing close to 60% of the overall turnover from manufacturing and services. This report estimates the environmental impact from SMEs in Europe building on data from Eurostat. Furthermore the report analyses the administrative burdens from EU environmental legislation and the business opportunities for the SMEs with concrete examples from SMEs in 13 European countries.

Key Subjects:

SMEs, environment, administrative burdens, eco-efficiency, business opportunities, environmental tools.

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EXECUTIVE SUMMARY

Sustainability and growth are on the European agenda. In March 2010, the European Commission published its strategy for smart, sustainable and inclusive growth entitled *Europe 2020*.[1] The strategy puts forward three mutually reinforcing priorities: **Smart growth**: developing an economy based on knowledge and innovation; **Sustainable growth**: promoting a more resource-efficient, greener and more competitive economy and **inclusive growth**: fostering a high-employment economy delivering social and territorial cohesion.

Sustainability and growth strategies also include the private sector in the European Union. In the European Union there are more than 20 million enterprises in the private sector – of these 99% are small and medium-sized enterprises (SMEs) with a workforce of nearly 90 million people. In general 60% -70% of the environmental impact relates to SMEs.

This study focuses on SMEs and their impact on the environment in the EU27. It addresses questions such as: What impact do the SMEs have on the environment? Are there administrative burdens associated with compliance with EU regulations? Can SMEs increase their competiveness by reducing their environmental impact? What are the business opportunities for SMEs in the eco-market?

The study has had four major data sources, i.e. *existing literature, databases, case studies* from 13 *countries*[2], and an *online survey covering all the EU27 countries*. A focus group of industry stakeholders has participated in the study in two workshops, and they have been active in commenting on results and helping with sources for interviews, data and literature.

The study has a dual focus. Firstly, it contributes to evidence-based and effective SME policy-making. Secondly, it proposes pragmatic and relevant recommendations to SMEs and their representatives. More specifically, the objectives of the study are the following:

- **Measuring the impact of SMEs on the environment.** Existing data on the environmental impact from SMEs are scarce. In this study the environmental impact from SMEs in the EU27 is estimated at a detailed level. By country, by sector and by size of SMEs, i.e. micro companies, small companies and medium-sized companies. The results are collected in the Environmental Impact Database for SMEs (EIDSME database) which can be used for further studies of SME impact. The data is analysed and visualised to make a first prioritisation of key SME groups.

[1] Brussels, 3.3.2010, COM(2010) 2020, COMMUNICATION FROM THE COMMISSION, EUROPE 2020 A strategy for smart, sustainable and inclusive growth

[2] Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, France, Germany, Greece, Italy, Poland, Slovenia, Spain, United Kingdom.

- **The impact of EU environmental measures on SMEs** has been studied through literature, interviews and surveys. The study explores the environmental compliance of SMEs and the impact of environmental regulations, as small businesses traditionally find it harder to comply with environmental legislation than large enterprises.
- **SMEs business opportunities** have been studied. The study has analysed whether there are new business opportunities for SMEs from complying with more energy-efficient production and business processes and by participating in the eco-industry. The study presents concrete examples from 13 countries on how SMEs transform environmental challenges into business opportunities. Although there are cost implications, companies that do take action can benefit from increased eco-efficiency and their participation in the eco-industry.

In the following we present an overview of the main findings.

THE IMPACT ON THE ENVIRONMENT FROM SMES

Key points

SMEs contribute 64% of environmental impact

Up to 24% of SMEs actively engage in actions reducing their environmental impact; 0.4% of SMEs use a certified Environmental Management System

Industries that have a particular negative impact on the environment are manufacturing of chemicals, basic metals, rubber and plastic, food, mining and quarrying, pulp, paper, coke, energy production, air and water transport and construction.

In the research literature it is widely recognised that it is complex and burdensome to determine SMEs' environmental impact in any detail from different types of pollutants in each Member State. Nevertheless, the present study attempts to provide a detailed and coherent estimate of the environmental impact of European SMEs. The main impacts under consideration are energy use, CO2, SOx, NOx, PM10, nmVOC, waste and hazardous waste.

The study's estimations suggest that SMEs account for approximately 64% of the industrial pollution in Europe. Sector variations are generally within the 60% to 70% range.

These figures are in line with SMEs' contribution to production and employment.

While the environmental impact from an individual company may be low, the overall impact of a sector can be very high if the number of enterprises operating in the sector is large. One prominent example is the G section of the General Industrial Classification of Economic Activities (NACE code) - wholesale and retail trade; repair of motor vehicles and motorcycles. In many countries this sector can be considered a high-impact sector, but the contribution from individual enterprises within the sector is relatively low. In most sectors medium-sized and large companies constitute a small proportion of the total number of European firms, whilst their negative environmental impact is much higher proportionally.

Therefore, the discussion about SMEs' environmental impact must be nuanced and be specific with regard to the sector and the size of the enterprise. Taking into account that small enterprises bear a disproportionate regulatory burden in comparison with larger businesses "one-size-fits-all" solutions run the risk of being "One-size-fits-only-a-few".

The study suggests that companies that actively promote actions to reduce their environmental impact or the "green segment" account for 3-4% of the micro companies, 7-8% of the small companies, 6-7% of the medium-sized companies and 16-17% of the large companies. However, if the green segment is defined narrowly as companies which use certified environmental management systems (EMS) such as EMAS, ISO 14001 or national or sector-specific systems, then approximately 80,000 companies of the 20 million companies in the EU27 are registered users and belong to the green segment, which equals to about 0.4% of all the companies in the EU. The EIDSME database is complemented by an analysis combining sector impacts, impacts at the firm level as well as the eco-efficiency and the potential for impact reductions in order to prioritise key sectors for action: manufacturing of chemicals, basic metals, rubber and plastic, food, mining and quarrying, pulp, paper, coke, energy production, air and water transport and construction. However, further actions may require caution, i.e. some sectors are already relatively eco-efficient while other sectors, such as the wholesale and retail sectors, are less efficient. The impacts considered are not weighted and while including important environmental impacts, there is still important omissions such as consumption of scarce resources, noise or water usage. Finally, the life-cycle perspective of products is not included.

SMEs AND ENVIRONMENTAL LEGISLATION

Key points

SMEs find it more difficult to comply with environmental legislation than large companies.

SMEs are more familiar with national environmental legislation than the legislation imposed by the EU.

SMEs lack knowledge regarding specific environmental legislation affecting them.

SMEs bear administrative burdens deriving from monitoring and reporting obligations.

Administrative burdens. SMEs find it more difficult to comply with environmental legislation than their large counterparts. In general, the smaller the company, the more difficult it is. Environmental legislation is general in nature and aimed at preventing and reducing negative environmental impacts, and therefore it does not take into account the specificities of SME operations.

There are a number of areas of EU environmental legislation relevant to SMEs' activities. Most have to do with particular aspects such as waste - and wastewater management, chemicals management (REACH[3], IPPC[4]), air emissions and emissions trading and energy efficiency. Environmental legislation concerning waste and water management as well as REACH Regulation affects SMEs in almost all NACE C-I and K sectors, while other particular elements of the legislation affect SMEs in some economic activities sectors.

For an SME it is local regulations and legislation that is important. SMEs are aware of the main environmental national legislation and the relevant requirements. However, the level of awareness of EU environmental legislation is low, since EU Directives are transposed in Member States' national legislation. In some Member States the national legislation is stricter than the EU legislation.

The level of information and specific knowledge about environmental legislation is low and lacking. Few SMEs consider REACH a main environmental issue that is related to their activities. This can be explained by information asymmetry provided by national competent authorities, but also due to lack of capacity in SMEs, which means that they seldom have an overview of sources of support (legal, technical) and how these can be used strategically. There is a lack of support for companies to implement the changes imposed by existing or new environmental legislation. Therefore, many SMEs are incurring extra costs to hire external environmental consultants and experts.

Monitoring and reporting environmental indicators also imposes costs on SMEs, and sometimes reporting has to be provided to different authorities and be presented in different formats. When complying with reporting requirements, allocated person-hours vary substantially among SMEs. Some enterprises estimate that environmental reporting engages (aggregated) 1 person for 1-1.5 month/year, others allocate a fulltime employee throughout the year.

SMEs AND ENVIRONMENTAL PERFORMANCE

Eco-efficiency and eco-business. An estimated 40-45% of SMEs are companies with a high impact on the environment. In general, they are companies with more than 50 employees, and to lesser extent micro companies in sectors with a high environmental impact. This segment is more likely to invest in environmental tools and solutions, due to business opportunities through cost reductions and/or compliance with environmental legislation.

The other segment, which consists of 55- 60% of the SMEs, is represented by SMEs with a low impact on the environment, and it will seldom invest in tools

[3] REACH is a European Community Regulation on chemicals and their safe use (EC 1907/2006). It deals with the **R**egistration, **E**valuation, **A**uthorisation and Restriction of **Ch**emical substances. The law entered into force on 1 June 2007

[4] Integrated Pollution Prevention and Control (IPPC) Directive (2008/1/EC). The aim of the IPPC Directive is to prevent and control emissions to air, water and soil from industrial installations across the European Union.

and solutions that improve their environmental performance. However, many low-impact SMEs have simple environmental policies and have implemented simple solutions, but the economic and environmental effect is also limited.

Key points

Environmental tools and solutions investment are mostly a priority in high environmental impact SMEs

Mainly low-cost investment in environmental tools and solutions

Certified environmental management systems are more attractive solutions for medium-sized and large enterprises as well as companies with a high impact on the environment.

SMEs can easily apply non-certified environmental management systems.

The SMEs that invest in environmental tools and solutions with significant results tend to identify these solutions through suppliers of equipment or through participation in projects aimed at reducing their environmental impact.

The main types of tools and solutions used by SMEs are investment in simple clean technologies, closed systems (recycling of water or waste), and solutions such as energy-efficient light bulbs and waste segregation.

These tools and solutions result in reductions in energy consumption, environmental resources (e.g. water, soil, raw- materials) consumption, waste generation and cost savings and environmental impact.

Certified environmental management systems (EMS) appear to be too costly and complex for most of the micro and small enterprises, and the public shows little or no interest. There are seldom rewards from the authorities, and customers rarely demand an EMS system. When they do, they usually ask for ISO 14001 systems or an industry specific system. EMAS and EMAS-Easy[5] seem to be better suited to medium-sized and large enterprises and companies with a high environmental impact.

Very simple and low-cost systems for reducing environmental impact should be promoted to SMEs with a low environmental impact. The systems could be simple guidelines on how to improve their environmental performance. Most importantly, external auditing should not be necessary, since this adds extra costs and burdens on the company. For low-impact micro companies the value of the reductions is equally low and expensive systems are not attractive. This said, simple environmental policies can not only reduce their environmental impact and save costs, but also trigger further investments as the SMEs realise that they can save cost by making simple changes.

[5] ISO 14001, EMAS and EMAS-Easy are all environmental management system for use in private and public organizations and companies.

RECOMMENDATIONS

The recommendations below are based on study findings. The recommendations are organised according to type and target group. First there is a series of recommendations for policy makers concerning the administrative burdens for SMEs followed by recommendations regarding financial burdens sustained through environmental regulations. There are also recommendations directed at SMEs and organisations representing them.

RECOMMENDATIONS ON ADMINISTRATIVE PROCEDURES

The recommendations on administration are all aimed at making it easier for SMEs to comply with EU environmental legislation, such as simplification of procedures, one-stop-shops, better use of ICT tools and avoiding of duplication of requested information:

Improvement of environmental permitting procedures and authorizations

- *Simplification of the permission procedures*. Simplification can be enhanced by issuing permits faster, by setting time limits for when public bodies may react, by imposing fewer certificates, and by improving internal communication between administrative units.
- *Enhanced staff competences*. Recruitment of employees from relevant technical fields in permission units.
- *Exchanges of information between administrations.* Creation of a common database to enable administrative units to exchange information.

Streamlining of environmental reporting

Simplification of the administrative requirements for reporting on environmental issues and avoiding duplication of requested information is necessary. Solutions could include the creation of e-registration systems at national level (except for the requirements stemming from the IPPC Directive and the REACH Regulation), which would enable monitoring information to be submitted electronically with a unified format and regular frequency.

Creation of one-stop shops for the provision of information and tools for the fulfilment of administrative requirements

SMEs demand one-stop-shop facilities to gather information (legislation in force, new requirements, criteria for applying for subsidies, contact details of advisors or providers, available tools, fiscal treatment, etc), on how to fulfil administrative requirements and, in short, save time and avoid duplication of work.

These one-stop-shops could also provide training services to SMEs concerning environmental legislation and its requirements. A suggestion would be to create a network of affiliated one-stop shops at national level to which SMEs could contribute a small yearly subscription fee.

Campaigns promoting environmental management systems should take into account the size and the environmental impact of a company

Complex management systems such as EMAS and ISO 14001 should target medium-sized and large companies as they are seen as too complex for micro and small companies. In case the introduction of EMAS is necessary e.g. because of marketing requirements or to prove legal compliance, methodologies tailored to SMEs should be used (e.g. EMAS Easy). Campaigns for EMAS and ISO 14001 should therefore mainly be focused on large and medium-sized companies, particularly in sectors with a high environmental impact and those subject to environmental legislation, e.g. REACH or IPPC.

92% of European companies are micro companies. There are more than 18 million companies, and they cause an estimated 30% of the environmental impact. Most are too small to use environmental management systems. Campaigns for environmental impact reduction, energy labels, eco-labels, test and certification of products will enable these companies to reduce their impact much in the same way as private households.

RECOMMENDATIONS REGARDING FINANCIAL SUPPORT

Support for alleviating the costs of complying with environmental legislation

- Free or subsidised advisory services to assist SMEs in complying with the legislation in force. One of the actions under the Environmental Compliance Assistance Programme for SMEs (ECAP) is to build local environmental expertise available to SMEs. Such efforts should be stepped up.

RECOMMENDATIONS TO INCENTIVISE IMPROVEMENTS IN THE ENVIRONMENTAL PERFORMANCE

Subsidies for SMEs that wish to upgrade to energy-efficient machinery or to improve their overall environmental performance, such as incentives for increased collaboration with suppliers of technical equipment and substances. Collaboration with suppliers will compensate for a lack of technical capacity in particular, but also of legal and business skills.

The promotion of projects and initiatives aimed at reducing SMEs' environmental impact and, and the same time, resulting in cost savings may not reach the expected results mainly due to a lack of the managerial skills to identify the business opportunities either through cost savings using an EMS or other tools, or the technical skills to identify new and better cost saving technical options in the production process. For micro companies and small companies hiring the required technical or managerial skill will often be too expensive. A reduction in the environmental impact can be simple by incorporating training for green skills in vocational education systems as well as training targeting those already in the workforce. This will empower employees and owners to take actions relevant to the sector and type of enterprise where they work. Studies undertaken by CEDEFOP show that such actions are under way in some Member States and already in place in others.

Reduced costs related to the application for certifications

Voluntary certification according to environmental management standards imposes costs on SMEs. The cost of certification could take size factors into account such as volume of production, size of the workforce, as well as the turnover of the company.

Standardized EMS reporting is expected to improve the cost and the time needed to comply with reporting requirements

Enterprises suggest that the use of standards and more standardised ways of EMS reporting might be an appropriate solution. This is currently being implemented within EMAS through the development of sectoral key indicators. The approach remains voluntary, but the reporting will be standardised.

Concrete examples of financial benefits of environmental initiatives should be promoted

Environmental projects and initiatives for SMEs should include concrete examples of financial benefits as well as environmental benefits. Most SMEs do not see a market for greener products or demand for a cleaner production. Until customer demand from the B2B (business to business), B2G (business to government) or B2C (business to consumer) markets increases, SMEs need other incentives to reduce their environmental impact. Drivers to change environmental behaviour could be: increased prices of raw materials, emissions, and waste, in combination with easy solutions such as energy-efficient light bulbs, efficient pumps and automation of light, heating, cooling and ventilation systems. The survey conducted in this project shows that the two main reasons for investing in cleaner solutions are either rising costs of energy, water or materials or new environmental legislation.

Collaboration in the value chain should be promoted for improving environmental performance

One of the major reasons for investing in environmental solutions is close collaboration within the supply chain and suppliers of technical equipment. Policy makers and organisations should focus on demonstration projects that comprise the whole value chain, for exchange of ideas to reduce the environmental impact and at the same time save costs. Companies perceive this to be a cheap and effective way to get the latest information on technological and environmental solutions.

High cost environmental solutions should target high impact companies

Projects and initiatives that promote high-cost environmental solutions, such as investment in expensive technology with a high potential for reducing the environmental impact, should aim at SMEs with high environmental impact. The return on investment could be too small for SMEs with limited environmental impact. Tools and solutions for low-impact SMEs should be simple and cheap to implement.

Actions to improve environmental data quality could be undertaken by the EU, by Member States and by SME organisations

Actions to improve the quality of environmental data could include improvement of the knowledge of impact distribution according to the size of the company (EU, Member States, SMEs organisations); improvement of the quality of selected indicators, i.e. energy (EU, Member States); improvement of Life Cycle Analysis (LCA) data on products to be compatible with NACE (EU); inclusion of environmental indicator questions in EU financed studies (EU).

RECOMMENDATIONS TO SMES AND SUPPORT ORGANISATIONS – REDUCING SMES' ENVIRONMENTAL IMPACT

Strong support is required from sector organisations

Sector organisations should offer sector-specific projects aimed at stimulating innovations regarding the main environmental challenges in the sector that increase costs or cause compliance problems. Collaborative projects with several companies will reduce R&D costs of the SMEs and can enable learning between enterprises that struggle with the same challenges. To enable impact, such demonstration projects should target the value chain and opportunities in collaborating with suppliers of technical equipment or suppliers in general.

Sector organisations should focus on projects aimed at managing environmental investments, especially to build capacity in micro- and small companies.

Improvements in the environmental base offer business opportunities:

SMEs could explore business opportunities within the following areas:

- *Environmental friendly products*. Many of the interviewed companies see an opportunity in more environmental friendly products, but at the same time they recognise barriers, and this has a significant negative impact on their motivation to pursue such a strategy.
- *Environmental management services*. The interviewed eco-industry companies see the largest opportunities in the provision of technical solutions and services to companies that seek to comply with both EU and national environmental legislation.
- *Investment in environmental tools and solutions.* Although, there are barriers for SMEs to invest in tools and solutions to reduce their environmental impact, there is a large cost-reducing potential. Therefore, SMEs should look more actively toward clean technologies through collaboration with suppliers and sector organisations or through applied research schemes.

TOOLKITS

In addition to findings and recommendations, the study has produced electronic toolkits.

The toolkits primarily target policy makers, SMEs, associations and networks supporting SMEs. They are intended to assist in developing environmental improvements according to each party's perspective.

Information is organised in the following sections:

- The *policy makers' perspective*. This section is targeted at European and national policy makers.
- The *SME perspective* targets SME networks and other groups or associations at the European or national level. The information is also of interest to individual companies.

The EIDSME database is intended to support policy makers as well as SME interest groups. The database provides a multi-dimensional quantitative perspective on economic, geographical, and environmental metrics related to the subject matter. The *Basic Knowledge* section consists of the *Terms and Concepts Dictionary*, the *Legal Compendium* and a *Country Perspective* that categorises identified legislative priority areas for action and good practices per country.

1 INTRODUCTION

1.1 THE BACKGROUND

The aim of this study was to:

- analyse the impact of SMEs on the environment;
- analyse EU environmental measures impact on SMEs;
- evaluate EU SMEs business opportunities as regards the environment; and
- develop concrete recommendations.

This study is not only a theoretical analysis of the relationship between SMEs and the environment; it is also aimed at producing concrete results in the following four domains A-D:

A. Impact analysis of SMEs on the environment

- Definition of the criteria for SMEs' impact on the environment by sector and company size, i.e. micro, medium and small, following the definitions of the EU in its recommendation 2003/361/EC. The criteria included the current take-up of environmental and energy management systems, level of investment in environment and energy fields as well as their impact on climate change.
- Development of a database on SMEs' impact on the environment based on the above criteria, that could be used in future impact assessments for EU legislation.
- Mapping of groups of SMEs with or without important impact on the environment and prioritisation of key SME groups regarding their environmental impact.

B. Impact analysis of EU environmental measures on SMEs

- Identification of the main EU regulatory measures in the environmental field, and the impact on SMEs in terms of administrative or generic costs on the key SME groups.

C. EU SMEs business opportunities evaluation

- Evaluation of potential cost reduction for SMEs related to sound environmental/energy management.
- Grouping of SMEs by type of "green potential".

D. Operational conclusions – concrete recommendations on how to help SMEs turn their environmental challenges into business opportunities by key SMEs groups

- Development of a toolkit of incentives that could foster SMEs' participation and market share into eco-industry and increase SMEs' eco-efficiency. The toolkit should be targeting two groups of users:

- EU policy maker: the above-mentioned information should help shape environmental legislation affecting SMEs to be more simple and cost-effective.
- Support services or network to help SMEs turn their environmental challenges into business opportunities.

1.2 THE STUDY APPROACH

The project has been organised according to the above-mentioned four domains A-D throughout the project. In the initial phases, a literature study was conducted concerning the subject matter of domains A-C. Additionally for domain A, an initial selection of database indicators and a preliminary analysis of the data were prepared to help the selection of countries and sectors in the analysis of the administrative burdens related to environmental legislation and the business opportunities in the eco-industry. Furthermore, an interview guide for the country studies and a questionnaire for the e-survey were developed.

To follow the study, a focus group of European stakeholders with members of European business associations, the Enterprise Europe Network, and Commission officials were identified and invited to two focus groups workshops in Brussels.[6] The focus group was headed by the European Commission, SME Policy Development Unit of DG Enterprise and Industry. At the first workshop, the preliminary data and the database, as well as the selection of countries and sectors were discussed. During the data collection, the focus group members have been active and very helpful in assisting the consultants in identifying national organisations to be included in the survey and identifying relevant companies and organisations for the country studies. At the final meeting, a draft version of the report and the databases were presented to the focus group.

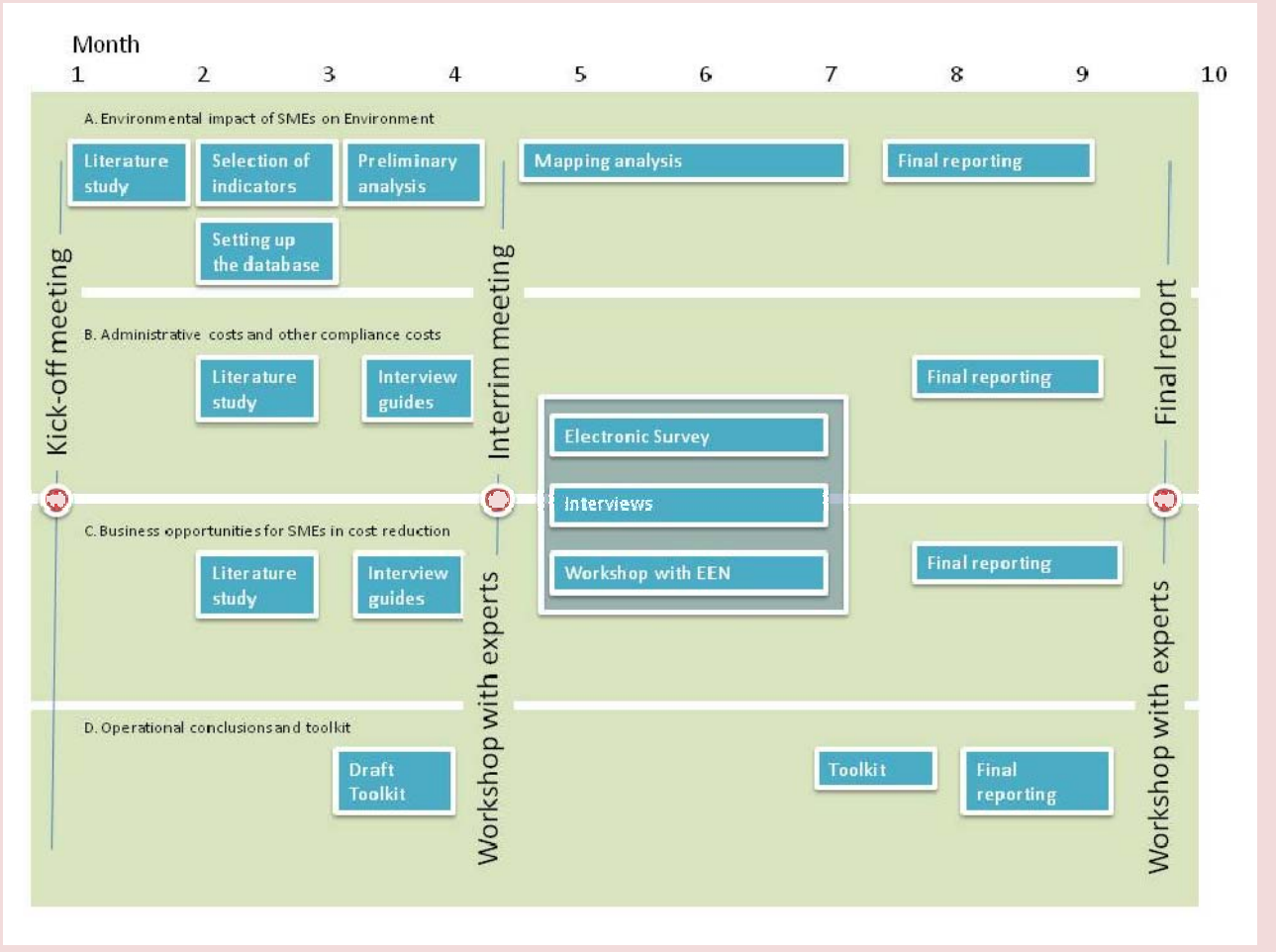
We are grateful for the constructive and informative input, comments and assistance that the study has received from the focus group. It is important to emphasise that none of the

[6] The participants of the first focus group workshop in Brussels in January 2010 were representatives of the following organisations: European Association for Forwarding, Transport, Logistic and Customs Services; Council of European Producers of Materials for Construction; AGIL GmbH Leipzig; ENEA; International confederation for printing & allied industries; The International Rayon and Synthetic Fibres Committee; European Travel & Tourism Action Group; European Apparel & Textile Organisation; ARIST Nord - Pas de Calais ; Federation of Enterprises in Belgium; European Chemical Industry Council; European Travel & Tourism Action Group; Confederation of Danish Industry (DI); Union européenne de l'artisanat et des PME ; Association of European Chambers of Commerce and Industry; European Construction Industry Federation; Confederation of the food and drink industries in the EU; Institute for Innovation by Science and Technology in Flanders; European Chemical Industry Council; Zentrum für Innovation und Technik in NRW

The participants at the second focus group workshop in Brussels on 16th of June represented: European Travel & Tourism Action Group, European Association for Forwarding, Transport, Logistic and Customs Services; Council of European Producers of Materials for Construction; AGIL GmbH Leipzig; Zentralverband des deutschen Handwerks; European Apparel & Textile Organisation; Austrian Federal Chamber of Commerce (member of Eurochambres); European Leather Industries; European Chemical Industry Council; Confederation of Danish Industry (DI); Confederation of the food and drink industries in the EU; Institute for Innovation by Science and Technology in Flanders; European Construction Industry Federation; Verband Deutscher Maschinen- und Anlagenbau - German Engineering Federation; Union européenne de l'artisanat et des PME.

focus group members are in any way responsible for the information or errors in this study.

The project flow



Between February and June 2010, the work in domain A primarily consisted of re-estimation and testing of the database content based on comments from the workshop. Moreover, the consultants developed interactive tools that provide easy access to the database from a web-interface. Finally, the information was moved and translated into MS Excel, and we developed a simulation tool that gives the possibility to set up and try different scenarios of policy outcomes.

Parallel to this, 13 country studies were conducted targeting selected sectors. The aim of the country studies was to get concrete and practical examples from SMEs concerning administrative burdens and business opportunities. In each country, the case studies were complemented with interviews with expert SME organisations and/or national experts. Most interviews were carried out in person and some on the telephone. The cases studies and main findings have been summarised in country reports of 15-20 pages per country.

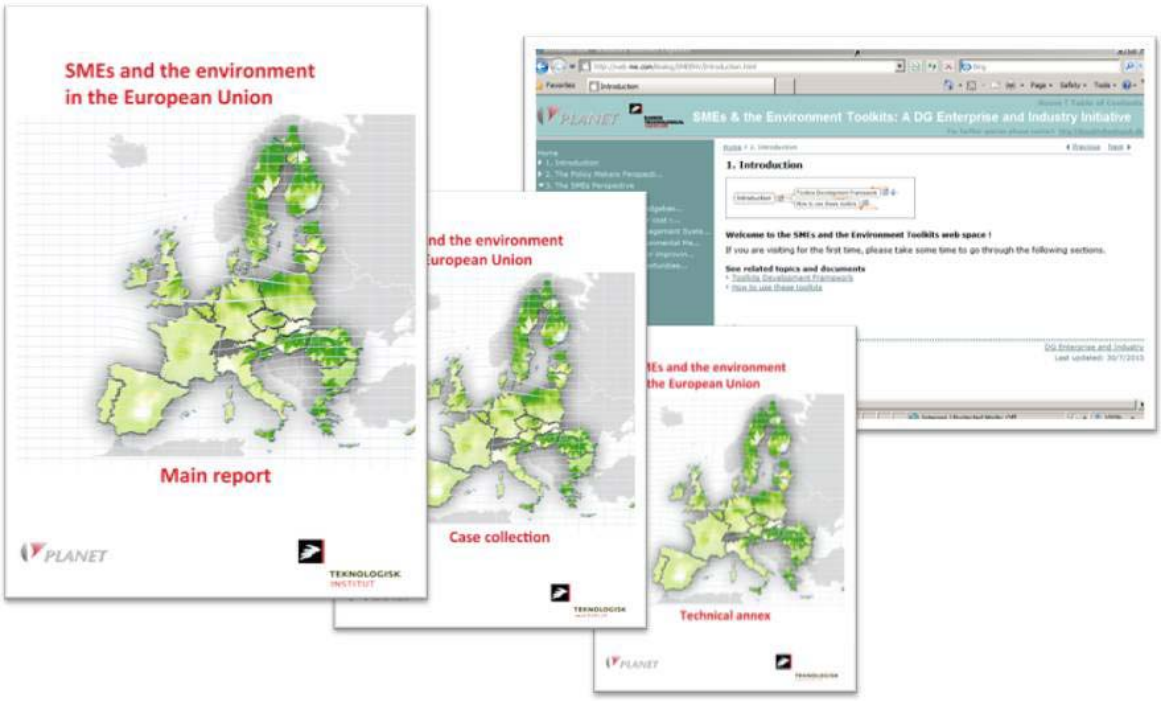
As a supplement to the literature and the concrete country reports, an e-survey has sent to a large number of SME organisations in the EU 27 countries. In total, 181 questionnaires were received; of these 142 questionnaires were fully completed while the rest of the questionnaires (39) were partly completed. The focus group was active in promoting the importance of the survey. To support the survey we developed a homepage with direct contact information to the project manager.

The country studies and the survey results are used as data material for the analysis of administrative burdens and business opportunities. However, the information gathered is valuable information and has also been published in annexes to the main report.

Finally, the information that we have gathered has been translated into interactive toolkits, which can quickly guide users through relevant information.

1.3 THE STRUCTURE OF THE REPORT

The structure of the reports



Summary and recommendations A. Database B. Administrative burdens C. Business opportunities D. Toolkits List of litterature	Case stories from 13 countries in the European Union	Methodology of the database Access and simulations explanied Overview of European Legislation Results of the online survey	WEB based toolbox

The outcome of the study is divided into several reports and files:

The main report contains a summary of conclusions and recommendations and the main analysis of domains A-D.

In the presentation of domain A, the structure of the database is presented and a section on the estimation of the green segment of SMEs is also provided. The complexity of the database does not allow for presentation of all the data in the report. Instead five electronic files have been developed and delivered with the report. The five files related to the database are

- 2 SPSS files: One containing the Environmental Impact Database for Small and Medium-sized Enterprises in Europe (EIDSME database) and another database containing informa-

tion on the green segment of enterprises in Europe. The SPSS files require the SPSS statistical program.

- 2 Flash files: One file with graphical, statistical information from the EIDSME database and another file with a map presentation of the EIDSME database. About 30,000 different maps of the environmental impact can be printed from this file. Both the files are in flash file format and can be opened through any web browser.
- 1 spreadsheet file. The final file to accompany domain A is a spreadsheet file containing a model for simulation of policies on with the data. It is a simple model and not a mathematical model for environmental impact in Europe. The spreadsheet needs at least version 2007 of MS Excel to run.

In the presentation of administrative burdens the requirements derived from environmental legislation, both EU and national, are presented before an analysis of the administrative burdens in different sectors. The data sources are literature, e-survey and country reports.

In the presentation of business opportunities, we present two different perspectives. One perspective is the internal opportunities the companies have by saving energy and optimising processes with instruments such as environmental management. The other perspective is the external opportunities for the company to be a part of – or deliver to – the eco-industry or just finding a competitive advantage by being able to deliver environmentally friendly products. Here the data sources are literature, e-survey and country reports as well

The case collection is a country-by-country report on the companies and the organisations we have interviewed in 13 European countries. The interviewed companies all have fewer than 250 employees.

The technical annex is organised in parallel to the main report. For domain A the technical annex contains an in-depth presentation of the methodology behind the database and supplementary tables of correlations and NACE codes. The access to the database through flash files is described in detail as well as the use of the simulation spreadsheet. For domain B, we provide an overview of the European environmental legislation. For domains B and C, we present the results and the questionnaire of the online survey.

Finally, we present an overview of **the toolkits** in the main report. However, the actual toolkits are delivered as a separate file, which can be accessed through an internet browser. The toolkits can be distributed via the internet or by CDs.

2 ENVIRONMENTAL IMPACT FROM EUROPEAN SMEs

2.1 INTRODUCTION

In the following, we outline the database concerning the environmental impact of European SMEs together with a discussion of the underlying methodology for its development. The terms of reference identify the purpose and content of the database accordingly

- Define relevant criteria for assessing SMEs' impact on the environment by sector and company size.
- The criteria should include the current take-up by SMEs of environmental and energy management systems (e.g. EMAS, energy savings systems), their level of investment in environmental and energy fields and their impact on climate change.
- Develop, according to these criteria, a database on SMEs' impact on the environment that could be used in future impact assessments for EU legislation.
- Map the groups of SMEs that have or do not have an important impact on the environment, and prioritise key SME groups to be tackled as regards their environmental impact.

The size and diversity of SMEs in Europe is enormous. Eurostat estimates that there are about 20 million enterprises in industry and services of which more than 99% are SMEs with fewer than 250 persons employed.[7] In fact, approx. 92% of the enterprises employ fewer than 10 persons.

Table 1: SME structure of the EU27 (2006)

		Enterprise size classes			
	Total	Large *(250+ persons employed)*	Medium *(50-249 persons employed)*	Small *(10-49 persons employed)*	Micro *(1-9 persons employed)*
Number of persons employed	129 754 720	42 360 134	22 027 425	26 938 777	38 428 189
Number of enterprises	20 156 779	42 245	219 956	1 388 759	18 505 812
Percent of persons employed	100%	33%	17%	21%	30%
Percentage of enterprises	100%	<1%	1%	7%	92%
			SMEs		

Note: Figures cover the EU27 and NACE sectors C-K (except sector J Financial intermediation). Source: Eurostat, 2006 and DTI estimations

[7] Legally SMEs are also defined by a financial threshold either based on annual turnover or balance sheet. In practice, however, most SME statistics rely solely on the staff headcount threshold as used here. See also

http://ec.europa.eu/enterprise/policies/sme/files/sme_definition/sme_user_guide_en.pdf

Almost 70% of the persons employed in private enterprises in Europe work in enterprises with fewer than 250 persons employed.[8]

The information on the 20 million enterprises is collected at national level in 27 countries – each with a different statistical tradition. In this relatively simple overview of the SME structure, all the data is in fact the result of a complicated data gathering process. The data has to be drawn from national statistics and other sources. In some cases the data is incomplete, confidential or cannot be compared in a number of ways. Thus, to present an overview of the EU27, Eurostat has found it necessary to add an element of estimation. As discussed in the section on data quality below, it is necessary to accept estimation as a method in the development of a database of the environmental impact of SMEs.

2.2 THE STRUCTURE OF THE DATABASE

2.2.1 PRESENTATION OF BASIC DATA STRUCTURE

The environmental impact database of SMEs has been designed with flexibility, transparency and upgradability in mind:

- *Flexibility* in choice of analytical software and in type of analysis to be performed is important. The data is organised by three sector level aggregations according to the standard NACE classification scheme of economic activities as well as by individual countries, thus allowing for a number of different cross-sections of data to be utilized. The data is kept in Excel and SPSS formats, but can be exported through CSV files to any other data management system not directly compatible with either of the two computer programs.

- *Transparency*. A large part of the information in the database is based on estimations. It is important that each piece of information can be traced from the database back through the estimation to the original data. We have noted the source of the data in the database, and this allows our analysis to be restricted to the original data or to be extended to include the full database with a combination of estimated and original data. The individual user of the database accordingly can choose the level of uncertainty that he or she is most comfortable to work with balancing the inherent trade-off between extent of information and extent of estimation. Moreover, this approach enables an assessment of the influence that working with more estimates has on the proposed effect of intended policy actions through repeat simulations with varying settings.

[8] Note that in statistical terms there is a distinction between the number of persons employed and employees. The number of persons employed thus is defined as the total number of persons who work in an enterprise including among others unpaid family members and not just the number of persons who have a contract of employment and receive compensation in the form of wages, salaries, fees, gratuities, piecework pay or remuneration in kind (the definition of employees).

- *Upgradeability*. The baseline year of the database is 2006, but future studies may wish to include newer data. This will be possible by updating the database with new original data and by following the procedures for estimation described in this report.

The database on environmental impact is grouped into three types of data:

Type 1: Structural data. The structural data describes the structure of European SMEs according to countries, sectors and enterprise size classes. The structural data is used to estimate the distribution of the environmental impact across countries and sectors when necessary and will be used to analyse the impact on the environment by different types of enterprises.

Type 2: Environmental indicators. The environmental indicators are data describing the input of raw materials and emissions to air, ground and water from SMEs. The environmental impact is calculated for all indicators according to the number of persons employed in the specific sector in the given type of country. In further analysis, normalising or ranking the data may be used to compare the environmental impact on different indicators and/or within different sectors.

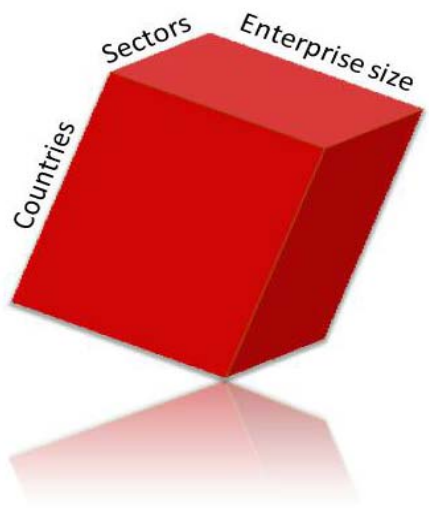
Type 3. **The green segment.** The data on the eco industries and the eco-efficient companies are organised a bit differently and this data has been gathered in a database for itself.

The information from type 1, 2 and 3 can be merged for specific analysis.

2.2.2 A MULTIDIMENSIONAL DATABASE: COUNTRIES, SECTORS AND SIZE

Most environmental indicators in the literature or in databases are aggregated figures per country. The challenge of this database has been to collect data on three dimensions, namely country, sector and enterprise size. The database dimensions enable a large number of possible views and perspectives on the data. The multidimensionality is excellent for analytical purposes, but it also presents challenges in collecting comprehensive data and presenting clear results in a few pages.

Figure 1: Overview of dimensions in the database



Country level data – all data in the database can be aggregated to country level and figures from different countries can be aggregated into any country group such as EU15, EU12, small countries, large countries or the EU27.

Sector level data – all data in the database is maintained at NACE Rev. 1.1 section, division and primary subdivision aggregation levels, which again can be combined into any group for analytical purposes such as high-tech sectors and low-tech sectors.

Enterprise size – all data in the database is measured or estimated according to the size of the enterprise, i.e. micro, small, medium and large. This allows analysis of micro-companies only or micro enterprises vs. large enterprises, or SME enterprises vs. large enterprises, etc.

2.2.3 DATA QUALITY AND ESTIMATION

In building a database concerning the impact of SMEs on the environment, comprehensive data on the SME structure in the EU27 and indicators of environmental impact are required. In addition, the statistical data and indicators identified for each group of SMEs, across sectors and countries, should preferably be as recent as possible to provide an up-to-date picture of SME contribution to environmental change.

However, national economic statistics generally do not tally with environmental data on emissions or waste generation, and there is no straightforward way to determine the environmental impact of a particular sector.[9] The overall estimation in the literature is that 60-70% of the industrial pollution in Europe can be contributed to SMEs. There is often a direct link between the level of output and the contribution to pollution that largely stems from the production process. Sometimes SMEs fully comply with legislation only after an inspection rather than a pro-active regular check of legal requirements[10]. Moreover, all in all, SMEs may not be as strictly regulated as large enterprises and may derive a lower financial benefits from investing in environmental protection measures (on a per Euro, per person employed basis).

Environmental data is collected nationally for a number of purposes, with different methods from country to country, and maintained in different databases. This fragmentation leads to obstacles in extracting and using the data for the present database on environmental impact.

[9] Commission staff working document {COM(2007) 379 final, SEC(2007) 907, SEC(2007) 908}

[10] . Fairman & C. Yapp, Making an impact on SME compliance behaviour: An evaluation of the effect of interventions upon compliance with health and safety legislation in SMEs, Kings College London for the Health and Safety Executive 2005, Research Report 366

This specifically applies to:

- Environmental data is seldom collected, organised or published according to sector and company sizes.
- Environmental data is neither collected for all countries nor for all sectors.
- Environmental data is idiosyncratically organised to highlight specific issues.

2.2.4 METHODOLOGY – A BRIEF INTRODUCTION TO ESTIMATIONS OF MISSING DATA

In building the EIDSME database, incomplete and missing data has been a fundamental condition. Even if indicators with as complete and updated datasets as possible are prioritised, estimation of certain sector sizes and environmental impacts is still necessary. There is no other alternative – either some estimation is accepted or there is no complete and comprehensive data at all.

Estimation should be understood as the reasoned approximation of an utilizable value when the real value is unknown. Indeed, for the purposes of this project estimation always builds on the calculation of logically possible values and on computed relationships with other (known) values.

However, this rigorous approach implies that some potentially relevant environmental indicators have to be left out of the database because an extensive lack of data makes it impossible to obtain solid estimates of missing values. The methodology behind estimation will briefly be introduced here and it is fully explained in the technical annex.

The process of estimating missing data in structural data has basically been a two-step process – first with logic and then with statistics.

Step 1: **Kakuro puzzle.** As the first step the missing values in the structural data have been estimated through an iterative process designed to extract as much new information as possible from the known information about the structure of each variable. Because of the hierarchical nature of the data is often possible to guess what the figure in missing cells must be. We have compared this logic to a sudoku or kakuro puzzle.

Step 2: **Estimating from similar activities in other countries.** In a second step the missing values have been tried to be estimated on the basis of the computed relationships between the structural variables – using knowledge about the number of enterprises to estimate the number of persons employed, and using knowledge about the number of persons employed to estimate turnover and value added. The idea of course is, on the one hand, that all other things being equal more of one unit systematically tends to imply more of the other, and, on the other hand, that enterprises engaged in similar economic activities even across borders tend to be relatively similar in other aspects as well.

In estimating environmental data it has only been possible to use estimation from similar activities in other countries.

2.3 THE STRUCTURE OF SMEs IN EUROPE

The primary source of data on the structure of businesses in Europe is Eurostat's Structural Business Statistics (SBS). SBS describes the economy through the observation of the activity of units engaged in particular economic activities. SBS answers questions such as "How much wealth is created in an activity?", "How many workers are needed to create this wealth?", "How many enterprises are involved?", "Where are they located?" and "What sectors do they belong to?".

SBS is an ideal source of data for the purposes of this study as it readily divides data by enterprise size classes, sectors and countries and provides comprehensive coverage of all EU27 countries with the exception of Malta (Malta's National Statistics Office's Business Register (BR), however, has kindly provided structural data on the number of enterprises and the number of persons employed by sector and enterprise size class derived from the Labour Force Survey[11]).

Even so, there are a number of limitations in the SBS database that have to be taken into account. The limitations are described in detail in the Eurostat documentation[12] and the next paragraph merely comprises two central excerpts from that documentation:

SBS data are generally collected by the National Statistical Institutes (NSI) among enterprises [and then reported to Eurostat]. The data are collected through statistical surveys, the business register or administrative sources. The NSIs can use one or several of these sources, according to the survey strategy they have adopted, taking into account the costs, the quality and the response burden on enterprises. Non-confidential national and EU data are released at the finest possible level of detail. Yet the general principle "the higher the level of aggregation (the more aggregated the data), the better the quality" applies to SBS. Detailed data for small countries should be used with a certain caution.

Naturally, any estimation error in the SBS data will be transferred to the present database and may be accentuated in some cases. For small sectors in small countries the estimation error might be greater than the estimation error for large countries.

To accommodate this uncertainty, three different sector level aggregations are included in the database based on the standard NACE classification scheme of economic activities (Rev. 1.1), with the least errors and the least detail in the highest aggregation (the section level) and a larger margin of errors and finer details in the lowest aggregation (the subdivision level)[13]:

[11] The National Statistics Office's Business Register (BR), 2008, Business Demographics: 2000-2008

[12] http://epp.eurostat.ec.europa.eu/cache/ITY_SDDS/EN/sbs_esms.htm

[13] NACE codes are very effective for statistical analysis but not so practical for use in graphs and presentations. If the codes are presented directly in graphs or tables the presentation is efficient – but incomprehensible to most people. If instead the title texts for the codes are used in graphs or tables the presentation is comprehensible to most people – but then the long titles leave almost no room for the graph or the data in the table. This is a catch-22. To solve this we have chosen to use the codes and if necessary we have used cropped titles. In the *technical annex* an overview of the NACE codes and their titles are presented in full to support the understanding the codes.

- **NACE sections –** C (Mining and quarrying), D (Manufacturing), E (Electricity, gas and water supply) , F (Construction), G (Wholesale and retail trade, repair of motor vehicles, motorcycles and personal and household goods), H (Hotels and restaurants), I (Transport, storage and communication), K (Real estate, renting and business activities)
- **NACE divisions –** CA (Mining and quarrying of energy producing materials), CB (Mining and quarrying, except of energy producing materials), DA, DB, DC, DE, DF, DG, DH, DI, DJ, DK, DL, DM, DN, EA, FA, GA, HA, IA, KA
- **NACE subdivisions –** CA10 (Mining of coal and ignite; extraction of peat) to KA74 (Other business activities)

Table 2: Overview of structural data

Indicator	Description	Unit
Country	Country – EU27	Typology
NACE	Division of enterprises into sectors based on Statistical Classification of Economic Activities in the European Community – NACE 1.1. Data can be broken down to a 2-digit level.	Typology
Demography		
Number of enterprises	The number of enterprises active during at least a part of the reference period.	No of enterprises
Number of persons employed	The total number of persons who work in the observation unit (inclusive of working proprietors, partners working regularly in the unit and unpaid family workers), as well as persons who work outside the unit who belong to it and are paid by it (e.g. sales representatives, delivery personnel, repair and maintenance teams). It excludes manpower supplied to the unit by other enterprises, persons carrying out repair and maintenance work in the enquiry unit on behalf of other enterprises, as well as those on compulsory military service.	No of persons
Output		
Value added at factor costs	The gross income from operating activities after adjusting for operating subsidies and indirect taxes. Value adjustments (such as depreciation) are not subtracted.	millions of €
Turnover	The totals invoiced by the observation unit during the reference period, and this corresponds to market sales of goods or services supplied to third parties; it includes all duties and taxes on the goods or services invoiced by the unit with the exception of the VAT invoiced by the unit to its customer and other similar deductible taxes directly linked to turnover; it also includes all other charges (transport, packaging, etc.) passed on to the customer. Price reductions, rebates and discounts as well as the value of returned packing must be deducted.	millions of €

Source: SBS, Eurostat http://europa.eu/estatref/info/sdds/en/sbs/sbs_base.htm

In the table below, the completeness of the structural business data is calculated for each activity level. The most important indicator is "No of persons employed" which after supplementing the known Eurostat SBS values with estimations is 100% complete at all three sector aggregation levels.

Table 3: Completeness of structural data

Indicator	Activity level	Known values (from Eurostat)	Estimated values	Unknown values
No of Enterprises	Section	98%	2%	0%
	Division	94%	6%	0%
	Subdivision	90%	10%	0%
No of persons employed	Section	95%	5%	0%
	Division	86%	14%	0%
	Subdivision	77%	23%	0%
Value added at factor cost	Section	90%	10%	0%
	Division	80%	19%	0%
	Subdivision	71%	29%	0%
Turnover	Section	90%	9%	0%
	Division	81%	19%	0%
	Subdivision	72%	28%	0%

Source: Eurostat, 2006 and DTI estimations. Percentages comprise total values and values for each of the four enterprise size classes, micro, small, medium and large.

The amount of data generated is rather impressive. The figures for each of the 27 countries are divided into sectors and then divided into five size categories (micro, small, medium, large and total) creating more than 10,000 cells of information for each indicator.

Thus, in the following, we present only a few tables to give a brief impression of the SME structure in the EU27. The tables are colour-coded as a heat chart with red colour highlighting the highest figures and green highlighting the lowest figures. On non-colour printers this will be illustrated by different shades of grey. The heat chart provides a guide to the reader of the table and has no additional meaning attached to the colour coding. In the same fashion, the highest totals are indicated with a red dot and the lowest totals are indicated with green dots.

Two comments should be taken into consideration when studying the following tables.

1. We are presenting aggregates from the top NACE division into sectors. With perfect data we would get the same results had we aggregated the data across NACE level 2 data or across NACE level 3 data. However, since the completeness of the data and the amount of estimation included differ, there are differences in the aggregates between levels. We have chosen only to present the aggregates at the top level because according to Eurostat these are the most reliable figures.

2. Since some estimation has been done for the purpose of creating a database, the totals differ somewhat from what is known in other presentations of the data.

2.3.1 THE NUMBER OF ENTERPRISES

Most European enterprises are SMEs. In 2006, Eurostat registered roughly 20 million SMEs, corresponding to 99.8% of all enterprises. A mere 0.2% of all enterprises have more than 250 persons employed. The Czech Republic, Greece, Malta and Poland have the highest shares of micro enterprises (95+%) and Italy the highest number of enterprises overall.

Table 4: The number of enterprises in the EU27, by country:

Country	Micro	Small	Medium	Large	Total	Pct
Austria	88%	11%	2%	0,3%	283.054	1%
Belgium	92%	7%	1%	0,2%	401.994	2%
Bulgaria	88%	9%	2%	0,3%	241.370	1%
Cyprus	92%	7%	1%	0,2%	43.317	0%
Czech Republic	95%	4%	1%	0,2%	856.559	4%
Denmark	87%	11%	2%	0,3%	207.336	1%
Estonia	83%	14%	3%	0,4%	43.138	0%
Finland	93%	6%	1%	0,3%	203.538	1%
France	92%	6%	1%	0,2%	2.332.399	12%
Germany	83%	14%	2%	0,5%	1.773.699	9%
Greece	96%	3%	0%	0,1%	829.029	4%
Hungary	94%	5%	1%	0,2%	543.135	3%
Ireland	82%	15%	3%	0,5%	92.669	0%
Italy	95%	5%	1%	0,1%	3.847.233	19%
Latvia	83%	14%	3%	0,3%	67.373	0%
Lithuania	88%	9%	2%	0,3%	125.936	1%
Luxembourg	87%	11%	2%	0,4%	23.434	0%
Malta	96%	4%	1%	0,1%	31.071	0%
Netherlands	90%	8%	1%	0,3%	516.865	3%
Poland	96%	3%	1%	0,2%	1.446.120	7%
Portugal	95%	5%	1%	0,1%	861.471	4%
Romania	88%	9%	2%	0,4%	438.840	2%
Slovakia	76%	19%	4%	1,0%	52.687	0%
Slovenia	93%	6%	1%	0,3%	96.317	0%
Spain	92%	7%	1%	0,1%	2.631.690	13%
Sweden	94%	5%	1%	0,2%	542.398	3%
United Kingdom	87%	10%	2%	0,4%	1.624.107	8%
Total	18.505.812	1.388.759	219.956	42.245	20.156.779	100%
Pct	92%	7%	1%	0,2%	100%	

Source: Eurostat, 2006 and DTI estimations. NACE section data.

By economic activity, the highest share of micro enterprises is within Real estate, renting and business activities (Computer and related activities, Research and development and Other business activities) and the highest number of enterprises overall within Wholesale and retail trade and repair. The smallest numbers of enterprises are by far within Mining and quarrying and Electricity, gas and water supply, which are also characterized by the lowest shares of micro enterprises.

Table 5: The number of enterprises in the EU27, by economic activity

NACE sector	Micro	Small	Medium	Large	Total	Pct
Mining and quarrying	71%	24%	4%	1.1%	20 703	0%
Manufacturing	81%	15%	4%	0.8%	2 308 810	11%
Electricity, gas and water supply	79%	11%	7%	3.1%	31 373	0%
Construction	91%	8%	1%	0.1%	2 902 346	14%
Wholesale and retail trade	94%	6%	1%	0.1%	6 334 118	31%
Hotels and restaurants	91%	8%	1%	0.1%	1 682 268	8%
Transport and communications	91%	7%	1%	0.3%	1 211 315	6%
Real estate, renting and business activ.	95%	4%	1%	0.2%	5 665 846	28%
Total	18 505 812	1 388 759	219 956	42 245	20 156 779	100%
Pct	92%	7%	1%	0.2%	100%	

Source: Eurostat, 2006 and DTI estimations. NACE section data.

2.3.2 THE NUMBER OF PERSONS EMPLOYED

Private enterprises in sections C to K include all the private sectors in the Eurostat SBS database except the financial intermediation industry (section J). Almost 130 million persons are employed in these sectors and one out of three is employed in large enterprises. Almost one third are employed by a micro enterprise.

Compared to the structure of enterprises, the distribution of persons employed varies more between countries. In Greece 58% are employed in micro enterprises whereas in Slovakia only 15% are employed in a micro enterprise. In Finland, Slovakia and the United Kingdom more than 40% work in a large enterprise.

Table 6: The number of persons employed in the EU27, by country

Country	Micro	Small	Medium	Large	Total	Pct
Austria	25%	23%	19%	33%	2 433 927	2%
Belgium	30%	22%	16%	33%	2 445 702	2%
Bulgaria	22%	24%	24%	30%	1 874 177	1%
Cyprus	39%	25%	20%	17%	220 264	0%
Czech Republic	29%	19%	20%	32%	3 539 482	3%
Germany	19%	22%	19%	40%	21 500 504	17%
Denmark	20%	25%	21%	34%	1 783 055	1%
Estonia	24%	28%	26%	22%	423 452	0%
Spain	38%	26%	15%	22%	13 907 780	11%
Finland	23%	19%	18%	41%	1 268 418	1%
France	25%	21%	16%	38%	14 662 802	11%
Greece	58%	17%	12%	13%	2 589 420	2%
Hungary	35%	19%	16%	29%	2 536 124	2%
Ireland	20%	26%	23%	32%	1 088 882	1%
Italy	47%	22%	12%	19%	15 176 780	12%
Lithuania	23%	25%	26%	25%	932 495	1%
Luxembourg	19%	24%	23%	33%	209 755	0%
Latvia	22%	28%	26%	24%	642 894	0%
Malta	34%	20%	20%	26%	112 137	0%
Netherlands	29%	21%	17%	33%	5 093 518	4%
Poland	39%	12%	19%	31%	7 881 747	6%
Portugal	42%	23%	16%	18%	3 301 200	3%
Romania	21%	20%	23%	36%	4 114 366	3%
Sweden	25%	21%	18%	36%	2 720 091	2%
Slovenia	28%	18%	21%	33%	597 014	0%
Slovakia	15%	18%	23%	44%	961 267	1%
United Kingdom	22%	18%	15%	45%	17 737 467	14%
Total	38 428 189	26 938 777	22 027 425	42 360 134	129 754 720	100%
Pct	30%	21%	17%	33%	100%	

Source: Eurostat 2006 and DTI estimations. NACE section data.

27% of persons employed in private enterprises in Europe are employed in Manufacturing, almost 50 times as many as within Mining and quarrying. The highest share of persons employed within micro enterprises are within Construction and within Hotels and restaurants (40+%).

Table 7: The number of persons employed in the EU27, by economic activity

NACE sector	Micro	Small	Medium	Large	Total	Pct
Mining and quarrying	6%	13%	13%	68%	733 145	1%
Manufacturing	14%	20%	25%	41%	34 406 131	27%
Electricity, gas and water supply	3%	5%	14%	78%	1 600 286	1%
Construction	42%	31%	16%	12%	14 089 209	11%
Wholesale and retail trade	39%	21%	13%	27%	31 671 143	24%
Hotels and restaurants	45%	27%	11%	18%	9 261 767	7%
Transport and communications	19%	15%	13%	53%	11 884 785	9%
Real estate, renting and business activ.	34%	17%	16%	33%	26 108 254	20%
Total	38 428 189	26 938 777	22 027 425	42 360 134	129 754 720	100%
Pct	30%	21%	17%	33%	100%	

Source: Eurostat, 2006 and DTI estimations. NACE section data.

2.3.3 TURNOVER

The direct contribution of SMEs to economic wealth can be measured by their contribution to turnover. The 33% of persons employed in large enterprises generate 42% of the turnover whereas the 30% of persons employed in micro enterprises generate just 19% of the total turnover (but as much as 35% in Greece, note however, the high proportion of persons employed in micro enterprises in Greece as well). France, Germany and the United Kingdom contribute the largest share of turnover overall.

Table 8: Turnover (millions of €) in the EU27 by country

Country	Micro	Small	Medium	Large	Total	Pct
Austria	18%	23%	22%	37%	€ 506 149	2%
Belgium	21%	20%	19%	39%	€ 796 132	4%
Bulgaria	20%	21%	22%	37%	€ 74 067	0%
Cyprus	30%	29%	24%	17%	€ 22 708	0%
Czech Republic	18%	18%	24%	41%	€ 324 538	1%
Denmark	23%	22%	22%	33%	€ 435 662	2%
Estonia	25%	29%	28%	18%	€ 36 191	0%
Finland	16%	14%	18%	52%	€ 340 696	2%
France	19%	19%	17%	44%	€ 3 197 686	14%
Germany	12%	16%	20%	52%	€ 4 322 906	19%
Greece	35%	23%	19%	23%	€ 289 033	1%
Hungary	21%	18%	19%	41%	€ 239 036	1%
Ireland	12%	20%	25%	44%	€ 330 514	1%
Italy	28%	23%	20%	29%	€ 2 773 486	12%
Latvia	23%	28%	28%	20%	€ 38 855	0%
Lithuania	13%	24%	27%	35%	€ 48 179	0%
Luxembourg	18%	24%	17%	42%	€ 76 252	0%
Malta	22%	22%	26%	30%	€ 12 204	0%
Netherlands	15%	21%	26%	38%	€ 1 129 874	5%
Poland	23%	14%	23%	41%	€ 595 103	3%
Portugal	26%	23%	22%	30%	€ 318 413	1%
Romania	16%	21%	21%	41%	€ 175 821	1%
Slovakia	13%	16%	21%	50%	€ 89 333	0%
Slovenia	20%	19%	24%	37%	€ 67 831	0%
Spain	23%	24%	20%	33%	€ 2 053 175	9%
Sweden	18%	18%	19%	44%	€ 605 897	3%
United Kingdom	14%	16%	18%	51%	€ 3 547 762	16%
Total	€ 4 177 553	€ 4 290 905	€ 4 459 776	€ 9 519 268	€ 22 447 502	100%
Pct	19%	19%	20%	42%	100%	

Source: Eurostat 2006 and DTI estimations. NACE section data.

One possible explanation of the distribution could be, that SMEs in general are more labour intensive with many small and not highly automated and less technologically developed companies.

Looking at turnover by economic activity, the largest turnover is within Wholesale and retail trade and repair, which is responsible for 37% of the generated turnover. The smallest sectors are Mining and quarrying and Hotels and restaurants which combined are responsible for less than 3% of the generated total turnover. Micro enterprises generate the largest shares of turnover within Construction, Real estate, renting and business activities and Hotels and restaurants at 30+% compared to 19% overall.

Table 9: Turnover (millions of €) in the EU27 by economic activity

NACE sector	Micro	Small	Medium	Large	Total	Pct
Mining and quarrying	7%	8%	20%	65%	€ 235 472	1%
Manufacturing	6%	13%	21%	61%	€ 6 817 030	30%
Electricity, gas and water supply	8%	7%	20%	66%	€ 933 310	4%
Construction	30%	29%	19%	21%	€ 1 553 776	7%
Wholesale and retail trade	23%	25%	21%	31%	€ 8 202 664	37%
Hotels and restaurants	40%	26%	12%	22%	€ 433 714	2%
Transport and communications	13%	15%	15%	57%	€ 1 742 328	8%
Real estate, renting and business activ.	36%	20%	18%	26%	€ 2 529 208	11%
Total	€ 4 177 553	€ 4 290 905	€ 4 459 776	€ 9 519 268	€ 22 447 502	100%
Pct	19%	19%	20%	42%	100%	

Source: Eurostat, 2006 and DTI estimations. NACE section data.

2.3.4 VALUE ADDED AT FACTOR COST

The share of the operating surplus in value added gives insight into the profitability of SMEs. This profitability measure is positively affected by labour productivity, and negatively by labour costs per employee. Micro enterprises contribute 21% of the value added with 30% of persons employed.

Table 10: Value added at factor cost (millions of €) in the EU27, by country

Country	Micro	Small	Medium	Large	Total	Pct
Austria	19%	20%	21%	40%	€ 137 648	2%
Belgium	19%	20%	19%	42%	€ 153 621	3%
Bulgaria	14%	18%	21%	46%	€ 11 815	0%
Cyprus	31%	26%	21%	21%	€ 7 555	0%
Czech Republic	19%	16%	20%	45%	€ 67 605	1%
Denmark	28%	21%	19%	32%	€ 117 563	2%
Estonia	21%	25%	30%	24%	€ 7 453	0%
Finland	19%	16%	18%	46%	€ 82 351	1%
France	21%	19%	16%	45%	€ 795 262	14%
Germany	16%	18%	19%	47%	€ 1 152 541	20%
Greece	35%	20%	17%	28%	€ 69 552	1%
Hungary	18%	16%	18%	48%	€ 42 005	1%
Ireland	12%	17%	23%	48%	€ 90 911	2%
Italy	33%	23%	16%	28%	€ 631 343	11%
Latvia	19%	27%	28%	26%	€ 8 734	0%
Lithuania	12%	23%	29%	36%	€ 10 016	0%
Luxembourg	24%	20%	19%	37%	€ 14 419	0%
Malta	21%	20%	23%	36%	€ 2 788	0%
Netherlands	20%	21%	21%	38%	€ 259 944	5%
Poland	18%	12%	22%	48%	€ 130 710	2%
Portugal	24%	22%	21%	32%	€ 71 397	1%
Romania	14%	16%	20%	50%	€ 35 113	1%
Slovakia	13%	15%	18%	54%	€ 18 050	0%
Slovenia	20%	19%	21%	40%	€ 15 758	0%
Spain	27%	24%	17%	32%	€ 536 808	9%
Sweden	20%	18%	18%	44%	€ 161 548	3%
United Kingdom	18%	16%	17%	49%	€ 1 072 552	19%
Total	€ 1 199 623	€ 1 078 212	€ 1 022 694	€ 2 404 505	€ 5 705 060	100%
Pct	21%	19%	18%	42%	100%	

Source: Eurostat 2006 and DTI estimations. NACE section data.

Whereas the largest share of turnover is generated within Wholesale and retail trade and repair, the largest share of value added is contributed by Manufacturing responsible for 30% of total value added. Micro enterprises generally contribute similar shares of value added as turnover within each economic activity.

Table: 11: Value added at factor cost (millions of €) in the EU27, by economic activity

NACE sector	Micro	Small	Medium	Large	Total	Pct
Mining and quarrying	12%	10%	14%	64%	€ 88 624	2%
Manufacturing	7%	15%	23%	55%	€ 1 711 704	30%
Electricity, gas and water supply	5%	5%	11%	79%	€ 203 916	4%
Construction	33%	32%	18%	17%	€ 510 105	9%
Wholesale and retail trade	27%	24%	18%	30%	€ 1 098 880	19%
Hotels and restaurants	35%	27%	14%	24%	€ 181 871	3%
Transport and communications	11%	12%	11%	65%	€ 652 544	11%
Real estate, renting and business activ.	36%	19%	17%	29%	€ 1 257 414	22%
Total	€ 1 199 623	€ 1 078 212	€ 1 022 694	€ 2 404 505	€ 5 705 060	100%
Pct	21%	19%	18%	42%	100%	

Source: Eurostat, 2006 and DTI estimations. NACE section data.

2.4 ESTIMATING THE GREEN SEGMENTS OF SMEs

The structural data in the environmental impact database for SMEs should include data on the current take-up on environmental and energy management systems and the level of investments in the environment and energy fields.

The objective of estimating the green segment of SMEs is to create a tool for estimating environmental effects by splitting the data material into green companies and non-green companies.

We defined the "green segment" as a sub-group of companies within a sector that has less impact on the environment than other companies in the sector. If we know the reduction in environmental impact on different indicators, we can distribute the environmental impact within a sector on green/non-green companies.

This would open analytical options of estimating the environmental effect by increasing the share of green companies within a sector or a country.

In this section we present data sources, which could be used for separating green and non-green companies.[14] The data sources are Eurostat, International Standards Organisation (ISO) and the European Commission.

We look at three different sources for estimating the green segment, namely the registration of EMAS systems, a 2008 survey on ISO 14001 systems, and a European survey among enterprises called Observatory 2007.

2.4.1 THE UPTAKE OF EMAS AMONG SMEs IN THE EUROPEAN UNION

Data on the uptake of EMAS environmental management systems is available from Eurostat.[15] In 2006, 3,506 private companies and public organisations had implemented an EMAS system.[16]

The 2009 count of the registrations by the Commission shows that 3,551 SMEs were EMAS registered. The distribution varies across countries. In 12 countries less than 10 SME companies has an EMAS registration, 9 countries has less than 100 SME companies has an EMAS registration. Austria had 194 EMAS registered SME companies, Italy 901, Spain 922 and Germany 944 SME companies. See the figure below.

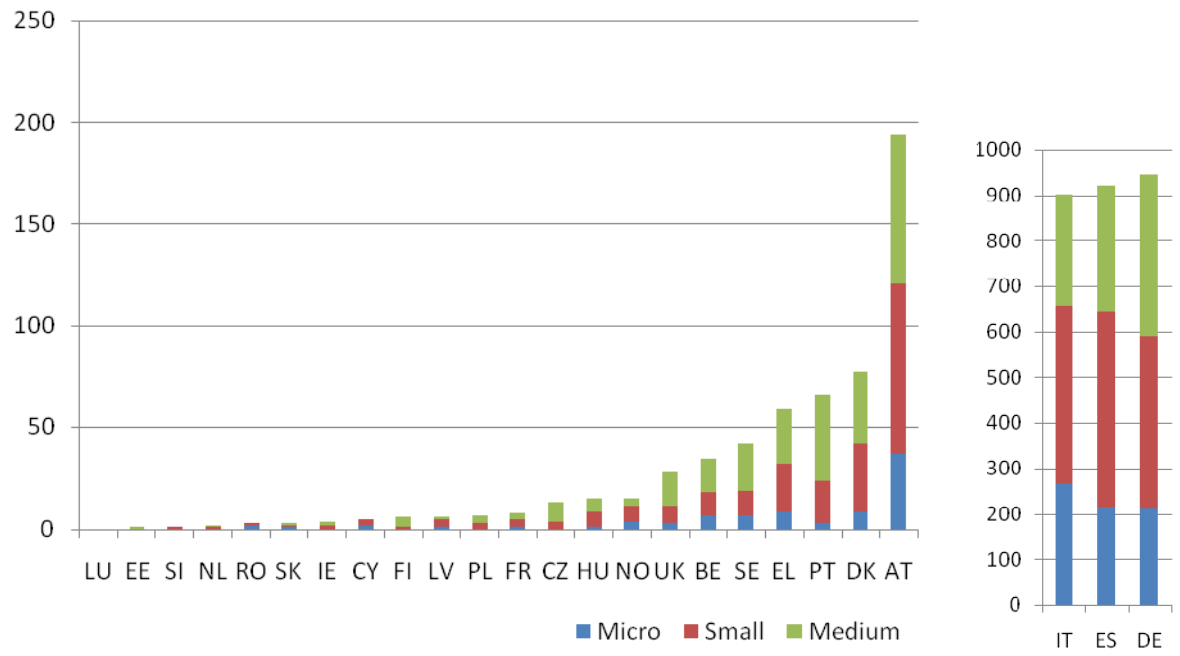
[14] We only have sector level data in the dataset –not data on individual companies. The data we are looking for is data which can estimate the share of green companies within a sector in a country.

[15] Eurostat data profile sheet:
http://epp.eurostat.ec.europa.eu/portal/page/portal/sdi/files/quality_profiles/ENTERPRISES%20WITH%20A%20REGISTERED%20ENVIROMENTAL%20MANAGEMENT%20SY.PDF

[16] http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&init=1&plugin=1&language=en&pcode=tsdpc410

A further analysis of the data by the Danish Technological Institute shows that of the 3,551 EMAS registered SMEs 2,634 SMEs belonged to NACE groups 10 – 74. The NACE group 10 – 74 are the NACE groups that we have included in the database. Excluded sectors are farming and forestry as well as public organisations. Among the 2,634 companies 82% of the EMAS registrations are from Germany, Italy and Spain. 23% of the SME registrations in EMAS are micro companies, 43% are small companies and 34% are medium sized companies. 338 SMEs registered EMAS companies are from sector DN37 (recycling), 223 SME companies are from HA55 (hotels and restaurants) and from sector DM34 (manufacturer of motor vehicles) 182 companies are registered. A table with the full analysis of EMAS registrations among SMEs per country and sector can be found in the technical annex.

Figure 2: Number of SME companies with an EMAS registration in EU member states.



Source: European Commission, 2009 data including computations by Danish Technological Institute. Please note that the graph has been divided in different scales. The graph on the left is countries with less than 100 registred companies. A total of 3.356 SME companies are registered.

2.4.2 THE UPTAKE OF ISO 14001 AMONG SMES IN THE EUROPEAN UNION

ISO 14001 is another international, and compared to EMAS arguably less rigorous, standard for environmental management. In terms of numbers, ISO 14001 has been more successful with more than 50,000 ISO 14001 certified companies worldwide in 2006. The most recent survey (2008) from the ISO organisation counted 38,419 ISO 14001 certified companies within the EU27 in sectors 10 – 74.

Other standards in the ISO 14001 series could be relevant as indicators of green companies:

- ISO 14004 provides guidance on the development and implementation of environmental management systems
- ISO 14010 provides general principles of environmental auditing (now superseded by ISO 19011)
- ISO 14011 provides specific guidance on audit an environmental management system (now superseded by ISO 19011)
- ISO 14012 provides guidance on qualification criteria for environmental auditors and lead auditors (now superseded by ISO 19011)
- ISO 14013/5 provides audit program review and assessment material.
- ISO 14020+ labelling issues
- ISO 14030+ provides guidance on performance targets and monitoring within an Environmental Management System
- ISO 14040+ covers life cycle issues

However, there is no company relevant information on these ISO 140xx tools.

The analysis of the data from the 2008 survey shows that 4,704 SMEs in the construction sector (FA45) have an ISO 14001 registration, 3,066 SMEs in the metal sector (DJ27) and 2,633 SMEs in other business activities (KA74). The technical annex shows a table with the full analysis of ISO 14001 registrations among SMEs per country and sector.

2.4.3 OTHER ENVIRONMENTAL MANAGEMENT SYSTEMS (EMS)

Apart from ISO 14001 and EMAS, there are a number of different national or regional schemes such as "123 environment " in France, "Bayrisches Umweltsiegel" in Germany, "Ecoprofit" and "Green Key". The project "Step up to EMAS" from the European Commission identified 39 different systems covering some 40,000 companies. The biggest of these is the "Green Office Management"[17] from WWF, which covers 31,000 companies[18].

Approx 80,000 companies have an EMS. (2,634 EMAS registered SMEs belonging to NACE groups 10-74 + 38,419 ISO 14001 certified companies in the same sectors + 40,000 using other EMS). This figure represents 0.4% of the 20 million enterprises in EU.

With about 80,000 EMAS/ISO 14001 and other EMS, about 0.4% of the total population of enterprises in the EU27 are covered by an environmental management system. Thus, the estimation of a green segment would yield very narrow segments of 0.00xx per thousand/sector.

If the green segment is equal to companies using EMAS/ISO 14001 and other EMS, the green segment in the EU27 is 0.4% of all companies.

[17] The WWF's Green Office is an Environmental Management System for offices encourages office staff to reduce the burdening of the environment and at the same time achieve savings in material and energy costs.
http://wwf.panda.org/what_we_do/where_we_work/greatermekong/our_solutions/projects/green_office/

[18] The Step-up to EMAS Study is found at the website for the European Commision:

http://ec.europa.eu/environment/emas/documents/kit_en.htm#stepUp

2.4.4 OBSERVATORY 2007 SURVEY

The last option for identifying the green segment is to use the results from the Observatory survey[19] series made for the European Commission. Here it is possible to make a less strict definition of the green survey.

The Observatory survey includes a few questions related to environmental management. The survey covers all of the EU27 countries and data can be divided according to country, sector (D – K) and company size. The question "Does the enterprise use an environmental management system or any other measures to save energy and resources?" has been used to identify the green segment.

Table 12: Observatory 2007: Identifying the green segment of SMEs in the EU27

Table showing the percentage of the EU27 companies using an environmental management system

Does the enterprise use an environmental management system or any other measures to save energy and resources?	Company size				
	Micro	Small	Medium	Large	Total
Simple rules or devices to save energy	29,0%	31,4%	34,0%	49,5%	29,5%
Yes, complex energy saving systems	3,6%	7,2%	6,5%	16,5%	4,1%
No	63,8%	59,3%	56,6%	29,7%	63,1%
Do not know/No answer	3,5%	2,0%	2,9%	4,4%	3,4%

Source: Observatory 2007: http://ec.europa.eu/enterprise/policies/sme/facts-figures-analysis/sme-Observatory/index_en.htm
Note that the answering categories are more focused on energy than the actual question; calculations by DTI.

The analysis of the Observatory data shows that about 4% of the enterprises in the EU27 use complex energy saving systems which, according to the question, could include EMAS and ISO 14001 systems. Furthermore, the analysis shows that the uptake of complex systems is much better among large companies than SMEs.

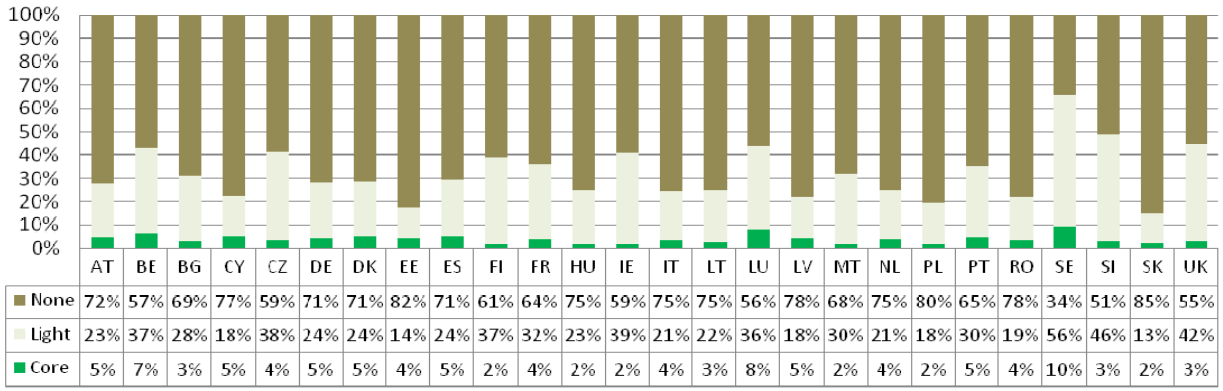
The question in the observatory has a very interesting additional answering category: companies that use simple rules or devices to save energy. In the EU27, 29.5% of the companies report using simple rules and devices. The figures illustrate that around the core green segment there is a cloud of light green companies using less complex and complete systems than EMAS, ISO 14001 or formal EMS to reduce their environmental impact. For many companies using a simple system may be fully appropriate to achieve environmental improvements.

[19] We have also checked the option of estimating the size of the green segment with the use of data on investments in green technologies or environmental improvements. However, the Eurostat data provides this information in terms of Euros rather than number of companies.

Especially for micro companies or small companies EMAS systems or ISO 14001 may be too complex or too expensive to implement. These simple systems are of interest if they are already delivering environmental results for SMEs.

There are some variations from country to country. Sweden, Luxembourg and Belgium have the highest percentages of core green companies with around 7 – 10% of the SMEs. In Hungary, Ireland, Finland, Poland and Slovakia about 2% of the SMEs can be considered core green companies. Systems are most widespread in sectors G wholesale and K business services.

Table 13: Green segment/non-green segments in the EU27 in percentage per country



	AT	BE	BG	CY	CZ	DE	DK	EE	ES	FI	FR	HU	IE	IT	LT	LU	LV	MT	NL	PL	PT	RO	SE	SI	SK	UK
None	72%	57%	69%	77%	59%	71%	71%	82%	71%	61%	64%	75%	59%	75%	75%	56%	78%	68%	75%	80%	65%	78%	34%	51%	85%	55%
Light	23%	37%	28%	18%	38%	24%	24%	14%	24%	37%	32%	23%	39%	21%	22%	36%	18%	30%	21%	18%	30%	19%	56%	46%	13%	42%
Core	5%	7%	3%	5%	4%	5%	5%	4%	5%	2%	4%	2%	2%	4%	3%	8%	5%	2%	4%	2%	5%	4%	10%	3%	2%	3%

Source: Figures calculated by DTI based on EIDSME database and the observatory 2007 figures.

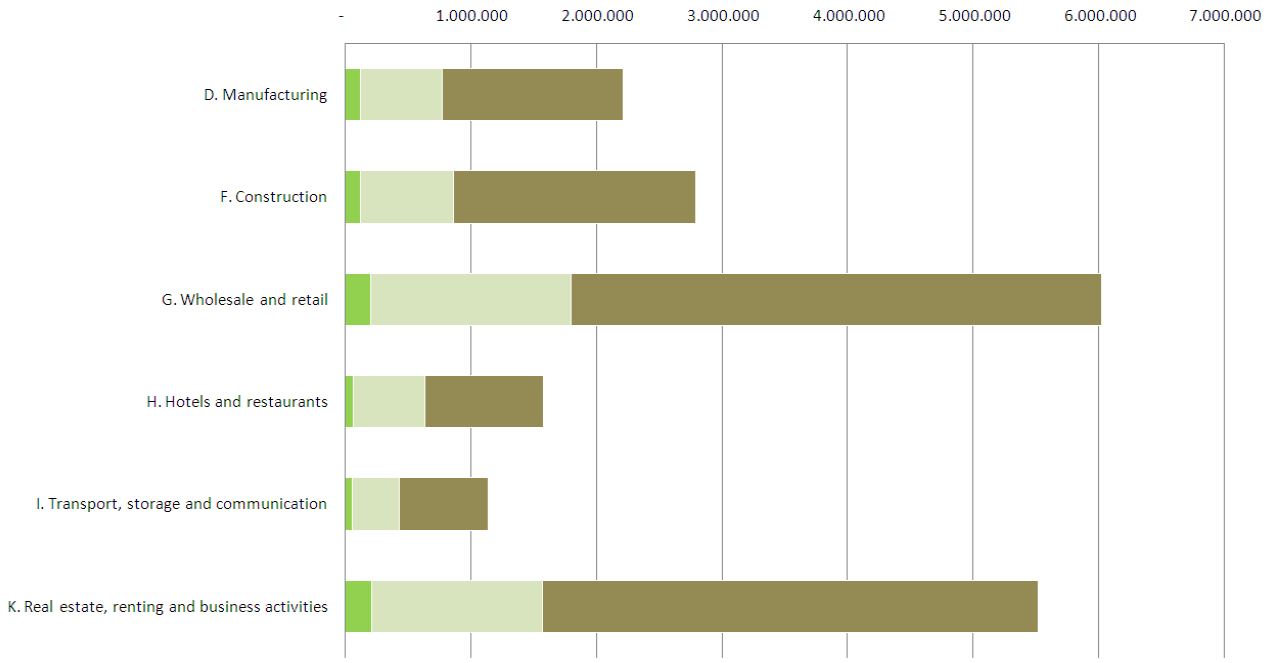
In the following analysis we have combined the information from the Observatory 2007 on the percentage distribution within sectors, company sizes and countries with the data in the EIDSME database.

This analysis allows us to estimate the number of enterprises using complex systems (the green core) and the number of companies using simple systems (light green) and the rest for each combination of sector, company size and countries.

According to the measurement, the green core consists of 777,695 enterprises in the included sectors D-K, the light green of 5.3 million companies and 13.2 million companies with no systems (19.2 million SME companies in total in the included sectors).

Table 14: Observatory 2007: Identifying the green segment of SMEs in the EU27

Table showing the estimated number of the EU27 companies using an environmental management system – or not.



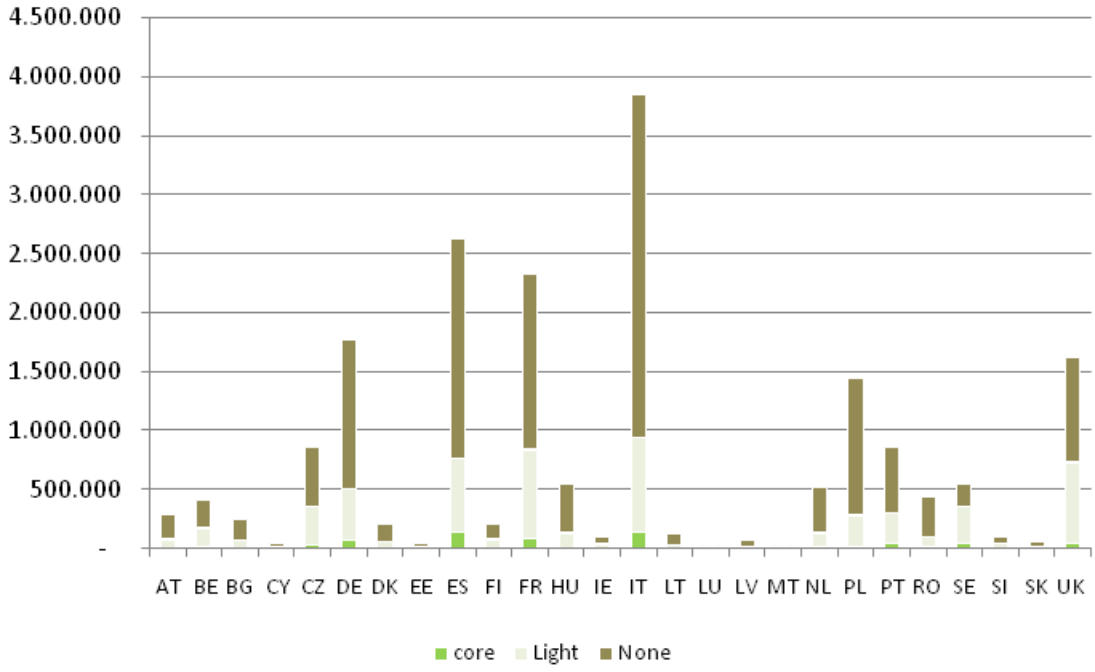
	K. Real estate, renting and business activities	I. Transport, storage and communication	H. Hotels and restaurants	G. Wholesale and retail	F. Construction	D. Manufacturing
Core	212.816	57.205	62.250	207.043	119.308	119.073
Light	1.355.357	377.460	573.509	1.593.799	741.342	656.858
None	3.954.429	705.043	942.577	4.224.631	1.931.173	1.439.536

Source: Figures calculated by DTI based on EIDSME database and the observatory 2007 figures.

For all sectors the size of the core green companies are 3.4–5.5% of the companies. In large sectors such as the G wholesale or the K real estate and business services this means that more than 200,000 SME companies can be estimated to be core green companies.

The same is true if the perspective is geographical. For most countries the share of core green companies is about 2-5%. Sweden is an exception with 10% of the companies as core green. For Luxembourg it is 8% and for Belgium it is 7%. The highest numbers of core green SMEs are in Spain (137,733) and Italy (143,205) which also has the highest number of companies.

Table 15: Green segment/non-green segments of SMEs in the EU27



Source: Figures calculated by DTI based on EIDSME database and the observatory 2007 figures.

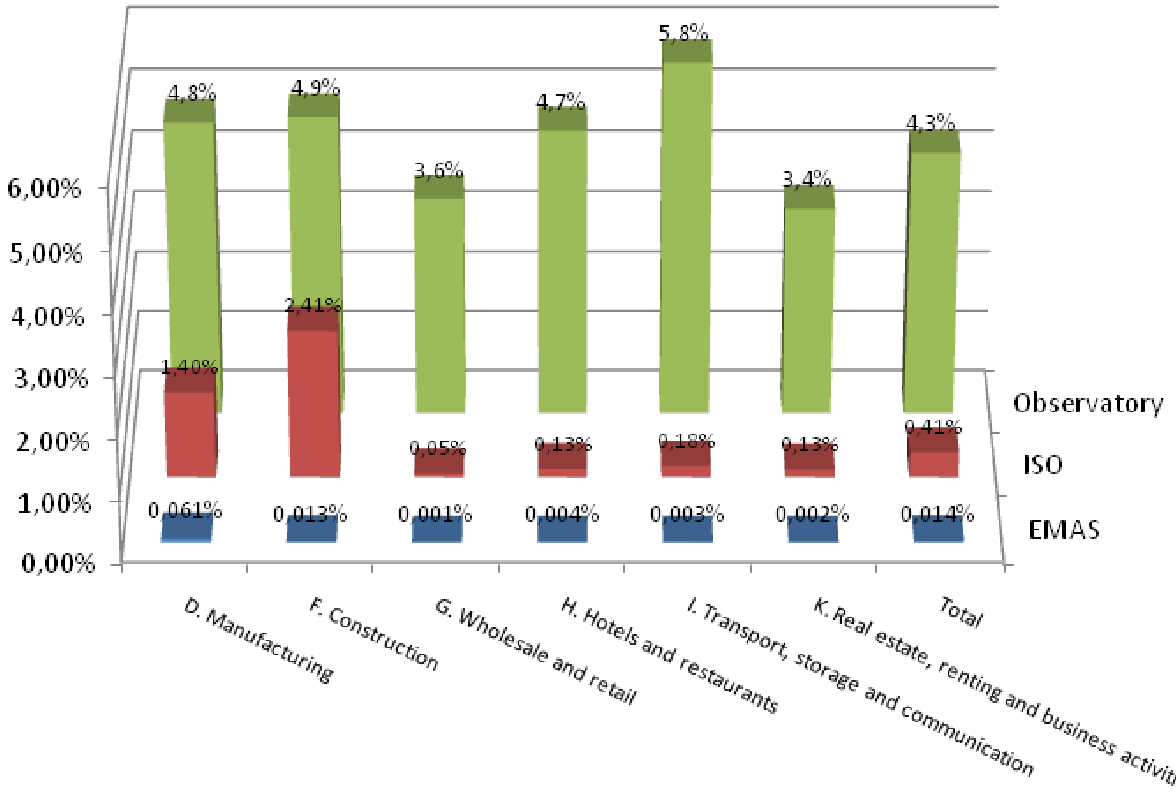
2.4.5 THE SIZE OF THE GREEN SEGMENT AND ITS IMPACT

The statistics on EMAS and ISO 14001 and the Observatory have been gathered into a single database file. The information from EMAS and ISO 14001 has a high correlation (0.91), which means that the two EMS systems have a very similar distribution across the sectors.

The correlation of the number of EMAS and ISO 14001 with the Observatory is statistically significant but at a lower level. The correlation is 0.32 between Observatory and EMAS and 0.28 between Observatory and ISO 14001.

The lower correlation is to be expected because the definition of a core green segment in the Observatory 2007 is less well defined compared to the strict definitions of either EMAS or ISO 14001.

Table 16: Average uptake of EMAS, ISO and complex systems in the EU



Source: European Commission, 2009 data Observatory 2008 and ISO survey 2008. Including computations by Danish Technological Institute. EMAS and Observatory data only for SMEs. ISO data for all sizes

The result of this analysis is that if the green segment is defined very narrowly, then companies using EMS systems such as EMAS, ISO 14001 or well defined national or sector-

specific systems approx. 80,000 companies in the EU27 belong to a green segment equal to about 0.4% of the companies in sectors D to K.

If the companies are asked if they comply to the wider and unspecified definition "we are using a complex energy management system" and we can accept this as a reasonable approximation of a core green segment, then the core green segment increase by a factor 10 to include almost 800,000 EU27 companies – equal to about 4% of the companies in sector C-K. These can be labelled the core green segment.

Moreover, we could choose an even wider definition of the green segment by using the definition of companies who "*use simple rules to save energy*". With that definition 5.3 million companies could be added – equal to 27% of the companies in these sectors. These companies could be labelled the light green segment.

Finally, the size of the EU27 green segment defined as enterprises using complex EMS systems corresponds to 0.4–4% of the companies. 84% of these almost 800,000 companies are SMEs. On top of this, we find approx. 27% or 5.3 million companies that use a simple system to some extent – of which about 90% are SMEs.

With the Observatory data we defined 3.6% micro companies, 7.2% small companies, 6.5 medium sized companies and 16.5% large companies as the core green segment.

This information can be used as input data in the EIDSME database to calculate an overall environmental effect of core segment industries to the environment in the EU 27. What is the overall reduction in environmental impact if the 800.000 companies, which according to the Observatory can be categorised as the core green segment, are reducing their impact? What if their overall reduction is assumed to be 10%? - what if 20%?

If it is *assumed* that core green segment of companies from the Observatory have reduced their impact on the environment by 10%, then a calculation with the data in the EIDSME database results in an overall effect of about a 0.9–1.3% reduction in the overall environmental impact for all companies in the EU27[20] depending on the indicator. If the *assumed* impact reduction from the core green segment is set to 20% then the overall environmental impact from the businesses in EU27 is reduced with about 1.9–2.5% depending on the indicator.

If we remove the 16.5% large companies from the equation, and assume a 20% reduction from the SMEs, then the overall reduction from core green SMEs in environmental impact in the EU27 is reduced to 0.4%-0.8%. In other words, the large companies are carrying the main part of the improvement. If the medium sized companies is removed from the equation as well, then the estimated 766.191 micro and small companies with 20% reduction would have an 0.2%-0.5% reduction effect on the overall impact from EU depending on the indicator. 766,200 small and micro companies are involved.

[20] The calculation has been used by using the share of core green companies according to the Observatory 2007 data in the simulator tool presented in the technical annex. The estimation is crude and considers only the distribution of companies across sectors. The environmental impact reduction is simply 10% or 20% for all environmental parameters.

If the strategy is reversed so that only large and medium sized companies are involved, then 21,269 companies are involved and the reduction – depending on indicator – would be 1.6%-2.6%.

In other words, *if* certified, systematic systems is primarily used by medium to large companies this may be reasonable in terms of costs and environmental benefit to both the companies and the environment.

The data on the green segment has been merged in a separate database on the green segment with information from the EIDSME database, EMAS registrations, ISO 14001 survey result and results from the observatory data.

By including just a few questions in surveys like the Observatory in the future it would be possible to obtain better insights into the size of the green segment, over time also the development and possible also statistical valid information on the reduced impact from the green segment.

2.5 SELECTION OF ENVIRONMENTAL INDICATORS

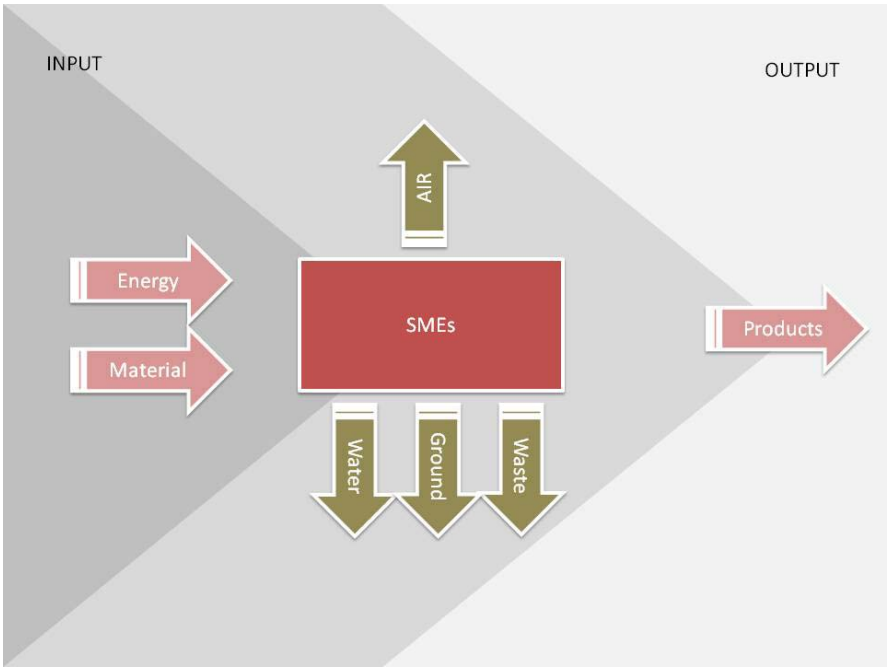
The objective of this section is to identify and present a relevant set of indicators of the environmental impact from SMEs in Europe.

In short, the environmental impact from enterprises comes from the use of different resources such as energy and materials, emissions in a broad sense in the form of impacts on air, ground and water and waste generation, and the environmental impact created by their products through use, disposal or recycling. Life Cycle Analysis (LCA) studies of the impact from products illustrate that the principal environmental impact from a given product may not be in the production of the product but in the use of the product, the disposal of the product or in the extraction of the raw materials to make the product.

However, our study has SMEs and their environmental impact as its immediate focus. The environmental impact from the products will not be included in the database. The figure below illustrates the environmental impact of generic SMEs with an input of energy and materials and output of products, but also wastes and emission to air, water and soil. It is a simple model inspired by the thinking in environmental management systems or environmental accounting systems. ISO 14031 on environmental performance evaluation standard presents a similar thinking.[21]

[21] Putnam, David, ISO 14031: *Environmental Performance Evaluation*, 2002. http://www.aipa.org/Adobe_Files/Conservation_Efficiency_Productivity_Etc/2002_09_ISO_14031_Environmental_Performance_Evaluation_David_Putnam.pdf

Figure 3: Environmental impact from SMEs



Overall, the set of indicators in the database concerning environmental impact of SMEs should:

- Be based on **readily available and routinely collected** data for the EU27 countries. By selecting readily available data it will be possible to develop the database further by updating the data with new statistics or to extend the database to cover time series.
- Be **consistent in space, sector and size coverage** and cover all or most of EU27 countries and all or most sectors. Complete and comprehensive datasets are prioritised. Drawing on data from different sources reduces the validity of the indicator and impairs the possibilities of updating the database. The better the coverage of countries, sectors and company sizes the less estimation is necessary.
- Be **close in time**. 2006 has been chosen as the baseline year for the data, and all data in the database is either from this year or very close in time to the baseline. Since the database does not contain time series, it is not a crucial criterion that the indicator includes a trend. Nevertheless, given the choice data from time series are preferable.
- Be **understandable and simple**. As it is, the results of the database are complex. Therefore, indicators which are as close to the environmental impact as possible are preferred rather than using indicators based on complex calculations. This principle also extends to estimating missing values. The more involved the estimation technique, the higher the risk of losing track of the meaning of the indicator.
- Be well **documented and of known quality**, provided with a clear definition (with units) and appropriate presentation of the indicator. Contradictory messages should not occur.

- Be **accepted as a valid indicator by most actors**. The chosen indicators should be considered valid by most actors in the industry and public authorities dealing with environmental issues. Generally acceptable indicators of environmental impact from SMEs are preferred to increase the use of the database.

This project is not the first project searching for indicators of environmental impact, and the inspiration for the selection of indicators comes from a number of sources. Below we present a selection of the existing environmental indicators and indicator projects.

The most important study for the present study is the core set of indicators (CSI) developed by the European Environmental Agency (EEA) in 2004.[22] The motivation behind the CSI was to provide a manageable and stable basis for indicator reporting, prioritise improvement in data flows and streamline EEA delivery of indicator contributions to other European and global indicator initiatives. The process eliminated 350 potential indicators before finally settling on a core set of 37 indicators regarding Air quality (6), Ozone depletion (1), Climate change (4), Biodiversity (4), Terrestrial (2), Water (7), Waste (2), Agriculture (2), Energy (5), Fishery (3), and Transport (3).[23]

In the present study we use the same variables wherever possible and relevant.

Other sources use similar sets of indicators. A predecessor to CSI was an EU funded study by Hertin et al. (2001), which identified a number of indicators to monitor the integration of environment and sustainable development into EU enterprise policy. The set of indicators developed by Hertin et al. was organised around the triple bottom line, i.e. economic results, social responsibility and environmental results or in more popular terms profit, people and planet. The interest here is the environmental indicators:

[22] http://themes.eea.europa.eu/IMS/whycsi

[23] http://themes.eea.europa.eu/IMS/CSI

Table 17: Environmental Indicators, Hertin et al. (2001)

Indicator	Sub-indicator	Measured as…
Energy use		Gross inland energy consumption per GDP (TOE per million Euro)
Air Emissions	Greenhouse gas emissions	Aggregated CO_2, N_2O and CH_4 emissions in million tonnes CO_2 equivalents
	SO_2 emissions	SO_2 emissions in million tonnes
	NOx emissions	NOx emissions in million tonnes
	VOCs emissions	VOC emissions in million tonnes
	Dust emissions	PM10 emissions in million tonnes
Transport	Freight transport	Freight transport by mode in tonnes kilometres
	Passenger transport	Passenger transport by mode in journeys
Waste		Waste generated from daily household and commercial activities in tonnes
Resources	Water	Use of public water in million tonnes
	Materials	Direct material input/total material requirement in million tonnes

Source: Hertin et al. (2001), Indicators for Monitoring Integration of Environment and Sustainable Development in Enterprise Policy, SPRU, University of Sussex, UK

Hertin et al.[24] also suggested indicators that could illustrate the integration of environmental considerations into industry. Examples are:

- **Patent applications** in the environment sector could be a proxy for technological innovation in the environmental sector. A possible data source is the European Patent Office.
- **Water used and waste generated** by industry per unit of value added in the industry sector. This indicator measures the eco-efficiency of industry in relation to water and waste.
- **Environmental management** by using the number of EMAS and ISO 14001 registered companies.
- Number of **start-ups offering new environmental services** – but there is no data available for this indicator.
- **Trade balance in environmental technology measured in Euro**. This indicator is a proxy for the international competiveness of the environmental technology sector.

[24] Hertin et. Al(2000), Report on SMEs and the Environment – for the European Commission, Directorate General Environment, Ecotec. The study was conducted by SPRU-Science and Technology Policy at the University of Sussex (UK) along with the Wuppertal Institute (D), Institute for Environmental studies at the Free University of Amsterdam (NL) and the Associazione Impresa Politecnico in Milano (I).

Another inspiration for selection of indicators is Calleja et al. (2004) Promoting Environmental Technologies.[25] The report provides an overview and good insight into the environmental issues in the selection of sectors with environmental impact.

Furthermore, on its website the EEA presents a number of different indicators sets[26] from LCA tools, international initiatives and environmental performance indicators.

Both the SDI data from Eurostat[27] and the environmental indicators from the OECD[28] are stored in databases with national sets of indicators of sustainable development strategies. Moreover, at the same level Yale University and Colombia University in the USA have developed the Environmental Performance Index in collaboration with the World Economic Forum and ISPRA. [29] The Environmental Performance Index is worth noticing because it attempts to calculate an aggregated EPI score per country. Aggregating across variables is like comparing not only apples and pears but the whole fruit bowl making the resulting EPI score per country an interesting starting point for discussions. Finally the EU Commission recently published an overview of relevant FP-funded research with sustainable development indicators.[30]

Two observations should be made from the sources mentioned above:

The first observation is that most indicator projects are concerned with the performance of nation states – not enterprises. Data from Eurostat is usually usable at sector level across the EU27 for environmental information. The data used by EEA is usually also to be found in Eurostat (with one notable exception, namely the European Pollutant Release and Transfer Register (E-PRTR), which at present covers approximately 24 000 of the most heavily polluting industrial facilities in Europe).

The second observation is that most indicator projects are hampered by missing data in parts or as a whole. It is impossible to develop indicators without some sacrifices, and it is only to be hoped that the data quality will improve in the future. Many of the indicators in other projects could be highly relevant for this project if they were broken down to sector level.

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[25] Calleja et al(2004) Promoting environmental technologies, IPTS, European Commission

[26] EEA: The Current Status of Concepts Relevant for Cleaner Technology Assessment at European Level, http://www.eea.europa.eu/publications/GH-07-97-595-EN-C2/3.html, accessed 13. December 2009

[27] Eurostat, Analysis of national sets of indicators used in the National Reform Programmes and Sustainable Development Strategies, 2007. http://epp.eurostat.ec.europa.eu/portal/page/portal/sdi/files/KS-RA-07-028-EN%5B1%5D_0.PDF

[28] OECD, Environmental indicators and outlooks – website and publications http://www.oecd.org/department/0,3355,en_2649_34283_1_1_1_1_1,00.html

[29] Environmental Performance Index, Columbia University, USA, 2007 http://sedac.ciesin.columbia.edu/es/epi/downloads.html#data

[30] Adelle, Camilla and Marc Pallemaerts, IEEP, Sustainable Development Indicators – overview of relevant FP-funded research and identification of further needs, European Commission, 2009 also consider the ECODRIVE project: Huppes et al., Measuring ECO-innovation: Framework and typology of indicators based on causal chains – final report of the ECODRIVE project, CML at Leiden University, 2009 (FP7), http://www.eco-innovation.eu/wiki/images/Ecodrive_final_report.pdf

2.5.1 OVERVIEW OF THE SELECTED INDICATORS

We have evaluated and selected a number of environmental indicators for the environmental impact database for SMEs. The indicators are listed below.

Table 18: Indicators of the environmental impact of SMEs in the EU27

Indicator theme	Included in database?	Indicator	Measured as…
Input			
Energy use	👍	**Energy consumption**	TOE – Tonnes of Oil Equivalents – in thousands tonnes. Can be estimated for most sectors – except incompatibility with regards to the transport sector
Resources	👎	**Water use**	Use of public water in million tonnes. The Eurostat data on water use is not consistent with either sector definitions or enterprise size classes
	👎	**Materials**	Direct material input/total material requirement in million tonnes. The Eurostat data on materials use is not consistent with either sector definitions or enterprise size classes
Emissions			
Greenhouse	👍	**Greenhouse gas emissions**	Aggregated CO_2, CH_4, N_2O, HFCs, PFCs and SF_6 emissions in tonnes of CO_2 equivalents.
Ozone depletion	👎	**Ozone depletion**	CFC, HCFC, HBFC, Halons
Air quality	👍	**NO_x**	NO_x emissions in tonnes of NO_2 equivalents
	👍	**SO_x**	SO_x emissions in tonnes of SO_2 equivalents
	👍	**NMVOC**	Non-methane Volatile Organic Compound emissions in tonnes
	👍	**Dust**	PM10 (Particle Matters of 10 micrometers or less) emissions in tonnes
Water emissions	👎		No relevant indicators found to be neither complete nor compatible.
Noise	👎		No relevant indicators found to be neither complete nor compatible
Ground emissions	👎		No relevant indicators found to be neither complete nor compatible
Waste	👍	**Nonhazardous Waste**	Nonhazardous waste generation from commercial activities in tonnes. Can be measured for most sectors except sections within service sector (G-K)
	👍	**Hazardous waste**	Hazardous waste from commercial activities in tonnes. Can be measured for most sectors except sections within service sector (G-K)

Indicator theme	Included in database?	Indicator	Measured as…
Products			
		LCA view	Data on products impact on environment from the EIPRO project has been considered, but ultimately lacked sufficient compatibility to be included in the EIDSME database.

The following table presents in overview the quality of the available data for each of the chosen environmental indicators, showing how many values it has been necessary to estimate across the three activity levels. In particular, little is known regarding emission levels across sectors of the three greenhouse gases HFCs, PFCs and SF_6, although to some extent accounted for by their likely specificity to a limited number of sectors.

Table 19: Completeness of environmental indicators

Indicator	Activity level (NACE)	Known values (from Eurostat)	Estimated values	Unknown values
Energy consumption	Section	96%	4%	0%
	Division	96%	4%	0%
	Subdivision	85%	15%	0%
CO_2	Section	53%	47%	0%
	Division	54%	46%	0%
	Subdivision	50%	50%	0%
CH_4	Section	50%	50%	0%
	Division	53%	47%	0%
	Subdivision	48%	52%	0%
N_2O	Section	52%	48%	0%
	Division	53%	47%	0%
	Subdivision	49%	51%	0%
HFCs	Section	15%	85%	0%
	Division	15%	85%	0%
	Subdivision	16%	84%	0%
PFCs	Section	19%	81%	0%
	Division	19%	81%	0%
	Subdivision	20%	80%	0%
SF_6	Section	26%	74%	0%

Indicator	Activity level (NACE)	Known values (from Eurostat)	Estimated values	Unknown values
	Division	27%	73%	0%
	Subdivision	27%	73%	0%
NO_x	Section	45%	55%	0%
	Division	49%	51%	0%
	Subdivision	45%	55%	0%
SO_x	Section	48%	52%	0%
	Division	48%	52%	0%
	Subdivision	45%	55%	0%
NMVOC	Section	52%	48%	0%
	Division	52%	48%	0%
	Subdivision	49%	51%	0%
PM10	Section	32%	68%	0%
	Division	32%	68%	0%
	Subdivision	31%	69%	0%
Non-hazardous waste	Section	50%	50%	0%
	Division	41%	59%	0%
	Subdivision	13%	87%	0%
Hazardous waste	Section	50%	50%	0%
	Division	41%	59%	0%
	Subdivision	13%	87%	0%

Source: Eurostat, 2006 and DTI estimations. Percentages comprise total values.

In the following, we present each of the environmental indicators in detail including an assessment of the quality of the data.

2.5.2 ENERGY CONSUMPTION

EU27 energy consumption is increasing. The fastest growing sectors are transport, households and services, whereas industrial energy consumption dropped on the average during 1990-2005 with the bulk of the drop in the industry during the early 1990s.

According to the EEA, this is largely the result of a shift towards less energy-intensive manufacturing industries as well as the continuous transition to a more service-oriented economy.

Transport is a matter of concern with higher volumes in goods transport, increased ownership of private cars and increases in passenger aviation.

In services, energy consumption grew by 22% from 1990 to 2005 due to increased demand for electrical appliances, in particular information and communication technologies and energy-intensive applications such as air-conditioning.

The type and extent of energy-related pressures on the environment both depend on the sources of energy, how they are used and on the total amount of energy consumed. One way of reducing energy-related pressures on the environment is to use less energy. This may happen by reducing the energy consumption in connection with energy-related activities (e.g. heating, personal mobility or freight transport), or by using energy in a more efficient way thereby using less energy per unit of demand, or from a combination of the two.[31]

The most detailed source concerning energy consumption is the annual statistics from Eurostat.[32] Energy consumption is calculated in TOE[33] (tonnes of oil equivalents) for different types of energy sources – including renewable energy. The database concentrates the total energy consumption rather than the different sources of energy as they depend more on tradition, available resources and national infrastructure than on the choice of the individual SME. It is assumed that individual SMEs mostly plug into the existing energy supply structure and rarely have any influence on the source of energy.

However, the total energy consumption is important because most SMEs have influence on the level of energy consumption and the energy performance of their enterprises.

The original dataset in the annual data is not entirely compatible with the NACE format, but for most sectors it is possible to estimate the total energy consumption by using the relative distribution of persons employed – an example of the original data from the Energy Balance Sheets by Eurostat is shown in Table 20 below.

For the energy data we have made no estimations of the totals because the dataset is complete for the sectors covered across the EU27. We have used the number of persons employed to estimate the energy use for each size class of enterprises within each country, however. Reasonably, this approach may even out some peaks in energy consumption within particular enterprises, for instance, within relatively large, fully automated car assembly facilities run by relatively small numbers of employees. The converse of the argument, though, is that other enterprises within the same economic activity (in principle other car assembly facilities) are likely to be similarly energy intensive, and that the distribution across enterprise size classes within the economic activity thus on average still will be fair.

[31] http://themes.eea.europa.eu/IMS/IMS/ISpecs/ISpecification20041007132121/full_spec

[32] Eurostat, Energy balance sheets, 2006-2007, 2009 edition

[33] The tonne of oil equivalent is a conventional standardized unit defined on the basis of a tonne of oil with a net calorific value of 41868 kilojoules/kg.

Table 20: Energy data from Energy Balance Sheets – example of detail level

Energy consumption in Belgium	1000 TOE
NACE	Total
All	**38165**
Industry (NACE D)	14429
1. Iron and steel (NACE1 27.1 + 27.2 + 27.3 + 27.51 + 27.52)	3284
2. Non-ferrous metals (NACE 27.4 + 27.53 + 27.54)	389
3. Chemical industry (NACE 24)	5123
4. Non-metallic mineral products (NACE 26)	1423
5. Ore-extraction (except fuels) (NACE 13 + 14)	92
6. Food, drink and tobacco (NACE 15 + 16)	1086
7. Textile, leather and clothing (NACE 17 + 18 + 19)	312
8. Paper and printing (NACE 21 + 22)	713
9. Engineering and other metal (NACE 28 + 29 + 30 + 31 + 32+ 34 + 35)	544
10. Other non-classified (NACE 20 + 25 + 33 + 36 + 37 + 45)	1463
Transport	9626
Households, commerce, pub. auth., ect.	14111
Households	8932
Agriculture	717

Source: Eurostat, Energy balance sheets, 2006-2007, 2009 edition

Transport is an important area. As described above the energy consumption of the transport sectors is of environmental concern. However, in the dataset the energy consumption from enterprises cannot be distinguished from the energy consumption from private or public bodies. A few estimates exist at national level in the literature but not enough to estimate the energy use from private SMEs in 27 different countries all with different infrastructure.

One solution to including transport data could be to include only the transport figures for the sector at section and division levels (I and IA respectively). This would mean that the energy consumption of the transport sector would be overestimated in the data for the two top levels, because the figures include public and household transportation as well.

The solution we have chosen is to make a linear estimation of the energy consumption for the transport sector based on the existing information regarding number of persons employed, emissions of greenhouse gases and particle matter (PM10) and waste generation. The model on known figures has an explained variance (Pearson's adjusted R^2) of 0.726.

Table 21: Total energy consumption in EU27 (thousands of TOE), by country and economic activity

	C	D	E	F	G	H	I	K	Total	Pct
AT	1%	54%	18%	7%	6%	2%	8%	4%	13 540	2%
BE	0%	65%	12%	6%	6%	2%	5%	5%	20 279	4%
BG	2%	55%	22%	3%	4%	1%	12%	2%	6 473	1%
CY	0%	37%	3%	10%	8%	5%	34%	3%	707	0%
CZ	1%	62%	14%	4%	7%	2%	6%	5%	14 402	3%
DE	1%	53%	15%	4%	8%	2%	10%	7%	96 508	17%
DK	1%	28%	15%	4%	5%	1%	41%	4%	8 861	2%
EE	1%	56%	13%	9%	7%	1%	8%	5%	1 420	0%
ES	1%	52%	19%	4%	6%	2%	11%	5%	45 696	8%
FI	0%	66%	8%	12%	4%	1%	7%	3%	17 106	3%
FR	0%	49%	15%	5%	9%	2%	10%	9%	63 937	11%
GR	1%	39%	22%	7%	8%	3%	17%	3%	8 966	2%
HU	0%	43%	19%	2%	10%	2%	16%	8%	7 695	1%
IE	3%	55%	4%	4%	9%	4%	16%	6%	4 572	1%
IT	0%	59%	13%	4%	7%	2%	8%	6%	59 897	11%
LT	0%	33%	32%	5%	7%	1%	20%	3%	2 802	0%
LU	1%	57%	2%	21%	2%	1%	14%	3%	1 301	0%
LV	1%	38%	6%	9%	13%	2%	25%	7%	1 573	0%
MT	0%	37%	25%	3%	7%	4%	20%	4%	405	0%
NL	1%	44%	25%	3%	7%	2%	12%	8%	28 372	5%
PL	1%	49%	22%	3%	7%	1%	14%	3%	32 896	6%
PT	1%	60%	9%	5%	7%	2%	10%	5%	8 530	2%
RO	1%	55%	25%	4%	5%	1%	8%	2%	16 199	3%
SE	2%	60%	8%	6%	5%	1%	13%	5%	18 926	3%
SI	1%	61%	4%	6%	5%	1%	18%	3%	2 500	0%
SK	1%	54%	26%	2%	7%	1%	6%	4%	8 106	1%
UK	0%	37%	19%	9%	6%	2%	21%	6%	72 779	13%
Total	3 740	287 775	93 204	28 896	38 620	10 957	68 369	32 887	564 448	100%
Pct	1%	51%	17%	5%	7%	2%	12%	6%	100%	

Source: Eurostat, Energy balance sheets, 2006-2007, 2009 edition and DTI estimations. NACE section data. TOE is Tonnes Oil Equivalents. C (Mining and quarrying), D (Manufacturing), E (Electricity, gas and water supply), F (Construction), G (Wholesale and retail trade, repair of motor vehicles, motorcycles and personal and household goods), H (Hotels and restaurants), I (Transport, storage and communication), K (Real estate, renting and business activities).

2.5.3 GREENHOUSE GASSES

Climate changes pose serious environmental, social and economic threats not only to countries within the EU, but to all countries and populations.[34] It is suspected that atmospheric phenomena such as a thinning ozone layer and rising average world temperatures over time may alter natural ecosystems and human habitats as well as productive opportunities significantly resulting in hunger, disease and mass migration – or worse. Accordingly, limiting the manmade (or anthropogenic) contributions to such changes has become a priority policy area at both national and international levels.

In particular, attention in recent years has centred on the impact of human activities on the greenhouse effect in which the absorption of infrared radiation by the atmosphere warms the Earth. For instance, the Intergovernmental Panel on Climate Change (IPCC) asserts that most of the global warming trend currently observed is likely attributable to the added human emissions of greenhouse gases causing natural concentrations, and consequently the greenhouse effect, to go up. Human emissions of greenhouse gases are also the main focus of the often cited Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC or FCCC), signed and ratified by all EU Member States and by the EU itself. In the 1997 COP3 Protocol, the Member States, with the exception of Cyprus and Malta, committed themselves to reducing their aggregate production of six types of greenhouse gases by 8% below 1990 levels before the year 2012, and the EU is now aiming at further reductions of 20% or more in emissions of these gases by 2020 (either unilaterally or building on the new 2009 COP15 agreement).

To attain the goals thus set up, the FCCC is monitoring annual national human emissions of the six greenhouse gases (or GHGs) covered by the Kyoto Protocol, namely:

- *CO_2 (carbon dioxide)*. Carbon dioxide is a naturally occurring gas and a by-product of burning fossil fuels or biomass, of land-use changes and of industrial processes. It is the principal anthropogenic greenhouse gas that affects the Earth's radioactive balance. It is the reference gas against which other greenhouse gases are measured and therefore has a Global Warming Potential (GWP) of 1.
- *CH_4 (methane)*. Methane is the major component of natural gas and associated with all hydrocarbon fuels, animal husbandry and agriculture (particularly wet rice cultivation). Its GWP, applying the modified AR4 approach to adjust for the differing lengths of time GHGs remain in the atmosphere and their relative effectiveness in absorbing outgoing infrared radiation over a 100-year time frame, is 25 (i.e., the impact of 1 unit of CH_4 is equal to 25 units of CO_2).
- *N_2O (dinitrogen oxide or more commonly nitrous oxide)*. Nitrous oxide is a naturally occurring gas, and a by-product of agriculture (fertiliser application and leaching) and the manufacture of adipic acid (a feedstock for nylon manufacture) and nitric acids. N_2O also arises from combustion processes in the power generation sector and from road transport. Its GWP is 298.

[34] Note though that some areas and sectors might also benefit from, for instance, rising temperatures, such as the agricultural sector in Northern Europe.

- *HFCs (hydro fluorocarbons)*. Hydro fluorocarbons are produced commercially as a substitute for chlorofluorocarbons (CFCs *also commonly referred to by their DuPont trade name as freons*). HFCs are largely used in refrigeration and semiconductor manufacturing. Their GWP range from 124 to14,800.
- *PFCs (per fluorocarbons)*. Per fluorocarbons are by-products of aluminium smelting and uranium enrichment. PFCs also replace CFCs in manufacturing semiconductors. Their GWP range from 7,390 to 12,200.
- *SF_6 (Sulphur hexafluoride)*. Sulphur hexafluoride is a chemical largely used in heavy industry to insulate high-voltage equipment and to assist in the manufacturing of cable-cooling systems and semi-conductors. Its GWP is 22,800.

Human emissions of the six GHGs listed in the Kyoto Protocol (in addition, water vapour, H_2O, and ozone, O_3, constitute significant GHGs in the Earth's atmosphere together with the banned chemicals CFCs and hydro chlorofluorocarbons, HCFCs, regulated by the Montreal Protocol, see further below) also have been identified by the EEA as belonging to its Core Set of Indicators and by the OECD as a Key Environmental Indicator.

On this background, knowledge about SME contributions to the human emissions of GHGs would appear to be a pertinent addition to the database of environmental impact.

Unfortunately, no data distinguishing between the GHG emissions of different enterprise size classes exists. Moreover, there is a tendency for the data on GHG emissions that does exist to be grouped in accordance with the IPCC or EEA sector classification schemes that does not translate well into the more detailed NACE code nomenclature applied.

Nonetheless, Eurostat has published some good quality data in a NACE code format providing decent coverage of 2006 emissions for especially CO_2, CH_4 and N_2O. At least 50% of all national sector divisions down to subdivision level are available for these three GHGs, whereas at most 27% of national sector divisions are available for the other three GHGs. It should be noted, however, that emissions of HFCs, PFCs and SF_6 are much rarer, which may account for part of the missing data (i.e. values may be lacking simply because the reporting categories are irrelevant for entire sector groupings). Furthermore, based on the available data it is still possible to estimate emissions for 100% of all national sector divisions down to the subdivision level for each of the six GHGs.

An aggregate indicator is calculated to show the total emissions of all six GHGs in thousands of CO_2 tonnes equivalents by country and economic activity. By this measure, Germany, the United Kingdom and Italy are the largest GHG emitting countries and the sectors: Manufacturing and the Energy, gas and water supply variably the largest and second-largest GHG emitting sectors.

Table 22: GHG emissions in EU27 (thousands of tonnes CO2 equivalents), by country and economic activity

	C	D	E	F	G	H	I	K	Total	Pct
AT	2%	49%	21%	5%	6%	2%	13%	2%	62 547	2%
BE	0%	47%	31%	3%	5%	1%	11%	2%	67 780	2%
BG	3%	22%	63%	2%	2%	0%	7%	0%	63 271	2%
CY	0%	23%	31%	4%	7%	2%	32%	1%	5 704	0%
CZ	10%	26%	52%	2%	2%	0%	7%	1%	111 608	3%
DE	2%	30%	51%	2%	4%	1%	9%	2%	739 243	20%
DK	2%	10%	28%	2%	2%	0%	54%	1%	97 660	3%
EE									-	0%
ES	1%	43%	17%	7%	8%	1%	19%	4%	261 361	7%
FI	1%	35%	37%	2%	3%	0%	20%	1%	46 872	1%
FR	1%	52%	16%	3%	6%	2%	16%	4%	269 719	7%
GR	5%	31%	28%	3%	9%	1%	20%	2%	61 069	2%
HU	1%	36%	42%	2%	4%	0%	13%	2%	86 395	2%
IE	2%	38%	32%	1%	5%	2%	18%	2%	34 542	1%
IT	1%	41%	37%	2%	5%	1%	11%	2%	405 320	11%
LT	0%	39%	20%	4%	8%	1%	26%	2%	19 878	1%
LU	0%	37%	19%	5%	4%	1%	32%	2%	6 228	0%
LV	1%	19%	58%	2%	4%	0%	14%	1%	24 894	1%
MT	1%	19%	49%	2%	4%	1%	22%	2%	4 024	0%
NL	2%	35%	32%	2%	4%	1%	18%	4%	156 463	4%
PL	4%	25%	54%	1%	1%	0%	14%	0%	328 362	9%
PT	1%	40%	35%	5%	3%	1%	13%	1%	55 781	2%
RO	32%	16%	37%	2%	4%	0%	8%	1%	149 337	4%
SE	1%	39%	16%	6%	6%	1%	28%	4%	52 346	1%
SI	1%	18%	45%	1%	2%	0%	33%	1%	14 715	0%
SK	4%	37%	48%	1%	2%	0%	7%	1%	59 800	2%
UK	6%	24%	41%	3%	4%	1%	20%	1%	470 016	13%
Total	137 989	1196 721	1418 769	92 240	155 903	28 255	550 552	74 507	3 654 936	100%
Pct	4%	33%	39%	3%	4%	1%	15%	2%	100%	

Source: Eurostat 2006 and DTI estimations. NACE section data. CO2 tonnes equivalents calculated by DTI with the formula CO2 + CH4 * 25 + N2O * 298 + HFCs + PFCs + SF6 (the latter three reported by Eurostat in CO2 tonnes equivalents from the outset). C (Mining and quarrying), D (Manufacturing), E (Electricity, gas and water supply), F (Construction), G (Wholesale and retail trade, repair of motor vehicles, motorcycles and personal and household goods), H (Hotels and restaurants), I (Transport, storage and communication), K (Real estate, renting and business activities)

2.5.4 AIR EMISSIONS

Substances emitted into the atmosphere by human activities cause numerous environmental problems, including acidification, air quality degradation, damage and soiling of buildings and human and ecosystem exposure to hazardous substances. Air emissions also contribute to global warming and climate change as well as stratospheric ozone depletion. Both are covered above and are not included in this section.

Four major polluters are described, namely sulphur oxides (SO_x), nitrogen oxides (NO_x), Non-Methane Volatile Organic Compounds (NMVOC) and Particulate Matter (PM), all of which are significant contributors to air pollution. One source of data for all four pollutants is the officially reported emission data included in the EMEP (European Monitoring and Evaluation Programme) Centre on Emission Inventories and Projections (CEIP)s´ database.[35] The database is structured so that emissions can be divided by countries, although it is not possible to make a division along the NACE sector codes. This is, however, possible in the Eurostat database, making it a more comprehensive tool, and a database more suited to the needs of the present study.

- *SO_x (sulphur oxides)*. Sulphur dioxide (SO_2) is the most common sulphur oxide, while sulphur trioxide (SO_3), an intermediate product during the manufacture of sulphuric acid, is a less important emittant, although it also contributes to acid rain in its gaseous form. The main emission source of SO_2 is the burning of fossil fuels. Power stations, oil refineries and other large industrial plants contribute the majority of the total mass released, while motor vehicles and domestic boilers are other emission sources. From 1970 to 1998, the amount of SO_x being released into the atmosphere annually was reduced by 75%, mainly through a decrease in the use of coal for power generation by replacing coal with natural gas. However, SO_x remains a significant pollutant today. SO_x emissions are measured in tonnes of SO_2 equivalents.
- *NO_x (nitrogen oxides)*. The most important nitrogen oxides are nitric oxide (NO) and nitrogen dioxide (NO_2). Other less important oxides of nitrogen are nitrogen trioxide (NO_3), nitrous oxide (N_2O covered above), N_2O_4 and N_2O_5. Major man-made releases of nitrogen oxides are primarily from fuel combustion, biomass burning and some production processes. Nitrogen containing species deposited on plants can act as nutrients, However, high levels of NO_2 and NO are damaging to plant life. Nitrogen dioxide is also one of the gases that contribute to acid rain causing damage to vegetation, buildings and contributing to the acidification of lakes and streams. NO_x emissions are measured in tonnes of NO_2 equivalents.
- *NMVOC (Non-Methane Volatile Organic Compounds)*. Volatile Organic Compounds (VOCs) are organic chemical compounds that under normal conditions are gaseous or can vaporise and enter the atmosphere. As such they contribute to the formation of ground-level ozone, which is harmful to human health and vegetation when present at high concentrations. VOCs include such compounds as methane, benzene, xylene, propane and butane. Methane is primarily emitted from agriculture (from ruminants and cultivation) and accounted for above as a GHG, whereas Non-Methane VOCs (NMVOCs) mainly are emitted from transportation, industrial processes and use of organic solvents.[36] NMVOCs are measured in tonnes.
- *PM (Particulate Matter – in common parlance also often simply referred to as dust*) is made up of a complex mixture of many different particles including soot (carbon), sulphate particles, metals and inorganic salts such as sea salt. The particles vary in size and shape and are classified on the basis of their size. The CEIP database contains information of PM10 and PM2.5, i.e. particulates with a maximum diameter of 10 and 2.5 micrometers respectively.

[35] http://www.ceip.at/emission-data-webdab/emissions-as-reported-by-parties/

[36] http://www.eea.europa.eu

PMs generally are produced as an accidental by-product of various chemical or physical processes although many industrial processes also use powders and dusts as a normal input into manufacturing and processing operations. Soot particles are released into the air from combustion processes like coal burning, road transport, waste incineration and other industrial processes. Sulphate particles can arise from combustion of fuel containing sulphur, either directly or by subsequent chemical reactions of sulphur dioxide with other airborne species. Other types of particulates are created by construction and quarrying. PM emissions are measured in tonnes.

The tables below show air emissions of NOx, SOx, NMVOCs and PMs by country and economic activity. The tables reveal considerable variations in the distributions across countries and sectors and some potentially unexpected values. Most if not all concentrations of emissions are directly attributable to the size or structure of single subdivisions within the particular country sectors. Thus, for instance, the extremely high NOx and SOx values within Transport, storage and communication in Denmark largely are due to the substantial shipping industry relying on heavy fuel oils, and, similarly the high SOx values within Energy, gas and water supply in Bulgaria may be explained by substantial use of low quality coal for energy production.

Table 23: NOx emissions in EU27 (tonnes of NO2 equivalents), by country and economic activity

	C	D	E	F	G	H	I	K	Total	Pct
AT	1%	25%	7%	11%	8%	1%	44%	3%	150 928	1%
BE	1%	29%	16%	7%	5%	0%	39%	2%	152 723	2%
BG	2%	23%	28%	6%	5%	0%	34%	1%	209 230	2%
CY	1%	8%	11%	5%	4%	1%	69%	1%	25 868	0%
CZ	4%	25%	44%	6%	3%	0%	18%	1%	215 165	2%
DE	1%	20%	27%	4%	6%	0%	39%	2%	1 007 977	10%
DK	1%	1%	3%	1%	0%	0%	93%	0%	1 350 916	13%
EE	5%	18%	31%	5%	4%	0%	35%	1%	37 416	0%
ES	2%	23%	9%	14%	7%	2%	40%	3%	757 730	7%
FI	1%	15%	13%	4%	2%	0%	64%	1%	158 466	2%
FR	2%	31%	12%	3%	3%	1%	45%	3%	786 817	8%
GR	6%	14%	14%	6%	7%	1%	50%	1%	199 008	2%
HU	2%	22%	29%	5%	4%	1%	35%	2%	196 526	2%
IE	3%	17%	12%	3%	4%	0%	60%	2%	111 708	1%
IT	1%	32%	12%	2%	12%	1%	35%	4%	743 936	7%
LT	2%	15%	9%	7%	5%	0%	61%	1%	74 714	1%
LU	1%	16%	8%	9%	3%	0%	62%	2%	17 809	0%
LV	1%	12%	38%	5%	4%	0%	37%	2%	59 191	1%
MT	2%	10%	26%	4%	4%	1%	51%	1%	11 634	0%
NL	2%	14%	10%	5%	2%	1%	62%	5%	385 853	4%
PL	0%	19%	42%	4%	0%	0%	35%	0%	735 933	7%
PT	2%	32%	22%	10%	5%	0%	26%	1%	221 380	2%
RO	32%	16%	22%	3%	3%	0%	23%	1%	548 030	5%
SE	1%	15%	5%	2%	3%	0%	73%	1%	276 704	3%
SI	0%	20%	33%	0%	0%	0%	47%	0%	40 178	0%
SK	8%	26%	38%	2%	3%	0%	22%	1%	118 573	1%
UK	7%	15%	25%	4%	4%	0%	44%	1%	1 581 028	16%
Total	392 753	1872 495	1913 553	463 060	427 669	47 956	4 886 722	171 233	10 175 441	100%
Pct	4%	18%	19%	5%	4%	0%	48%	2%	100%	

Source: Eurostat, 2006 and DTI estimations. NACE section data. C (Mining and quarrying), D (Manufacturing), E (Electricity, gas and water supply), F (Construction), G (Wholesale and retail trade, repair of motor vehicles, motorcycles and personal and household goods), H (Hotels and restaurants), I (Transport, storage and communication), K (Real estate, renting and business activities)

Table 24: SOx emissions in EU27 (tonnes of SO2 equivalents), by country and economic activity

	C	D	E	F	G	H	I	K	Total		Pct
AT	1%	73%	20%	1%	1%	2%	3%	0%	21 086		0%
BE	0%	68%	16%	0%	1%	0%	13%	0%	66 175		1%
BG	0%	11%	85%	1%	0%	0%	3%	0%	853 391		11%
CY	0%	6%	47%	0%	0%	0%	45%	0%	22 524		0%
CZ	5%	23%	70%	0%	0%	0%	0%	1%	184 891		2%
DE	3%	41%	53%	0%	1%	0%	1%	0%	492 046		6%
DK	0%	1%	1%	0%	0%	0%	98%	0%	925 171		12%
EE	2%	14%	79%	0%	0%	0%	5%	0%	56 770		1%
ES	1%	32%	59%	1%	1%	0%	6%	0%	450 545		6%
FI	1%	36%	12%	0%	0%	0%	50%	0%	72 781		1%
FR	2%	68%	26%	0%	1%	0%	1%	0%	380 268		5%
GR	2%	18%	57%	0%	1%	0%	22%	0%	182 193		2%
HU	0%	18%	79%	0%	0%	0%	2%	0%	281 087		4%
IE	2%	33%	12%	0%	1%	0%	53%	0%	50 219		1%
IT	0%	49%	33%	0%	0%	0%	17%	0%	377 565		5%
LT	2%	42%	33%	0%	1%	0%	22%	0%	40 752		1%
LU	0%	57%	16%	1%	1%	0%	24%	1%	3 866		0%
LV	1%	5%	92%	0%	0%	0%	3%	0%	96 168		1%
MT	0%	5%	84%	0%	0%	0%	10%	0%	14 055		0%
NL	0%	39%	8%	1%	0%	0%	52%	0%	122 763		2%
PL	0%	9%	89%	0%	1%	0%	0%	0%	967 389		12%
PT	0%	44%	50%	0%	0%	0%	5%	0%	195 671		2%
RO	6%	27%	67%	0%	0%	0%	1%	0%	908 623		11%
SE	0%	21%	8%	0%	0%	0%	71%	0%	113 329		1%
SI	0%	29%	70%	0%	0%	0%	1%	0%	13 800		0%
SK	1%	20%	78%	0%	0%	0%	1%	0%	225 178		3%
UK	2%	24%	41%	0%	0%	0%	32%	0%	874 356		11%
Total	125 604	1912 203	4 270 434	19 119	30 267	8 101	1615 812	11 122	7 992 662		100%
Pct	2%	24%	53%	0%	0%	0%	20%	0%	100%		

Source: Eurostat, 2006 and DTI estimations. NACE section data. C (Mining and quarrying), D (Manufacturing), E (Electricity, gas and water supply), F (Construction), G (Wholesale and retail trade, repair of motor vehicles, motorcycles and personal and household goods), H (Hotels and restaurants), I (Transport, storage and communication), K (Real estate, renting and business activities)

Table 25: NMVOC emissions in EU27 (tonnes), by country and economic activity

	C	D	E	F	G	H	I	K	Total	Pct
AT	1%	69%	1%	9%	5%	0%	6%	8%	79 314	2%
BE	0%	79%	2%	6%	5%	0%	6%	2%	91 620	2%
BG	1%	37%	1%	30%	8%	1%	22%	1%	90 254	2%
CY	0%	26%	2%	17%	8%	1%	44%	1%	7 245	0%
CZ	1%	36%	9%	5%	6%	1%	23%	19%	101 504	2%
DE	0%	91%	1%	1%	3%	0%	3%	0%	893 403	18%
DK	0%	27%	5%	3%	3%	0%	60%	1%	62 186	1%
EE									-	0%
ES	0%	44%	1%	23%	7%	0%	23%	2%	449 804	9%
FI	0%	69%	2%	6%	4%	0%	17%	1%	52 485	1%
FR	0%	56%	1%	22%	5%	0%	15%	1%	548 061	11%
GR	2%	42%	2%	13%	9%	1%	31%	1%	90 544	2%
HU	0%	57%	3%	8%	5%	0%	24%	1%	109 583	2%
IE	4%	54%	3%	6%	8%	0%	22%	3%	27 103	1%
IT	1%	65%	7%	13%	7%	0%	7%	1%	518 366	11%
LT	0%	48%	1%	9%	5%	0%	36%	1%	53 611	1%
LU	0%	46%	2%	20%	9%	0%	19%	4%	4 015	0%
LV	0%	46%	5%	10%	6%	0%	31%	1%	26 739	1%
MT	1%	46%	6%	12%	6%	1%	27%	1%	3 608	0%
NL	7%	54%	1%	11%	8%	0%	17%	2%	94 116	2%
PL	3%	53%	4%	6%	0%	0%	34%	0%	406 889	8%
PT	0%	72%	1%	18%	3%	0%	5%	1%	171 711	4%
RO	2%	47%	6%	4%	2%	0%	38%	1%	242 813	5%
SE	0%	64%	6%	8%	6%	0%	12%	4%	49 318	1%
SI	16%	15%	11%	3%	0%	0%	55%	0%	16 793	0%
SK	2%	69%	5%	4%	2%	0%	17%	1%	61 598	1%
UK	15%	51%	7%	10%	9%	0%	8%	0%	632 360	13%
Total	135 396	2 972 000	162 803	522 208	241 537	9 194	775 046	66 860	4 885 044	100%
Pct	3%	61%	3%	11%	5%	0%	16%	1%	100%	

Source: Eurostat, 2006 and DTI estimations. NACE section data. C (Mining and quarrying), D (Manufacturing), E (Electricity, gas and water supply), F (Construction), G (Wholesale and retail trade, repair of motor vehicles, motorcycles and personal and household goods), H (Hotels and restaurants), I (Transport, storage and communication), K (Real estate, renting and business activities)

Table 26: PM10 emissions in EU27 (tonnes), by country and economic activity

	C	D	E	F	G	H	I	K	Total	Pct
AT	44%	21%	4%	11%	4%	1%	14%	2%	22 576	2%
BE	7%	49%	5%	19%	4%	0%	14%	2%	20 852	2%
BG	12%	31%	26%	9%	2%	0%	19%	0%	28 439	2%
CY	7%	15%	9%	14%	2%	0%	52%	1%	3 481	0%
CZ	7%	37%	22%	7%	3%	0%	19%	4%	19 709	1%
DE	11%	45%	9%	13%	4%	0%	16%	2%	173 906	13%
DK	5%	29%	6%	19%	4%	0%	35%	2%	15 978	1%
EE	8%	30%	23%	13%	3%	0%	23%	1%	5 519	0%
ES	9%	30%	6%	30%	3%	0%	19%	2%	131 100	10%
FI	9%	42%	6%	14%	2%	0%	25%	1%	14 461	1%
FR	33%	28%	5%	21%	2%	0%	10%	1%	175 754	13%
GR	10%	23%	10%	15%	4%	0%	36%	1%	29 022	2%
HU	6%	33%	22%	12%	3%	0%	22%	1%	28 489	2%
IE	25%	27%	6%	11%	4%	0%	23%	3%	9 710	1%
IT	0%	49%	6%	5%	9%	1%	26%	3%	92 737	7%
LT	0%	25%	31%	14%	3%	0%	25%	1%	11 996	1%
LU	6%	43%	3%	25%	3%	0%	18%	2%	2 118	0%
LV	4%	24%	30%	12%	3%	0%	25%	1%	8 265	1%
MT	9%	17%	27%	13%	3%	0%	29%	2%	1 254	0%
NL	0%	42%	2%	9%	1%	0%	41%	5%	26 508	2%
PL	9%	31%	30%	8%	0%	0%	22%	0%	123 224	9%
PT	0%	68%	2%	23%	1%	0%	4%	0%	110 765	8%
RO	16%	46%	20%	8%	2%	0%	7%	0%	72 527	5%
SE	0%	47%	12%	5%	4%	0%	30%	2%	35 268	3%
SI	8%	36%	10%	14%	2%	0%	30%	1%	7 356	1%
SK	9%	43%	27%	5%	1%	0%	14%	1%	18 418	1%
UK	9%	23%	7%	7%	4%	0%	49%	1%	142 323	11%
Total	154 646	499 468	145 127	189 353	40 337	3 394	279 735	19 695	1 331 755	100%
Pct	12%	38%	11%	14%	3%	0%	21%	1%	100%	

Source: Eurostat, 2006 and DTI estimations. NACE section data. C (Mining and quarrying), D (Manufacturing), E (Electricity, gas and water supply), F (Construction), G (Wholesale and retail trade, repair of motor vehicles, motorcycles and personal and household goods), H (Hotels and restaurants), I (Transport, storage and communication), K (Real estate, renting and business activities)

2.5.5 WASTE GENERATION

Overall, modern systems of waste management distinguish between municipal solid waste from households, construction and demolition waste, industrial and commercial waste, medical waste, hazardous waste (including radioactive and electronic waste) and biodegradable waste.

The most detailed source for the generation of waste is the annual Eurostat statistics reporting on both the amount of non-hazardous waste and the amount of hazardous waste by country and sector.

However, only the sectors that generate the majority of waste – Agriculture, hunting and forestry, Fishing, Mining and quarrying, Manufacturing, Electricity, gas and water supply and Construction – are included separately in the Eurostat data. This makes it necessary to estimate the amount of waste generated from each of the remaining sectors (the service sectors essentially).

Also, sectors are generally not divided into subsectors except for Manufacturing for which breakdowns are available at division level or at least for collapsed divisions (e.g. manufacture of textiles and textile products together with Manufacture of leather and leather products). However, compared to the lack of detailed data for the service sectors this is believed to be a minor problem.

Regarding the distribution of waste across service sectors, the somewhat unsatisfactory solution has been to divide the entire lump sum according to the number of persons employed in each section, division and subdivision.

Given the very aggregated level for which data is available, this procedure is unfortunately likely to significantly flatten any peaks in waste generation existing within particular service industries including, for instance, enterprises within Land transportation and enterprises within Real estate activities handling waste from other enterprises.

Moreover, the way Eurostat stores its data on waste generation makes it impossible to distinguish between waste generation in the private and public service sectors (i.e. Public administration and defence, Education, Health and social work and Other community, social and personal service activities) and this leads to a general overestimation of the waste generated in sections G to K.

This inherent distortion, however, does not include the two largest "sources" of waste generation, namely *Wholesale of waste and scrap* which is correctly attributed in its entirety to Wholesale trade and commission trade and *Sewage and refuse disposal, sanitation and similar activitie*s which can be separated out individually and excluded from the service sector lump sum.

Note as well that any distortion will presumably be less severe for hazardous waste than for non-hazardous simply because overall enterprises in the service sectors generate less hazardous waste than enterprises in primary and secondary sectors.

Table 27: Nonhazardous waste generation in EU27 (thousands of tonnes), by country and economic activity

	C	D	E	F	G	H	I	K	Total	Pct
AT	2%	23%	4%	64%	4%	1%	1%	2%	49 114	2%
BE	0%	44%	3%	30%	13%	2%	2%	6%	41 015	2%
BG	95%	2%	3%	0%	0%	0%	0%	0%	238 138	10%
CY	6%	38%	0%	29%	12%	7%	4%	4%	1 055	0%
CZ	2%	33%	13%	44%	5%	0%	1%	2%	18 819	1%
DE	16%	15%	3%	62%	2%	0%	1%	2%	302 628	12%
DK	0%	14%	14%	58%	6%	1%	2%	5%	10 057	0%
EE	52%	25%	3%	6%	7%	1%	3%	4%	11 552	0%
ES	23%	18%	6%	41%	5%	2%	2%	4%	115 462	5%
FI	32%	28%	3%	35%	2%	0%	0%	1%	65 031	3%
FR	0%	5%	0%	89%	2%	1%	1%	2%	400 997	16%
GR	36%	13%	31%	17%	2%	1%	0%	1%	41 290	2%
HU	0%	37%	26%	20%	8%	1%	3%	5%	15 214	1%
IE	17%	15%	1%	58%	4%	2%	1%	2%	28 374	1%
IT	1%	41%	3%	50%	2%	1%	1%	1%	103 653	4%
LT	0%	75%	1%	8%	10%	1%	2%	2%	4 115	0%
LU	1%	11%	0%	86%	1%	0%	0%	1%	7 788	0%
LV	0%	67%	3%	2%	13%	2%	6%	7%	836	0%
MT	0%	1%	0%	92%	2%	1%	1%	2%	2 704	0%
NL	0%	21%	2%	71%	2%	1%	1%	3%	75 611	3%
PL	28%	43%	16%	10%	2%	0%	0%	1%	140 286	6%
PT	8%	54%	2%	11%	12%	4%	3%	8%	27 207	1%
RO	63%	3%	33%	0%	1%	0%	0%	0%	314 139	13%
SE	60%	29%	1%	8%	1%	0%	0%	0%	103 358	4%
SI	8%	51%	11%	21%	4%	1%	2%	2%	4 603	0%
SK	3%	47%	14%	8%	14%	1%	7%	7%	11 397	0%
UK	29%	16%	2%	37%	8%	2%	2%	5%	297 300	12%
Total	737 472	397 170	188 346	950 332	73 900	17 004	20 505	47 016	2 431 745	100%
Pct	30%	16%	8%	39%	3%	1%	1%	2%	100%	

Source: Eurostat, 2006 and DTI estimations. NACE section data. C (Mining and quarrying), D (Manufacturing), E (Electricity, gas and water supply), F (Construction), G (Wholesale and retail trade, repair of motor vehicles, motorcycles and personal and household goods), H (Hotels and restaurants), I (Transport, storage and communication), K (Real estate, renting and business activities)

Table 28: Hazardous waste generation in EU27 (thousands of tonnes), by country and economic activity

	C	D	E	F	G	H	I	K	Total	Pct
AT	2%	51%	8%	5%	15%	5%	5%	9%	755	1%
BE	0%	56%	1%	23%	9%	2%	3%	6%	3 137	4%
BG	1%	98%	0%	0%	0%	0%	0%	0%	784	1%
CY	0%	28%	2%	2%	30%	18%	11%	10%	41	0%
CZ	3%	76%	4%	10%	3%	1%	1%	2%	911	1%
DE	0%	34%	2%	51%	6%	1%	2%	4%	17 943	23%
DK	0%	72%	15%	3%	4%	1%	2%	4%	456	1%
EE	0%	17%	82%	0%	1%	0%	0%	0%	6 602	9%
ES	0%	54%	2%	8%	16%	5%	4%	11%	3 536	5%
FI	35%	37%	0%	16%	4%	1%	2%	3%	2 483	3%
FR	1%	38%	1%	35%	9%	2%	4%	9%	8 283	11%
GR	0%	30%	10%	0%	31%	10%	8%	11%	275	0%
HU	1%	28%	1%	1%	62%	1%	2%	4%	1 290	2%
IE	2%	50%	3%	14%	15%	5%	3%	8%	534	1%
IT	0%	76%	2%	5%	7%	2%	2%	5%	6 649	9%
LT	0%	17%	1%	13%	36%	5%	14%	14%	113	0%
LU	0%	29%	0%	48%	8%	2%	4%	8%	214	0%
LV	0%	84%	1%	1%	7%	1%	3%	3%	43	0%
MT	0%	100%	0%	0%	0%	0%	0%	0%	48	0%
NL	0%	14%	0%	69%	6%	1%	2%	7%	4 405	6%
PL	0%	81%	8%	2%	5%	0%	2%	2%	2 202	3%
PT	25%	11%	0%	12%	23%	7%	5%	16%	6 019	8%
RO	48%	50%	0%	0%	1%	0%	0%	0%	1 031	1%
SE	0%	26%	10%	45%	8%	1%	3%	6%	1 992	3%
SI	0%	76%	1%	10%	6%	2%	3%	4%	95	0%
SK	9%	55%	6%	2%	13%	1%	7%	7%	469	1%
UK	0%	34%	6%	9%	21%	7%	6%	17%	6 546	9%
Total	3 273	29 611	7 181	19 410	7 903	1 960	2 174	5 343	76 855	100%
Pct	4%	39%	9%	25%	10%	3%	3%	7%	100%	

Source: Eurostat, 2006 and DTI estimations. NACE section data. C (Mining and quarrying), D (Manufacturing), E (Electricity, gas and water supply), F (Construction), G (Wholesale and retail trade, repair of motor vehicles, motorcycles and personal and household goods), H (Hotels and restaurants), I (Transport, storage and communication), K (Real estate, renting and business activities)

3 THE ENVIRONMENTAL IMPACT FROM SMEs

3.1 INTRODUCTION

The collection of structural and environmental data in the EIDSME database has resulted in a very detailed and complex estimate of the environmental impact from 20 million businesses in Europe of all sizes, i.e. from micro companies and small, medium and large companies.

The original data in the database is not new and has been analysed many times before in connection with research, business development, background information or policy development. The novelty of the data is that in this project the data is presented in a single integrated database including both original data and its estimates on missing data as well as an estimate of the environmental impact for different company sizes according to the number of persons employed in that size class. The database contains a lot of information, and because of the amount and multidimensionality of the data any presentation of data will have to be a trade-off between the general overview and the details. It is impossible to provide both at the same time. For this project, we have developed tools that allow the reader to study the figures of the EIDSME database in their finest detail. The tools are presented in the technical annex.

The preceding chapters have concentrated on establishing the EIDSME database and giving a short presentation of each of the structural and environmental indicators. In the following we analyse the database data in more detail.

3.2 THE ENVIRONMENTAL IMPACT FROM SMEs IN OVERVIEW

3.2.1 ACCESSING THE DATABASE

The data in the database is organised conventionally with a row of data for each section, division and subdivision for each of the 27 European countries and with the structural and environmental variables along the columns. The original downloads are kept in Excel spreadsheets but after relevant transformations and estimations the data has been transferred and collected in a SPSS database which is suitable for analytical purposes.

SPSS is the preferred file format because of its ability to keep labels on values and variables. This makes it easy to navigate and to make advanced statistical analysis at the same time. All data can be exported to a common database and spreadsheet file formats – including plain CSV files in ASCII format. The SPSS database is part of the delivery to the Commission.

SPSS is a highly specialised analytical computer program but it is a licensed program and it is not very accessible for most people or organisations. As a supplement we have created two interactive database interfaces as integrated flash-file presentations with the key in-

formation[37] from the database. The data behind the two presentations is the same EIDSME data. The first presentation is country-centred and allows the user to drill into data and view it by country. The second presentation is indicator-oriented and allows the user to drill into data and view it by indicator. The flash files are presented and explained in the technical annex.

3.3 ANALYSIS OF THE EIDSME DATABASE

In this section we make a more general analysis and presentation of the general tendencies in the environmental impact of enterprises in the EU27. The analysis is also a step in finding a way to prioritise SMEs and sectors. We address four questions:

- **What is the environmental impact from SMEs?** Only a general assessment exists in the literature, and the assessment in the EIDSME database is the first attempt to estimate the share of environmental impact.
- **Where is the biggest and the lowest environmental impact?** When viewing across sectors and countries – where should we look to observe the extremes in the environmental impact – overall, and indicator by indicator?
- **What is the potential for reductions in environmental impact?** Eco-efficiency defined as the environmental impact relative to economical results – which sectors have the greatest, unleashed eco-efficiency potential?
- **Prioritising the SMEs according to environmental impact**. In the final analysis we will use the answers from the above analysis to show a way to prioritise sectors.

3.3.1 THE EIDSME DATABASE SUGGESTS 64% ENVIRONMENTAL IMPACT FROM SMES

The literature says that 60–70% of the environmental impact originates from SMEs.[38] There is little evidence on the actual impact from SMEs, and it would be too complex and burdensome for companies and public authorities to determine the detailed contribution made by the 20 million SMEs to pollution (e.g. air pollution) in terms of the environmental load from different types of pollutants (e.g. CO_2, SO_x, NO_x, etc.).

We argue that the number of employees can be used as an indication of the distribution of environmental impact between different sizes of companies. In many sectors we have

[37] In the SPSS database it is possible separate original data from estimated data. In the interactive version indicators of data quality is included and presented in detail for the user.

[38] COMMUNICATION FROM THE COMMISSION TO THE COUNCIL, THE EUROPEAN PARLIAMENT, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS Small, clean and competitive A programme to help small and medium-sized enterprises comply with environmental legislation Executive summary of the impact assessment {COM(2007) 379 final SEC(2007) 906SEC(2007) 908}

proved a strong relationship between the number of employees in a sector and the environmental impact.

Table 29: Bivariate correlations at country level between structural variables and environmental indicators

	CO2	CH4	N2O	HFCs	PFCs	SF6	NOx	SOx	NM-VOC	PM10	TOE	Haz. waste	N-haz. waste
Empl.	0.97	0.94	0.92	1.00	0.85	0.51	0.75	0.37	0.92	0.75	0.99	0.81	0.73
Turn.	0.96	0.94	0.94	1.00	0.90	0.58	0.77	0.36	0.90	0.78	0.99	0.85	0.68
N	*13*	*12*	*13*	*3*	*4*	*6*	*13*	*13*	*12*	*9*	*26*	*27*	*27*

Source: Eurostat, 2006. EU27. Empl. is Number of persons employed and Turn. is Turnover. Values shown are Pearson's *r* (scores of -1/1 equal to perfect linear relationships).

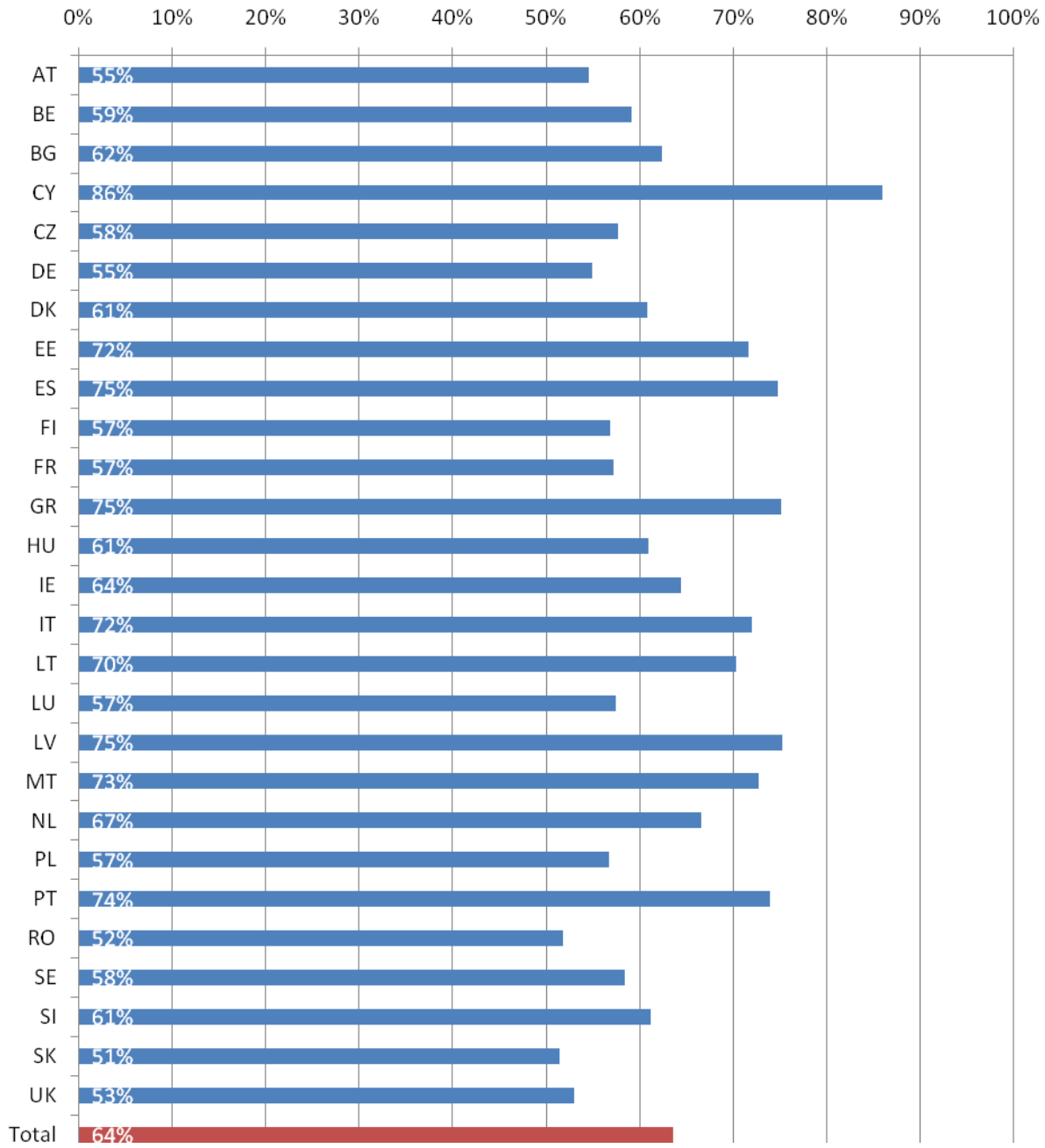
While the number of persons employed and turnover are equally good estimators, though, they explain much the same variation. In the following analysis number of employees is used as an estimator of the share of environmental impact for each indicator. This is done by calculating the environmental impact per person (for each sector and country) and then multiplying by the number of employees in micro, small, medium and large companies (for each sector and country).

In the technical annex we present a detailed breakdown of correlations between environmental impact and number of employees across economic activities and an extended discussion of the methodology. As it turns out there is a good match between the figures quoted previously in literature and the figures we have estimated in this project. Our estimate says that on average 64% of the environmental impact originates from SMEs in the EU27 when looking at the indicators studied in this project. The variation from country to country or sector to sector is typically within the 60–70% range. However, the variation in specific cases can be bigger (the 50–80% range), which reflects the underlying business structure and size of companies.

Table 30 illustrates the variations across countries where the impact from SMEs can be as low as 51% in some countries, such as in the United Kingdom (with a relatively low share of persons employed in SMEs), or above 70% or even 80%, such as in Cyprus (with a relatively large share of persons employed in SMEs) where the estimated impact share is 84%. The table is the calculated average of employees in SMEs per country across sectors. Across sectors the variations can be even bigger. In Table 31 we have illustrated the SME share at NACE subdivision level – from subdivision 10 to subdivision 74 across all 27 countries. In IA62 air transport and IA64 post and telecommunications the average impact from SMEs goes as far down as to 18–20%. In other sectors with more people employed by SMEs, the impact can be above 90%. This applies to sectors such as G50 sales and maintenance or KA70 real estate activities. Obviously, the variation in the overall figures is even more diverse when we study different sectors – and if we were able to zoom further in on individual companies the diversity would be even larger. It seems fair to conclude that the 60-70% share of the environmental impact from SMEs as quoted in the literature as a rough figure is a reasonably accurate estimation. Moreover, it should be added that there is considerably variation to be seen within the individual countries and for individual sectors.

Table 30: The average environmental impact from SMEs in the EU27 – per country (*equals the average share of employees* in the SME size companies per country).

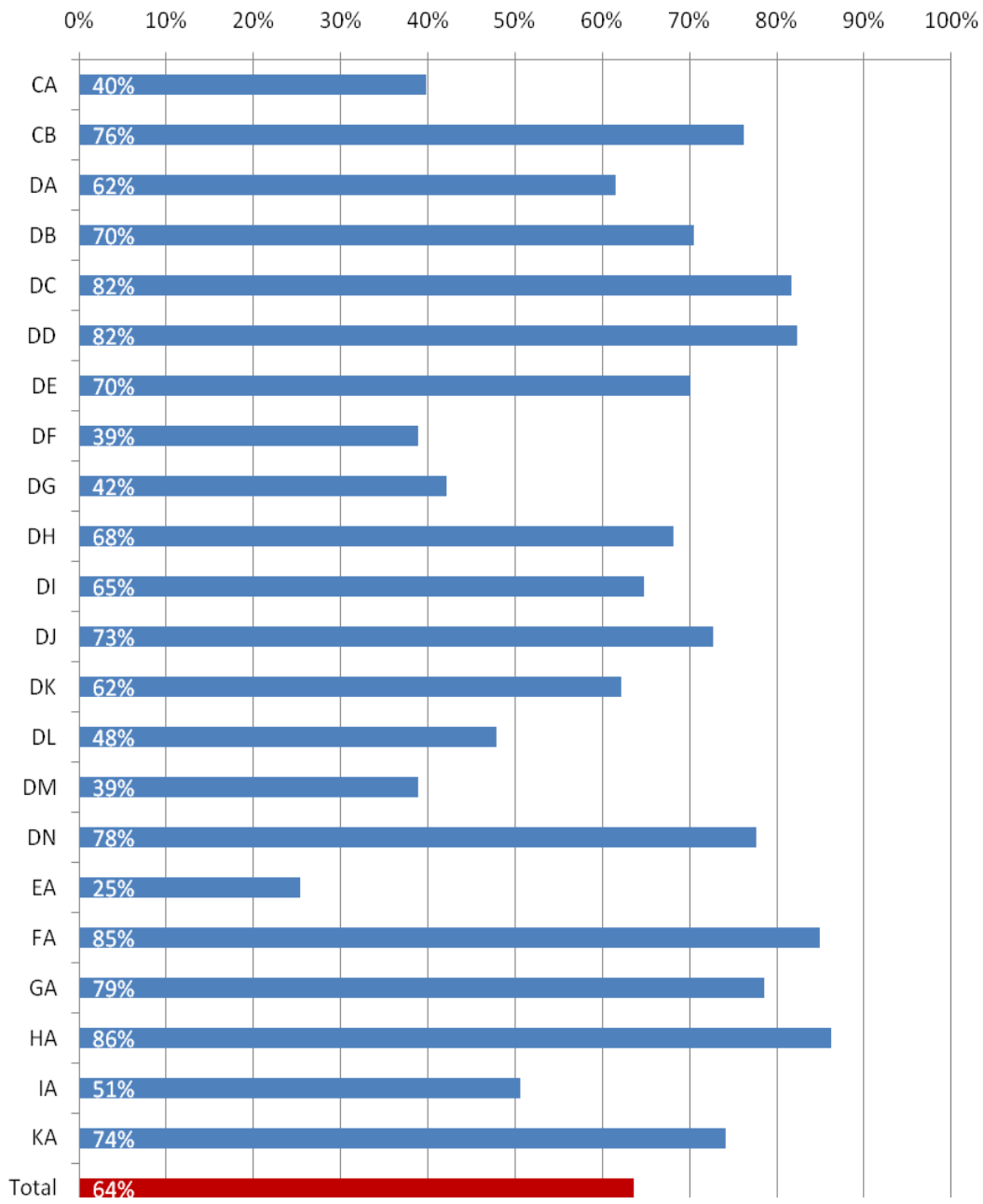
Average Environmental impact from SMEs in the EU27 – divided by country



Source: SBS and environmental data from Eurostat and own estimations for the EU27. Aggregated at level 3 data.

Table 31:The average environmental impact from SMEs in the EU27 – per sector – at NACE subdivision level. (*equals the average share of employees* in the SME size companies per country).

Average Environmental impact from SMEs in the EU27 – divided by sector at NACE subdivision level



Source: SBS and environmental data from Eurostat, 2006 and own estimations for the EU27. Aggregated at level 3 data.

3.3.2 GREEN AND BROWN SECTORS – A TYPOLOGY OF ENVIRONMENTAL IMPACT

In the next analysis, we will use the indicators of environmental impact to divide the sectors into a typology of environmental impact from SMEs.[39]

In principle, the SMEs are divided by three dimensions:

- **The size of SMEs** by using the standard definitions of micro, small and medium businesses already presented in the structural data.

- **The total sector impact** is the second dimension. We will divide the sectors according to the total sector impact in the country. High-impact sectors are sectors with a high environmental impact on at least one of the indicators "energy use", "greenhouse gases", "air emissions", "waste or hazardous waste". The high- and low-impact sectors are defined *per country*. The data in the EIDSME database will be divided into two groups, i.e. high- and low-impact sectors.

- **The impact per company** from individual SMEs is the third dimension. We include this dimension because even if the sector impact is heavy, the contribution from each company may be relatively small. The sectors will be divided into two groups based on this dimension. High-impact companies are defined as sectors where the "average environmental impact *per company per size group"* is one standard deviation greater than "the average impact across all countries and sectors" for at least one of the indicators "energy", "greenhouse gases", "air emission", "waste or hazardous waste". The data in the EIDSME database will be divided into two groups for each of the size classes "micro", "small" and "medium size" companies corresponding to six different groups.

The categorization will result in a typology of 12 different groups of companies, which again can be divided according to size.

Defining the cutting point between high and low decides the size of the groups. However, defining high-impact as an impact above one standard deviation is as arbitrary as defining high impact as above the mean or above two standard deviations. We have selected one standard deviation as the cutting point. Under the assumption of a normal distribution we would expect that about 16% would have an impact larger than one standard deviation from the average. Consequently, the criteria for entering into the "high" group are quite strict.
The following analysis is calculated with data at NACE subdivision CA10-KA74, which is the most detailed level of analysis possible.

[39] We have used the typology to select sectors for interviews in the country reports, but the typology is also useful for observing the environmental impact across sectors and countries. The selection of the sectors from the country report was done early in the project before the complete dataset were tested. Therefore some variations in relation to the final report will remain.

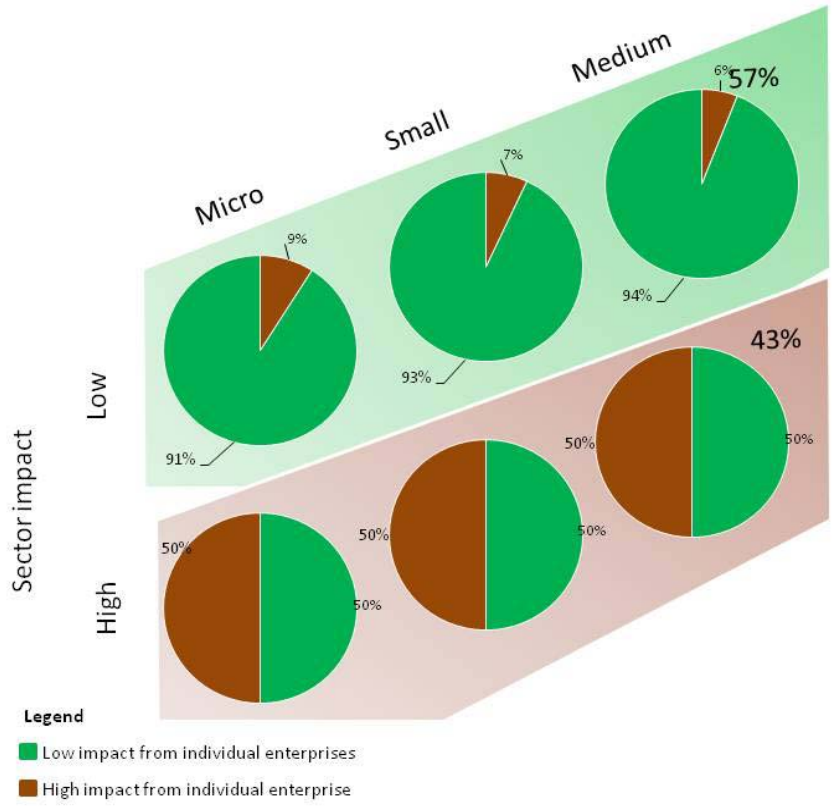
Figure 4 illustrates the groups and is based on analysis of sector divisions. 57% of the sectors are low-impact sectors and 43% of the sectors are high-impact sectors.

Looking at the low-impact sectors, the division between high- and low-impact sectors calculated as impact per company at company sizes shows a skewed distribution of about 4-9% of the sectors in the high-impact group – depending on company sizes.

In the high-impact sectors the picture is almost the other way round with 50% of the sectors having a high impact per company.

Figure 4: Typology of environmental impact from SMEs

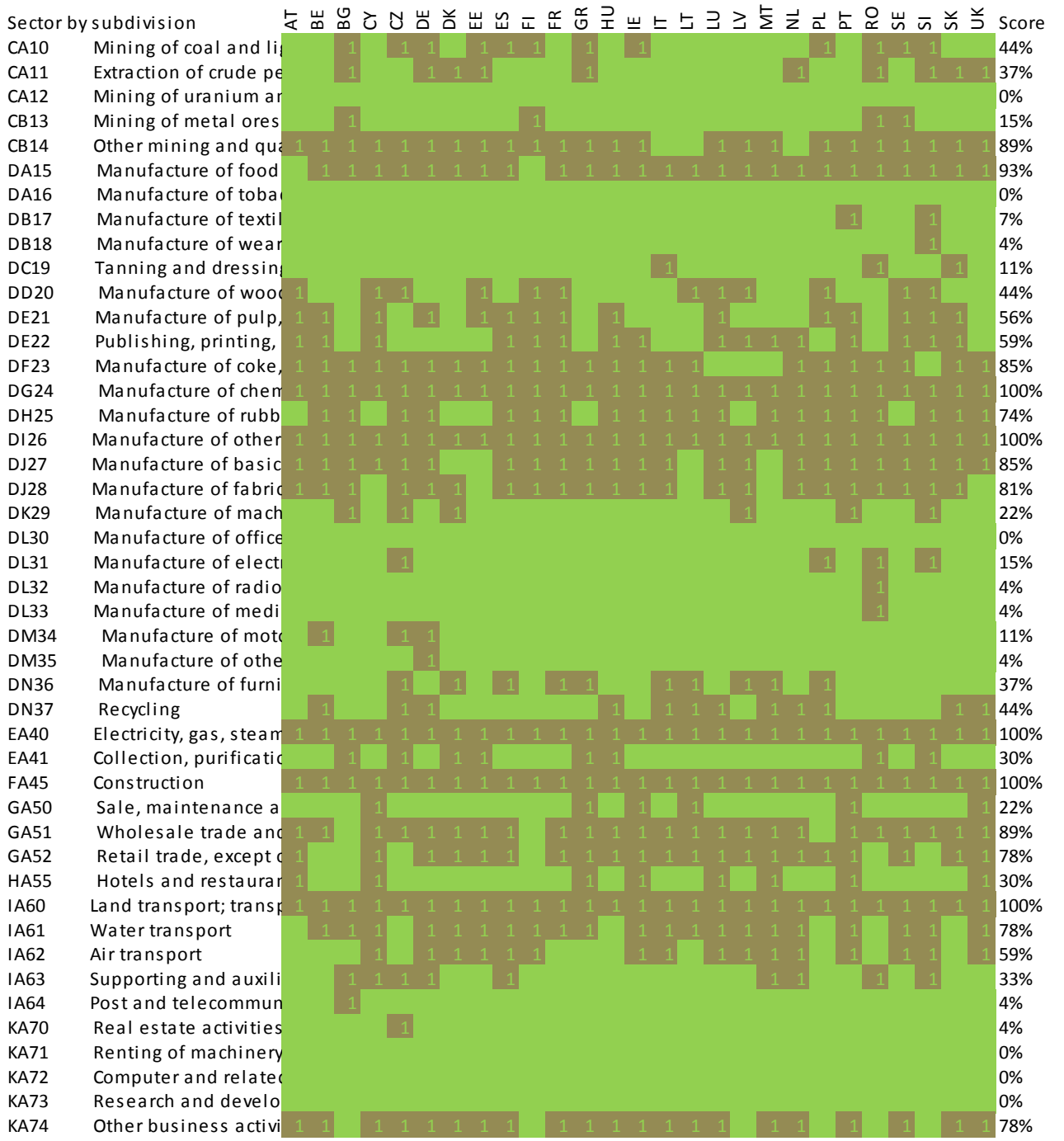
Typology of environmental impact from SMEs



Percentages calculated for sectors at subdivision level CA10-KA74. Source: Eurostat 2006 and own calculations.

Table 32: Overview of total sector impact per country

Overview of total sector impact



Percentages calculated for sectors at subdivision level CA10 – KA74. Source: Eurostat 2006 and own calculations. Sector descriptions have been cropped. For full description please see the technical annex. Sectors with low impact are illustrated by green colour and sectors with high impact are shown in brown colours.

The table above shows the results from each sector. Each sector is listed vertically and each of the 27 countries is listed horizontally. The column on the far right shows the percentage of the countries where the sector can be a high impact sector. A sector is coloured brown if it has an unusually high impact on either of the environmental indicators as defined above. Actual scores are not shown.

In most countries, there is a high environmental impact from especially mining and quarrying and manufacturing sectors such as food, pulp, printing, chemical, rubber, plastics, metals, recycling. There is a high impact from energy production, construction and from wholesale, land and water transport and business services.[40] However, the table does not reveal the composition of the observed environmental impact.

In the table below the perspective is turned from the countries to the environmental indicators and adds detail to understanding the high impact and low impact sectors.[41] The number of countries where the impact is high is counted in the table for each sector. The darker brown cells illustrate that the environmental impact in this sector is usually high. Some examples from some of the high impact sectors:

- In mining and quarrying the most frequent impact is particles and waste and air emissions. In 21 countries this is an important environmental impact.
- In food manufacturing there is an important impact on most indicators except hazardous waste. Especially energy use and NMVOC's are important impacts in many countries. Waste is an important problem in 12 countries.
- In the chemical, manufacturing of rubber and plastics, non-metal and metal, energy sector, construction and wholesale sectors all impacts are frequent.
- In the fabrication of metal products hazardous waste is often a problem as well as in the construction sector, and wholesale and retail sale.
- The sectors with the highest impacts in most countries are manufacture of chemicals and plastics, non-metallic mineral products and metal products as well as energy production, construction and land transport. The sum of the impacts is seen in the far left column.

Reading the table from top to bottom shows in which sectors an environmental problem is most frequently seen in the 27 countries. Sectors with high energy use are manufacture of food products, manufacture of chemicals, manufacture of metals and non-mineral products as well as energy production, construction and transport. Since greenhouse gases and air emissions are related to energy use the pattern is the same here.

[40] A brief listing of the sectors with a high impact in more than 60% of the EU27

Table 33: Environmental profile per sector

Environmental profile per sector

Sector by subdivision		TOE	GHG	Nox	Sox	PM10	NMVOC	Waste	Hazardous waste	Total
CA10	Mining of coal and lignite; extraction of peat	-	3	1	2	-	1	11	3	21
CA11	Extraction of crude petroleum and natural gas;	-	4	5	5	1	3	5	1	24
CA12	Mining of uranium and thorium ores	-	-	-	-	-	-	-	-	-
CB13	Mining of metal ores	-	-	-	-	-	-	4	1	5
CB14	Other mining and quarrying	-	-	-	-	21	-	14	3	38
DA15	Manufacture of food products and beverages	20	3	5	8	4	18	12	2	72
DA16	Manufacture of tobacco products	-	-	-	-	-	-	-	-	-
DB17	Manufacture of textiles	-	-	1	2	-	-	-	1	4
DB18	Manufacture of wearing apparel; dressing; dyeing	-	-	-	-	-	-	-	1	1
DC19	Tanning and dressing of leather; manufacture of	-	-	-	-	-	3	-	-	3
DD20	Manufacture of wood and of products of wood	1	-	-	2	6	7	8	1	25
DE21	Manufacture of pulp, paper and paper products	2	1	2	13	4	2	3	-	27
DE22	Publishing, printing, reproduction of recorded	7	-	-	1	-	11	4	-	23
DF23	Manufacture of coke, refined petroleum products	2	15	9	22	7	17	-	7	79
DG24	Manufacture of chemicals and chemical products	23	18	9	23	6	12	3	13	107
DH25	Manufacture of rubber and plastic products	1	5	1	4	-	7	2	14	34
DI26	Manufacture of other non-metallic mineral	23	23	23	26	23	4	7	1	130
DJ27	Manufacture of basic metals	21	20	7	20	20	3	4	14	109
DJ28	Manufacture of fabricated metal products, except	-	1	-	-	-	5	18	20	44
DK29	Manufacture of machinery and equipment n.e.c.	-	-	-	2	-	-	1	4	7
DL30	Manufacture of office machinery and computers	-	-	-	-	-	-	-	-	-
DL31	Manufacture of electrical machinery and	-	-	1	3	-	-	-	1	5
DL32	Manufacture of radio, television and	-	-	-	1	-	-	-	-	1
DL33	Manufacture of medical, precision and optical	-	-	-	1	-	-	-	-	1
DM34	Manufacture of motor vehicles, trailers and semi-	-	-	-	-	-	2	-	1	3
DM35	Manufacture of other transport equipment	-	-	-	-	-	1	-	-	1
DN36	Manufacture of furniture; manufacturing n.e.c.	-	-	-	-	-	9	1	1	11
DN37	Recycling	-	-	-	-	-	-	9	6	15
EA40	Electricity, gas, steam and hot water supply	24	26	27	27	26	9	14	6	159
EA41	Collection, purification and distribution of water	-	-	-	-	-	-	6	2	8
FA45	Construction	18	10	24	1	27	24	25	16	145
GA50	Sale, maintenance and repair of motor vehicles	-	-	-	-	-	5	-	3	8
GA51	Wholesale trade and commission trade, except of	1	4	7	-	1	2	13	18	46
GA52	Retail trade, except of motor vehicles,	6	3	2	-	-	-	11	17	39
HA55	Hotels and restaurants	1	-	-	-	-	-	2	7	10
IA60	Land transport; transport via pipelines	20	26	27	5	26	18	1	2	125
IA61	Water transport	8	9	18	17	13	8	-	-	73
IA62	Air transport	3	11	14	4	1	2	-	-	35
IA63	Supporting and auxiliary transport activities;	-	-	5	-	4	6	1	1	17
IA64	Post and telecommunications	-	-	1	-	-	1	-	-	2
KA70	Real estate activities	-	-	-	-	-	1	-	-	1
KA71	Renting of machinery and equipment without	-	-	-	-	-	-	-	-	-
KA72	Computer and related activities	-	-	-	-	-	-	-	-	-
KA73	Research and development	-	-	-	-	-	-	-	-	-
KA74	Other business activities	8	-	-	-	-	1	10	16	35

The figures are calculated as the normalised score across all sectors for each country at subdivision level CA10 – KA74. Source: Eurostat 2006 and own calculations. Sector descriptions have been cropped. For full description please see the technical annex. Sectors with low impact are illustrated by green colour and sectors with high impact are shown in brown colours.

A sector's environmental impact can be high because of the products produced, the processes used or it can be high simply because the sector is very big in terms of people and companies. That this can be the case is illustrated by the next table.

In the table, the total sector impact is cross-tabulated with impact per company – per company size. The first two columns are the sector subdivision. The third column is the sector impact illustrated as the percentage of countries, where the environmental impact per company is high. The last columns show the number of countries, where the impact per company is high. This has been calculated for all sizes of companies, i.e. micro, small, medium and large companies.

In most sectors there is correspondence between a high environmental impact from the sector and the impact from companies at each company size. This is the case in low-impact sectors such as the manufacture of tobacco products, textile, leather and wood, etc.

However, there are also some notable differences, such as the wholesale and retail sector. It is the sheer size of this sector that makes it environmentally visible. With more than 6 million companies almost every third company in the EU 27 belongs to this sector. The impact of the individual company is rarely noteworthy in comparison with the impact of companies from other sectors. The construction sector and the fabricated metal products sector follow almost the same pattern, where the impact per company is low – but the number of companies means that the sector impact is high.

In the mining and quarrying industry, the pulp and paper industry, in recycling, in fabricated metal products and in water transport the impact from large companies is less frequently a problem than in smaller companies.

The most important insight from this analysis is that the discussion about "the environmental impact from SMEs" needs to be very nuanced. First, the discussion needs to be sector-specific because some sectors have more impact than other sectors. Secondly, it is necessary to be specific about the specific company size. Thirdly, the environmental impact of a sector depends on the environmental indicators analysed.

In some cases, the impact from individual companies will be very low, even if the total impact is very high. The wholesale sector and the real estate sector are the best examples of this.

In other cases, large companies seem to have a lower impact per company than the impact of SMEs – especially in manufacturing. One important explanation could be that large manufacturing companies can apply new technologies faster and be more efficient in their resource use than their smaller counterparts. In these sectors it is important to find useful environmental impact reduction tools for the SMEs as well.

Table 34: Overview of total sector impact – and impact per company

Overview of total sector impact and the impact per company

Sector by subdivision		Sector impact	pr size Micro	Small	Medium	Large
CA10	Mining of coal and lignite; extraction of peat	44%	14	14	15	14
CA11	Extraction of crude petroleum and natural gas;	37%	16	14	13	14
CA12	Mining of uranium and thorium ores	0%	1			
CB13	Mining of metal ores	15%	8	7	9	6
CB14	Other mining and quarrying	89%	24	24	22	13
DA15	Manufacture of food products and beverages	93%	3	1	2	
DA16	Manufacture of tobacco products	0%	1	2	1	2
DB17	Manufacture of textiles	7%				
DB18	Manufacture of wearing apparel; dressing; dyeing	4%				
DC19	Tanning and dressing of leather; manufacture of	11%				
DD20	Manufacture of wood and of products of wood and	44%	6	3	4	3
DE21	Manufacture of pulp, paper and paper products	56%	15	10	10	5
DE22	Publishing, printing, reproduction of recorded	59%	6	5	5	3
DF23	Manufacture of coke, refined petroleum products	85%	24	21	19	21
DG24	Manufacture of chemicals and chemical products	100%	25	25	24	22
DH25	Manufacture of rubber and plastic products	74%	12	6	5	4
DI26	Manufacture of other non-metallic mineral products	100%	26	26	26	22
DJ27	Manufacture of basic metals	85%	25	24	24	21
DJ28	Manufacture of fabricated metal products, except	81%	6	5	5	2
DK29	Manufacture of machinery and equipment n.e.c.	22%				
DL30	Manufacture of office machinery and computers	0%				
DL31	Manufacture of electrical machinery and apparatus	15%	1	1	1	1
DL32	Manufacture of radio, television and	4%		1	1	
DL33	Manufacture of medical, precision and optical	4%				
DM34	Manufacture of motor vehicles, trailers and semi-	11%	2			1
DM35	Manufacture of other transport equipment	4%				
DN36	Manufacture of furniture; manufacturing n.e.c.	37%				
DN37	Recycling	44%	16	16	15	7
EA40	Electricity, gas, steam and hot water supply	100%	23	24	24	27
EA41	Collection, purification and distribution of water	30%	5	8	5	5
FA45	Construction	100%	6	8	9	7
GA50	Sale, maintenance and repair of motor vehicles	22%				
GA51	Wholesale trade and commission trade, except of	89%				
GA52	Retail trade, except of motor vehicles, motorcycles;	78%				
HA55	Hotels and restaurants	30%				
IA60	Land transport; transport via pipelines	100%	6	11	12	14
IA61	Water transport	78%	25	25	24	18
IA62	Air transport	59%	21	23	22	24
IA63	Supporting and auxiliary transport activities;	33%	1	1	2	1
IA64	Post and telecommunications	4%	1	1	1	3
KA70	Real estate activities	4%				
KA71	Renting of machinery and equipment without	0%				
KA72	Computer and related activities	0%				
KA73	Research and development	0%	1			
KA74	Other business activities	78%				

Percentages calculated for sectors at subdivision level CA10 – KA74. Source: Eurostat 2006 and own calculations. Sector descriptions have been cropped. For full description please see the technical annex. Sectors with low impact are illustrated by green colour and sectors with high impact are shown in brown colours.

3.3.3 ECO-EFFICIENCY IN SECTORS

In this analysis eco-efficiency is defined as the environmental impact relative to the economical results.

The measure of eco-efficiency is calculated indicator by indicator as [environmental impact] divided by [the valued added at factor cost]. In a sector where the average enterprise uses a lot of energy to earn one euro this is considered less eco-efficient than an enterprise that uses only a little energy to earn one euro.

The database cannot compare enterprise by enterprise, but it can make the calculation sector by sector and identify the most energy-efficient sectors. In interpreting the results one must remember that there can still be huge variations between enterprises in a size class that is not revealed due to the level of data in the database.

The analysis where we compare the sectors by their eco-efficiency should not stand alone, since the environmental impact is a function not only of efficiency but also of the technologies inherent to the sector. Thus, we would expect the wholesale sector to have a much lower environmental impact per earned euro than the metal sector or the steel sector. It is possible that sectors with low eco-efficiency (high impact per earned euro) are more interesting to prioritise than sectors with a high eco-efficiency. The analysis cannot reveal this potential.

However, the eco-efficiency measure becomes really interesting when observing the *variance* between countries within a sector. Sectors that exhibit a large span or variation in efficiency from most eco-efficient to least eco-efficient are interesting to observe, because within these sectors enterprises in one country can produce the same type of products as in other countries – but with a much lower environmental impact per earned Euro.

The database does not reveal the explanation or background for large variations but explanations can be found in differences in technology, organisation, infrastructure, competences or framework circumstances between the countries. Such an evaluation of the results, however, is beyond the scope of the present analysis. The analysis, however, is a necessary input to prioritising key SME groups in the development of policies.

In sectors with large variations in the eco-efficiency measure there may be an eco-efficiency potential, which can be unleashed by changes in technology, organisation, infrastructure, competences or framework circumstances.

In sectors with a small variation in eco-efficiency the impact per earned euro is more even between countries. This might be an indication that the enterprises have more equal conditions or that the enterprises have adapted equally well. On the one hand, an increase in eco-efficiency may require a large technology shift or more radical changes in organisation, infrastructure, competences or framework circumstances. On the other hand, the challenges in these sectors may be more similar and the same tools can be applied. For in-

stance, the environmental challenges for a small shoe shop are probably very alike in Cracow, Cologne or Colchester.

In the following we analyse both eco-efficiency and eco-efficiency potential:

- The **eco-efficiency indicator** is calculated as the ratio impact per value added at factor cost and the results are then ranked on scale of 1 to 4, where 1 is a very high eco-efficiency and 4 a very low eco-efficiency.

- Eco-efficiency potential (or **Eco-potential**) is calculated as the range between the maximum observed eco-efficiency value and the minimum observed eco-efficiency in a sector across the 27 countries. The range is then ranked on a scale from 0 to 4. The difference expresses the eco-potential of a sector where 0 is a low or no eco-potential and 4 is a high eco-potential.

The result of the analysis is shown in the table below for each of the main environmental indicators.

When the eco-efficiency is described in this way differences between sectors and indicators become very clear. First it is striking that some of the most energy-intensive sectors are also some of the most energy-efficient sectors in terms of value created per unit of energy. This is true for energy production (EA40), basic metals (DJ26) or land transport (IA60). In these sectors the price of energy matters, the price is a huge account item for many companies and there is regulation concerning energy use. In many of the service sectors the energy use per earned euro is lower.

When turning to eco-potential most sectors may have a potential for reductions. The explanation of the difference in earned euro per unit of impact will vary from sector to sector and from country to country and other factors such as technologies, competences, infrastructure, product types and framework conditions must be taken into account when evaluating the variation in eco-efficiency.

Table 35: Eco-efficiency and eco-potential – for SMEs

Overview of eco-efficiency and eco-potential for SMEs

		Efficiency								Potential							
		Toe	GHG	Nox	Sox	PM10	NMVOC	Waste	HazWaste	Toe	GHG	Nox	Sox	PM10	NMVOC	Waste	HazWaste	Total
CA10	Mining of coal and lignite;	4	2	3	2	2	3	2	2	4	4	4	4	4	3	4	4	3
CA11	Extraction of crude petroleum	4	2	2	2	2	2	2	3	3	4	4	4	4	4	4	4	3
CA12	Mining of uranium and thorium	4	2	2	1	1	2	2	2									1
CB13	Mining of metal ores	2	2	2	2	2	3	1	2	4	4	4	4	4	4	1	4	3
CB14	Other mining and quarrying	1	2	1	2	1	3	2	2	4	4	4	4	4	4	4	4	3
DA15	Manufacture of food products	1	2	2	2	2	2	2	3	3	4	4	4	4	4	4	4	3
DA16	Manufacture of tobacco products	3	4	4	3	3	4	3	4	4	4	4	4	4	3	4	2	4
DB17	Manufacture of textiles	2	2	2	2	2	2	3	3	4	4	4	4	4	4	4	4	3
DB18	Manufacture of wearing	2	3	3	3	3	3	3	3	4	4	3	3	3	3	4	4	3
DC19	Tanning and dressing of leather;	2	2	3	3	3	2	3	3	4	4	4	4	4	4	4	4	3
DD20	Manufacture of wood and of	2	2	2	2	1	2	1	3	4	4	3	3	3	4	4	4	3
DE21	Manufacture of pulp, paper and	2	1	2	1	1	2	2	3	4	4	4	4	3	4	4	4	3
DE22	Publishing, printing,	2	3	3	3	3	2	2	3	4	3	3	3	3	4	4	4	3
DF23	Manufacture of coke, refined	2	2	2	1	1	2	3	2	4	4	4	4	4	4	3	4	3
DG24	Manufacture of chemicals and	1	2	2	2	2	2	2	1	4	4	4	4	3	4	4	4	3
DH25	Manufacture of rubber and	3	2	2	2	2	2	2	1	3	4	4	4	4	4	4	4	3
DI26	Manufacture of other non-	1	1	1	1	1	2	2	2		4	1	1	2	4	4	4	2
DJ27	Manufacture of basic metals	1	1	2	1	1	2	2	1	4	4	4	4	4	4	3	4	3
DJ28	Manufacture of fabricated metal	3	3	3	3	3	2	1	1	4	3	4	4	3	4	3	4	3
DK29	Manufacture of machinery and	3	3	3	3	3	3	3	2	3	3	3	4	3	4	4	4	3
DL30	Manufacture of office machinery	3	3	3	3	3	3	3	2	4	3	4	4	3	4	4	4	3
DL31	Manufacture of electrical	3	3	3	3	3	3	3	2	3	3	4	4	3	4	4	4	3
DL32	Manufacture of radio, television	3	3	3	3	4	3	3	2	3	3	4	4	2	4	4	4	3
DL33	Manufacture of medical,	3	3	4	3	4	3	3	2	4	2	4	4	2	4	4	4	3
DM34	Manufacture of motor vehicles,	3	3	3	3	3	2	3	2	3	3	3	3	3	4	4	4	3
DM35	Manufacture of other transport	3	3	3	3	3	2	3	2	4	3	3	3	3	4	4	4	3
DN36	Manufacture of furniture;	2	2	3	2	2	2	3	3	4	4	3	4	3	4	4	4	3
DN37	Recycling	3	2	2	3	2	3	1	1	3	3	4	4	4	4	4	4	3
EA40	Electricity, gas, steam and hot	1	1	1	1	2	2	2	3	4	4	2	1	3	4	4	4	2
EA41	Collection, purification and	3	3	3	3	3	3	2	2	3	4	4	3	3	4	4	4	3
FA45	Construction	2	3	2	3	2	2	1	2	4	3	4	4	2	4	4	4	3
GA50	Sale, maintenance and repair of	3	3	3	3	3	2	3	2	3	3	3	3	3	4	3	4	3
GA51	Wholesale trade and	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	3
GA52	Retail trade, except of motor	3	3	3	3	3	3	2	2	4	3	4	4	3	4	4	4	3
HA55	Hotels and restaurants	2	3	3	3	3	4	2	2	4	3	3	3	2	3	3	4	3
IA60	Land transport; transport via	2	1	1	2	1	2	3	3	2	4		4	1	4	3	4	2
IA61	Water transport	1	1	1	1	1	1	4	3	4	4	4	4	4	4	3	4	3
IA62	Air transport	2	2	2	2	2	2	4	3	4	4	4	4	4	4	4	4	3
IA63	Supporting and auxiliary	3	3	2	3	2	2	3	3	4	4	4	4	3	4	3	4	3
IA64	Post and telecommunications	3	3	3	4	3	3	3	3	4	4	4	4	3	4	3	4	4
KA70	Real estate activities	4	4	4	4	4	4	3	3	3	3	2	3	3	4	3	4	3
KA71	Renting of machinery and	4	3	2	3	2	3	3	3	2	3	4	2	4	2	3	4	3
KA72	Computer and related activities	3	4	4	4	4	4	3	3	3	2	2	3	2	2	3	4	3
KA73	Research and development	3	3	2	3	3	3	3	3	3	4	4	4	2	4	4	4	3
KA74	Other business activities	3	4	4	4	4	4	3	3	3	2	3	3	2	3	3	4	3

Percentages calculated for sectors at subdivision level CA10 – KA74. Source: Eurostat 2006 and own calculations. Sector descriptions have been cropped. For full description please see the technical annex. Calculated for SMEs.

3.3.4 PRIORITISING THE SMEs ACCORDING TO ENVIRONMENTAL IMPACT

The amount of structural and environmental information gathered is enormous. In order to prioritise SMEs according to environmental impact it is necessary to develop a simple decision-making tool. At the same time, the tool must encompass the complexity of the data and be relatively easy to understand.

This final analysis will put together four pieces of information in order to prioritise the sectors. The four parameters are:

- **Sector impact**. The sectors will be scored on a scale from 1 to 4, where 1 is a low-impact sector and 4 is a high-impact sector.
- **Company impact**. In some sectors a high impact is a function of a high number of companies in the sector. Therefore, it is important to include the environmental impact per company. The company impact will be scored on a scale from 1 to 4, where 1 is a low impact per company and 4 is a high impact per company.
- The **eco-efficiency indicator** is calculated as the ratio impact per value added at factor cost and the results are then ranked on a scale from 1 to 4, where 1 is a very high eco-efficiency and 4 a very low eco-efficiency.
- Eco-efficiency potential (or **Eco-potential**) is calculated as the range between the maximum observed eco-efficiency value and the minimum observed eco-efficiency in a sector across the 27 countries. The range is then ranked on a scale from 0 to 4. The difference is expressing the eco-potential of a sector where 0 is a low or no eco-potential and 4 is a high eco-potential.

The calculation is straightforward. Nevertheless, it includes information on environmental impact for eight environmental indicators and structural information such as geography, sector, number of people employed, number of enterprises and value added at factor cost.

The result is shown in table 36 below.

The scores are simply added and grouped in four categories from the highest to lowest. The data table is sorted according to result. The result is shown for all SMEs in EU 27 at subdivision level. The figures are colour coded to facilitate reading.

Table 36: Prioritising SMEs according to environmental impact and structural differences

Prioritising SMEs

Score	Subdivision		Total impact								Per company								Efficiency								Potential							
			Toe	GHG	Nox	Sox	PM10	NMVOC	Waste	HazWaste	Toe	GHG	Nox	Sox	PM10	NMVOC	Waste	HazWaste	Toe	GHG	Nox	Sox	PM10	NMVOC	Waste	HazWaste	Toe	GHG	Nox	Sox	PM10	NMVOC	Waste	HazWaste
1,54	CA12	Mining of uranium and	1	1	1	1	1	1	1	1	2	3	3	4	4	3	3	3	4	2	2	1	1	2	2	2	#	#	#	#	#	#	#	#
2,41	KA72	Computer and related	3	2	2	2	2	2	3	3	1	1	1	1	1	1	1	2	3	4	4	4	4	4	3	3	3	2	2	3	2	2	3	4
2,50	DB18	Manufacture of wearing	3	2	2	2	2	2	2	2	2	2	1	2	1	1	2	1	2	3	3	3	3	3	3	3	4	4	3	3	3	3	4	4
2,53	KA71	Renting of machinery and	2	2	3	2	3	2	2	2	1	2	3	1	3	2	1	2	4	3	2	3	2	3	3	3	2	3	4	2	4	2	3	4
2,54	DL30	Manufacture of office	1	1	1	1	1	1	1	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	2	4	3	4	4	3	4	4	4
2,57	HA55	Hotels and restaurants	3	3	3	3	3	2	3	3	1	1	1	2	1	1	2	2	2	3	3	3	3	4	2	2	4	3	3	3	2	3	3	4
2,58	KA73	Research and development	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	2	3	3	3	3	3	3	4	4	4	2	4	4	4
2,60	KA70	Real estate activities	3	3	3	2	2	2	3	3	1	1	1	1	1	1	1	2	4	4	4	4	4	4	3	3	3	3	2	3	3	4	3	4
2,61	KA74	Other business activities	4	3	3	3	3	3	3	4	1	1	1	1	1	1	1	2	3	4	4	4	4	4	3	3	3	2	3	3	2	3	3	4
2,61	DL32	Manufacture of radio,	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	4	3	3	2	3	3	4	4	2	4	4	4
2,62	DM35	Manufacture of other	2	2	2	2	2	2	2	2	3	2	2	2	2	3	2	3	3	3	3	3	3	2	3	2	4	3	3	3	3	4	4	4
2,63	CB13	Mining of metal ores	1	1	1	1	1	1	2	2	4	3	3	3	3	3	4	3	2	2	2	2	2	3	1	2	4	4	4	4	4	4	1	4
2,64	DL33	Manufacture of medical,	2	2	2	2	2	2	2	3	2	2	1	2	1	2	2	3	3	3	4	3	4	3	3	2	4	2	4	4	2	4	4	4
2,64	DC19	Tanning and dressing of	2	2	2	2	2	2	2	1	3	2	2	2	2	3	2	2	2	2	3	3	3	2	3	3	4	4	4	4	4	4	4	4
2,68	IA64	Post and telecommunications	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	4	3	3	3	3	4	4	4	4	3	4	3	4
2,69	IA60	Land transport; transport via	4	4	4	3	4	4	3	3	3	3	4	2	3	3	2	2	2	1	1	2	1	2	3	3	2	4	#	4	1	4	3	4
2,69	GA50	Sale, maintenance and	3	3	3	3	3	3	3	3	1	2	2	2	2	2	2	2	3	3	3	3	3	2	3	2	3	3	3	3	3	4	3	4
2,72	DM34	Manufacture of motor	2	2	2	2	2	3	2	3	3	3	3	3	2	3	3	3	3	3	3	3	3	2	3	2	3	3	3	3	3	4	4	4
2,72	CA10	Mining of coal and lignite;	1	2	1	2	2	1	2	2	2	3	3	3	3	2	4	3	4	2	3	2	2	3	2	2	4	4	4	4	4	3	4	4
2,75	DN36	Manufacture of furniture;	3	3	3	3	3	3	3	2	2	2	2	2	2	3	2	2	2	2	3	2	2	2	3	3	4	4	3	4	3	4	4	4
2,75	DE22	Publishing, printing,	3	3	2	2	2	3	3	3	3	2	2	2	2	3	3	2	2	3	3	3	3	2	2	3	4	3	3	3	3	4	4	4
2,75	DL31	Manufacture of electrical	2	2	2	2	2	2	2	3	3	2	2	2	2	2	2	3	3	3	3	3	3	3	3	2	3	3	4	4	3	4	4	4
2,76	GA52	Retail trade, except of motor	4	3	3	3	3	3	4	3	1	1	1	1	1	1	1	2	3	3	3	3	3	3	2	2	4	3	4	4	3	4	4	4
2,76	EA41	Collection, purification and	1	2	2	2	2	1	3	2	3	3	3	2	3	2	4	4	3	3	3	3	3	3	2	2	3	4	4	3	3	4	4	4
2,77	DI26	Manufacture of other non-	4	4	4	4	4	3	3	3	4	4	4	4	4	3	3	3	1	1	1	1	1	2	2	2	#	4	1	1	2	4	4	4
2,78	DN37	Recycling	2	2	2	2	2	2	3	3	2	3	3	2	3	3	4	4	3	2	2	3	2	3	1	1	3	3	4	4	4	4	4	4
2,83	DB17	Manufacture of textiles	3	3	3	3	3	2	2	2	3	3	3	3	3	2	2	2	2	2	2	2	2	2	3	3	4	4	4	4	4	4	4	4
2,84	CA11	Extraction of crude petroleum	1	2	2	2	2	2	2	2	2	4	4	3	4	4	4	3	4	2	2	2	2	2	2	3	3	4	4	4	4	4	4	4
2,84	DD20	Manufacture of wood and of	3	3	3	3	4	3	3	3	2	2	2	3	3	3	3	2	2	2	2	2	1	2	1	3	4	4	3	3	3	4	4	4
2,85	DK29	Manufacture of machinery	3	3	3	3	2	3	3	3	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	2	3	3	3	4	3	4	4	4
2,86	GA51	Wholesale trade and	3	3	4	3	3	3	4	3	2	2	2	2	2	2	2	2	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4
2,87	DA16	Manufacture of tobacco	1	1	1	1	1	1	1	1	3	3	3	3	3	3	4	3	3	4	4	3	3	4	3	4	4	4	4	4	4	3	4	2
2,89	DJ28	Manufacture of fabricated	3	3	3	3	3	3	4	4	2	2	2	2	2	3	3	3	3	3	3	3	3	2	1	1	4	3	4	4	3	4	3	4
2,89	IA63	Supporting and auxiliary	3	3	3	2	3	3	3	3	2	2	3	2	3	3	2	2	3	3	2	3	2	2	3	3	4	4	4	4	3	4	3	4
2,95	FA45	Construction	4	4	4	3	4	4	4	3	2	2	2	2	3	2	3	2	2	3	2	3	2	2	1	2	4	3	4	4	2	4	4	4
2,95	IA61	Water transport	3	3	3	4	3	3	1	2	4	4	4	4	4	4	2	2	1	1	1	1	1	1	4	3	4	4	4	4	4	4	3	4
2,95	IA62	Air transport	2	3	3	3	2	2	1	1	4	4	4	4	3	3	2	3	2	2	2	2	2	2	4	3	4	4	4	4	4	4	4	4
2,98	EA40	Electricity, gas, steam and	3	4	4	4	3	3	3	2	4	4	4	4	4	4	4	3	1	1	1	1	2	2	2	3	4	4	2	1	3	4	4	4
2,99	DF23	Manufacture of coke, refined	2	3	3	3	3	3	1	2	4	4	4	4	4	4	3	3	2	2	2	1	1	2	3	2	4	4	4	4	4	4	3	4
2,99	DE21	Manufacture of pulp, paper	3	3	3	3	3	3	3	2	4	4	3	4	4	3	3	3	2	1	2	1	1	2	2	3	4	4	4	4	3	4	4	4
3,00	CB14	Other mining and quarrying	3	3	3	3	4	2	3	3	4	3	4	3	4	3	4	3	1	2	1	2	1	3	2	2	4	4	4	4	4	4	4	4
3,03	DA15	Manufacture of food	4	3	3	4	3	4	4	3	3	3	3	3	3	3	3	2	1	2	2	2	2	2	2	3	3	4	4	4	4	4	4	4
3,04	DH25	Manufacture of rubber and	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	3	2	2	2	2	2	2	1	3	4	4	4	4	4	4	4
3,04	DJ27	Manufacture of basic metals	3	3	3	3	3	3	3	3	4	4	4	4	4	3	4	4	1	1	2	1	1	2	2	1	4	4	4	4	4	4	3	4
3,13	DG24	Manufacture of chemicals	3	3	3	4	3	3	3	3	4	4	4	4	4	4	3	4	1	2	2	2	2	2	2	1	4	4	4	4	3	4	4	4

The most interesting sectors to prioritise are at the bottom of the table with manufacturing of chemicals, basic metals, rubber and plastic, food, mining and quarrying, pulp, paper, coke, energy production, air and water transport, and construction.

These are sectors with a high environmental impact , a high impact per individual company and perhaps also a high potential for increasing energy efficiency because there are large variations between countries within the specific sectors. It is worth noticing that most of these sectors are already among the most eco-efficient sectors. Here the observation of eco-efficiency and eco-potential is in conflict and may indicate that the potential is smaller and the variations are due to product types, technologies and so forth.

The explanation may be that the environmental impact of these sectors is obvious. Consequently, there has been a focus on reducing their impact over many years.

At the other end of the list of priorities we primarily find service industries and light industries. The overall impact is low as is the impact per company. However, their eco-efficiency could be better and in some sectors there even appears to be a potential for reductions. Manufacturing of office equipment is one such example.

3.3.5 CONCLUSIONS OF THE IMPACT ANALYSIS OF THE EIDSME DATABASE

The analysis of the database provides new insights into the environmental impact from SMEs. First of all, the analysis confirms that the general environmental impact from SMEs can be described as a 60 – 70% of the total impact. However, there are rather large variations between sectors. The overall average impact is 64%.

The analysis has included different perspectives on the EIDSME database: Impact per sector, impact per company, eco-efficiency and eco-potential.

Based on the data, the following sectors stand out with a priority for actions: manufacturing of chemicals, basic metals, rubber and plastic, food, mining and quarrying, pulp, paper, coke, energy production, air and water transport and construction.

Nevertheless, it is a conclusion with serious modifications:

- The selected sectors already have a relatively high eco-efficiency and there might be sectors were improvements come easier and are necessary as well. This could be the whole sector. The impact per company in the wholesale and retail sectors is low but so is the eco-efficiency and the potential appears to be high. Small gains at a company level will add up to a large improvement.
- The environmental indicators are not prioritised. In this analysis improvements in energy use are just a good as reductions in hazardous waste. A different weight according to the price for a unit reduction or according to the threat of the impact would enhance the prioritisation.
- The analysis is a simple analysis and even more information could be added, such as more structural information and more environmental indicators, but as they do not exist in any useful form they have been left out - not because they are not important. In prioritisations more qualitative information should be included as well.

- The life cycle perspective of products has been omitted. The LCA perspective is important because decisions made already in the design stage in the companies have environmental effects in the use and disposal (or recycling) of products. The product perspective could mean a different order of the sectors mentioned.
- The business potential could be added as a priority with scoring of sectors with a huge business potential in environmental reduction and scoring of sectors where further environmental regulation or reduction would be very expensive or adversely affecting the competitiveness of the sector.
- Finally, perhaps the most obvious modification: what is the objective of the prioritisation? In the prioritisation above it has been our goal to prioritise the sectors according to environmental impact and potential for change. Other prioritisations keys could be: where do we best improve the competitiveness of European companies or where do we best improve the living conditions for the citizens of Europe? Any other similar question could of course be addressed too.

4 IMPACT OF EU ENVIRONMENTAL MEASURES

4.1 INTRODUCTION

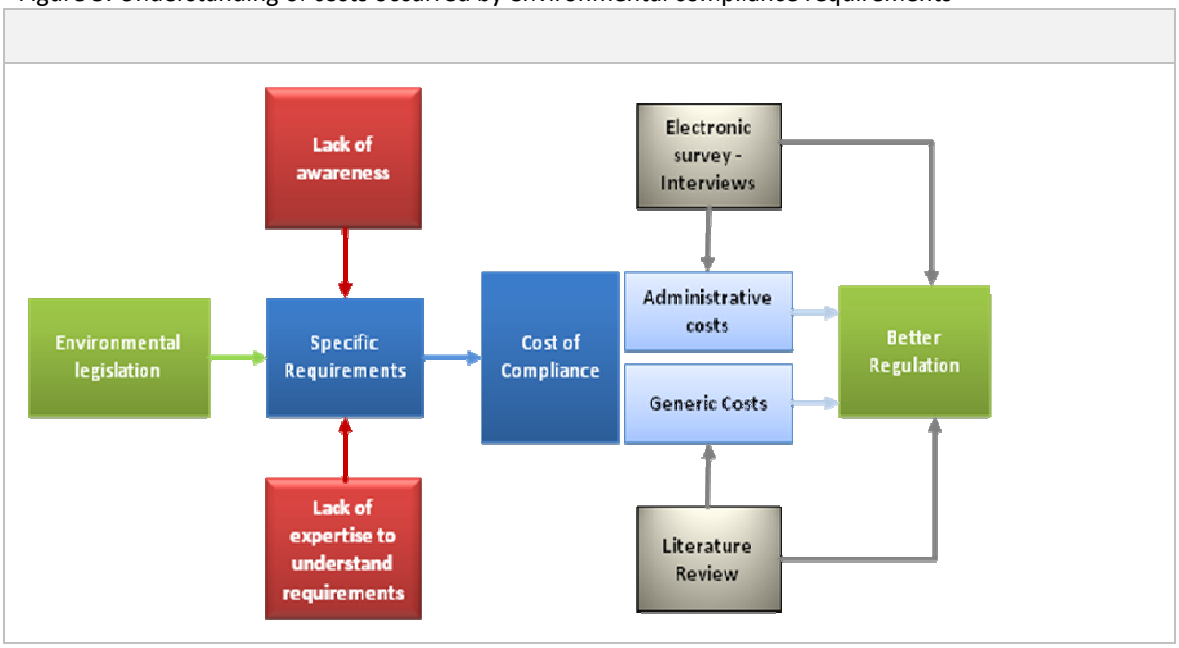
In the past 30 years, the EU has adopted a substantial and diverse range of environmental measures aimed at improving the quality of the environment for European citizens and providing them with a high quality of life. The European Commission understands the compliance pressures faced specially by small businesses and is taking action to help them.

Aim of this section of the report is to determine the implied environmental compliance costs arisen for SMEs based on the findings of Literature Review and the results of communications with SMEs and SMEs organizations (see figure below).

This section of the report focuses on EU environmental legislation and identifies the main EU regulatory measures in the environmental field that impact in terms of administrative or generic costs on SMEs. Ultimately, it provides suggestions that should help to shape environmental legislation affecting SMEs to be more simple and cost-effective.

In this way it will be easier to detect issues of better regulation possibilities and make it easier for SMEs to comply with their obligations and improve their environmental performances.

Figure 5: Understanding of costs occurred by environmental compliance requirements



The study focused on selected sectors and the Consultant used data extracted from the Environmental Impact Database for Small and Medium-sized Enterprises in Europe (EIDSME) prepared in the context of this project, suggestions and guidance documented

in the workshop with the focus group that took place in January 2010 and expert judgement in order to select sectors. The sectors covered are:

- C Mining and quarrying
- DA Manufacture of food products, beverages and tobacco
- DB Manufacture of textiles and textile products
- DE Manufacture of pulp, paper and paper products; publishing and printing
- DG Manufacture of chemicals, chemical products and man-made fibres
- DI Manufacture of other non-metallic mineral products
- DJ Manufacture of basic metals and fabricated metal products
- F Construction
- G Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods
- H Hotels and restaurants
- I Transport, storage and communication
- Eco-industries. As defined by the OECD and Eurostat, eco-industries are "activities which produce goods and services to measure, prevent, limit, minimize or correct environmental damage to water, air and soil, as well as problems related to waste, noise and eco-systems. This includes technologies, products and services that reduce environmental risk and minimize pollution". This comprises the following "sectors":
    - Air pollution and control
    - Waste management
    - Soil remediation
    - Noise and vibration control
    - Waste and waste water treatment
    - Environmental monitoring
    - Renewable energy sources
    - Eco-construction
    - Clean technologies and processes
    - Environmental consulting.

More specifically:

- the first part of this section, named **Literature Review,** presents a comprehensive review of the literature on the implementation requirements of EU environmental legislation. The literature review provides the theoretical underpinning for this section,

as well as some preliminary conclusions from other case studies on the effects of environmental policies and instruments.

- in the second part, entitled **Environmental Legislation Requirements**, the findings and interpretations concerning areas of EU environmental legislation relevant to SMEs and how they affect SMEs of the selected sectors for this project are presented, based on the finding of the e-survey and the case studies (see Appendix for more details). In the Appendix, a detailed presentation of the main EU regulatory issues is provided (as they derive from specific legislative issues) in the environmental field for each of areas that influence SMEs' operation in terms of administrative or generic costs.
- the third part, **Impact of EU Environmental Measures on SMEs**, presents a sector analysis of EU environmental measures impact on SMEs as documented in the e-survey and as suggested by actors interviewed during country case studies. For each sector, the following topics are analysed:
    - EU environmental legislation and environmental requirements
    - EU environmental legislation and stemming costs
    - Simpler and cost-effective environmental legislation

4.2 LITERATURE REVIEW

4.2.1 PURPOSE

SMEs traditionally find it more difficult to comply with environmental legislation than their larger counterparts. In general, the smaller the company, the more difficult it is. [42]

Although there is a cost implication in environmental compliance, companies that do take action can benefit from lower energy bills and greater efficiency in their operations.

Environmental legislation imposes specific requirements concerning SMEs operation. In many cases: lack of awareness on environmental legislation on behalf of SMEs, lack of time and expertise to understand legislation and implement environmental measures, lack of clear, simple information, lack of financial resources to address environmental issues, make it harder for SMEs to comply with their obligations and create higher compliance costs.[43]

The Informal Environment Council on SMEs, which took place in April 1997 under the Dutch presidency Council, had concluded that "*SMEs are an important engine for economic growth and employment throughout the European Union. SMEs are also an important contributor to environmental pollution. Environmental requirements should be related to the nature and mag-*

[42] (http://ec.europa.eu/environment/sme/programme/programme_en.htm)

[43] European Compliance Assistance Programme for SMEs : 2_ecap_bedo_en.pdf

nitude of environmental pollution not to the size of the enterprise- Informal meeting of EU Environment Ministers, Amsterdam, April 1997".[44]

As it is well understood, the compilation of environmental legislation requirements and complying of enterprises to them generate costs for the enterprises.

These costs may be financial, substantive and administrative. For example, enterprises, complying with legislation may have:

- To pay direct fees (or charges), mainly to the public authorities;
- To change the nature of their products and/or production processes –in order to meet new environmental standards;
- To provide information either to public authorities or to general public.

The first type cost entails "financial costs". The second type of obligation (having to meet a new legislative requirement) leads to "substantive or generic costs". The third type (having to keep a register of pollutant emissions) results in "administrative costs".

Several studies and reports have been implemented during the last years for the assessment of these costs and especially for SMEs in the frame of European Commission's intension to simplify and streamline the disproportionate environmental legislation requirements for SMEs.

In the next paragraphs a brief literature review is undertaken aiming at:

- Recording of administrative burdens and imposed costs already studied before
- Determination of sectors characterized by significant environmental impacts
- Cross-correlation of EU environmental legislation requirements with SMEs sectors affected
- Review of Market Based Instruments, applied for the support of enterprises and specifically SMEs to correspond to the requirements of environmental legislation

4.2.2 ADMINISTRATIVE BURDENS AND IMPOSED COSTS

In November 2006, the Commission proposed launching an "*Action Programme to reduce the administrative burden of existing regulation in the EU*".[45] As part of this, the Commission proposed an administrative burdens reduction target of 25 %, to be achieved by 2012. This Action Programme represents an important effort to streamline and make less burdensome the way in which policy objectives are implemented. The Programme provided by November 2008, an assessment of administrative costs imposed by the selected Commu-

[44] Report on SMEs and the Environment: Analysis of the replies given by 6 European Union Member States to a European Commission's questionnaire on Small and Medium-Sized Enterprises (SMEs) and the Environment, ECOTEC RESEARCH AND CONSULTING, February 2000

[45] Action Programme to reduce the administrative burden of existing regulation in the EU

nity legislation. Final results will be reported to the Spring 2012 European Council taking into consideration all reduction measures entered into force up to 31 December 2011.

Environment is one of the priority areas addressed. *Environment area* is accompanied by specific legislation selected for the measurement of administrative burdens and it is reviewed whether the same Information Obligation (IO) is not requested several times through different channels (e.g. a number of environmental information obligations that presently required by more than one piece of legislation). The following regulations and directives fall within the scope of the action programme on reducing administrative burdens on priority area of environment:

- Regulation (EC) No 1013/2006 of the European Parliament and of the Council of 14 June 2006 on shipments of waste
- Council Directive 96/61/EC of 24 September 1996 concerning Integrated Pollution Prevention and Control
- Waste Electrical and Electronic Equipment (WEEE) Directive 2002/96/EC.
- Directive 2000/53/EC of the European Parliament and of the Council of 18 September 2000 on End-of Life Vehicles
- Directive 2003/105/EC of the European Parliament and of the Council of 16 December 2003 amending Council Directive 96/82/EC on the control of major-accident hazards involving dangerous substances.

Forty five Information Obligations have been identified in the above regulations and directives under review and prioritised according to level of cost, complexity, and burden potential. According to a related Memo[46] an overview of examples of measures for reducing administrative burden is given. In the Priority Area of Environment an overview of the reduction measures adopted by legislators, proposed or under preparation by the Commission as well as the expected savings, gives an estimation of a cost of 1,180,600,000 € derived from Administrative Burdens, a sectoral reduction of -242,100,000 €, thus a reduction of 21% of administrative burdens. The reductions are deriving from the measures shown in the table below.

[46] MEMO/09/474 of 22.10. 2009 titled: "Cutting red tape – Overview of reduction measures and illustrative examples

Table 37: Measures for reducing administrative burdens

• Simplifying procedures for controlling waste shipments • Simplifying the regime for integrated pollution prevention and control • Harmonise national information obligations on waste electrical/electronic equipment and ensure register interoperability • Streamlining reporting obligations on substances depleting the ozone layer • Simplifying authorisation procedures for the placing of biocidal products on the market • Improving coordination between IPPC and Seveso inspections by national authorities • Improving coordination between IPPC and Seveso inspections by national authorities (Implementing Provisions • Encouraging Member States to update IPPC permits rather than demanding their renewal • Simplifying and streamlining the notification system for shipments of waste • Introducing online systems through which treatment facilities can issue vehicle destruction certificates.

The above results are strongly encouraging that there should exist more possibilities for lightening administrative burdens imposed by other (than the examined) legislative issues.

Actions have been taken by many Member States, Candidate Countries and other non-EU countries to simplify and streamline the requirements of environmental regulation, and thereby reduce burdens on businesses.[47] A wide range of simplification initiatives were identified and were grouped into seven categories:

1. organisation/institutional, framework;
2. simplification of permit schemes;
3. simplification of monitoring/reporting;
4. simplification of inspection;
5. use of IT tools/electronic systems;
6. risk-based/incentive-driven approach; and
7. compliance assistance/support.

A significant output of this study was, that the relevant participating countries have confirmed that none of the initiatives described in the report have led to a reduction of the levels of environmental protection. The initiatives presented in the report are relevant to

[47] Streamlining and simplification of environment related regulatory requirements for companies

all types and scales of industry including SMEs. Many Member States have already made significant progress in their efforts to simplify and streamline the burdens imposed on all businesses by environmental regulation.

There are clearly a variety of approaches undertaken in the Member States to perform similar functions (permitting, monitoring, etc.). Many of the differences reflect local circumstances, but this variety is also likely to result in widely different costs. This project has not sought to identify these differences, but further comparative research in this area could be beneficial.

The study recognised the importance of a simplified, consistent and predictable regulatory framework (at all levels) to ensure that environmental outcomes can be delivered effectively and efficiently and enabling the adoption of proportionate and risk-based approaches that reduce burdens on business.

Better administrative measures should reduce costs to business. It should also be emphasised that simpler administration can be better for the environment. When businesses have simple, clear obligations, implementation of the law is likely to be smoother for the enterprises– thus the environmental requirements are easier to be met and deliver visible environmental benefits. The study has also focused on simplification of existing measures, i.e. how to make better what is already there. In taking forward such initiatives, Member States should not lose sight of the importance of proper analysis of business costs (e.g. to SMEs) and environmental outcomes as new regulations are developed to ensure new measures meet better regulation criteria. This includes taking advantage of the flexibility available in EU Directives as they are transposed to the National Legislation framework.

From this study is concluded that there is still a wide area for initiatives to be undertaken in order environmental regulations to be simplified bringing benefits to both: related enterprises (mainly SMEs) and environment.

Additionally according to other implemented studies[48], it can been concluded that **small enterprises bear a disproportionate regulatory burden in comparison with larger businesses**: On average, where a big company spends one euro per employee to comply with a regulatory duty, a medium-sized enterprise might have to spend around four euros and a small business up to ten Euros.

Several reasons create this disproportionate distribution of regulatory costs:

- A **large part of regulation results in costs that are fixed** or do not change much with the size of a business. Filling in a form takes a certain amount of time, and it makes no difference that a larger business might have to fill in bigger figures than a smaller enterprise.
- **Larger businesses can employ specialists to deal with regulatory obligations more efficiently**. For larger businesses, investment in computerisation and rationalisation of

[48] Models to reduce the disproportionate regulatory burden on SMEs

regulatory obligations will often be worthwhile because of the larger number of cases to be dealt with.

- **In small enterprises the entrepreneur himself will often be responsible for taking care of the regulatory obligations**. This means that the most valuable resource of the small business will be occupied with tasks that do not directly contribute to the success of the enterprise.

The above results are supported also in other pieces of literature [49]where it is concluded that large companies can hire environmental managers to oversee regulatory compliance, while owners of small companies often try to manage these duties themselves. In either case, companies also may choose to outsource the three main regulatory compliance components concerning waste - transportation, treatment, and disposal—to an environmental services company. Outsourcing these duties does not mean a company relinquishes control of its waste; rather, it allows a manager to oversee the process while waste disposal experts do their jobs.

Furthermore to the above, smaller SMEs seem to have even more difficulty with meeting the requirements of regulations, having very limited resources, particularly in terms of time and money.[50] The main barriers for SMEs, in terms of compliance and in terms of making environmental improvements in general include:

- lack of understanding of environmental problems and risks;
- lack of time/staff resources;
- lack of financial resources (for investments);
- lack of understanding of the potential benefits of environmental improvements;
- lack of expertise/confidence;
- lack of access to appropriate information (e.g. through IT);
- the view of environmental activity as peripheral to the core business; and
- initiative fatigue/overload (related to lack of staff resources).

Some models for reducing disproportionate regulatory burden on SMEs are suggested, including:

- Size-related exemptions,
- Reduced obligations (i.e. partial exemptions),
- Simplified obligations,
- Temporal exemptions,
- Administrative coordination (especially one-stop shops),
- Common commencement dates,
- Tailor-made information,
- Coaching & training,

[49] http://www.thefabricator.com/ceos/ceos_article.cfm?id=422

[50] Report on SMEs and the Environment: Analysis of the replies given by 6 European Union Member States to a European Commission's questionnaire on Small and Medium-Sized Enterprises (SMEs) and the Environment

- Electronic services,
- Privileged treatment of small businesses,
- Early evaluation of regulatory impact on small businesses.

4.2.3 COST OF ENVIRONMENTAL REQUIREMENTS COMPLIANCE

Industry, amongst the other sectors of economic activities, causes considerable environmental degradation. Therefore it is much affected by environmental policy and consequent legislation. As a result, environmental costs arise for industries in order to comply with the environmental regulations.

Legislation imposes requirements to industries both in terms of pollution protection (*waste treatment, air emissions, hazardous waste etc.*) as well as periodic-regular demand to react on administrative requirements (*reporting, public information etc.*).

Complying with all these regulations seems to be enough complicated specifically for SMEs, and regulatory compliance affects the operation of SMEs. Although some plant managers believe the first corner to cut during difficult financial times is compliance spending, the cost of noncompliance will render these short-term fiscal-year savings meaningless over time.[51] Additionally, it should be mentioned that regulatory compliance activities do not generate revenue, these duties cannot be ignored. Cost-effective regulatory compliance is fundamental in the growth of fabricating plants.

For example, sectors like "Oil chain industry or "Refineries" and "Mining" (NACE1 11 and NACE 23); "Electricity production or "Power" (NACE 40); "Textiles and leather industry or "Textiles" (NACE 17 and NACE 19); and "Iron and steel industry, and other metals "Metals" (NACE 27) characterized by significant environmental impacts, therefore they have been much affected by environmental policy.[52] For the enterprises of these sectors the most interesting findings concerning costs of environmental policy are summarized as following. It is a pity that no special approach for SMEs has been conducted. However, some of the results are related also to SMEs:

- **Environmental policy accounts for a relatively low percentage of costs for the different sectors**. Annual environmental costs in the four sectors studies are typically less than 2% of production value (being in the order of 0.25 to 2% of production value).
- On the other hand the perception from the respondents of an on-line survey is **that environmental costs are much higher and that these costs are higher than their competitors[53]**.

[51] Achieving cost-effective environmental compliance : How outsourcing waste management can help

[52] Sectoral Costs of Environmental Policy

[53] Sectoral Costs of Environmental Policy

- There is **no evidence that environmental policy has a material effect on the competitiveness of Europe's manufacturing sectors** or leads to relocation.

It is assumed that the following findings relate also to SMEs operation:

- The **costs of environmental policy** since the 1990s vary between the studied sectors, but **generally tend to fall**, except for the refineries where the environmental costs show an increasing trend; during this period there has been a marked improvement in environmental performance. One **would expect a higher unit cost to reduce the more costly emissions**, however **innovation** and **the shift from end-of-pipe towards integrated investments** could be viewed as important factors stabilising the unit costs of environmental protection. This finding is applicable to SMEs too.
- There seem to be synergies between different policies meaning that the cumulative costs of environmental policy are less than the costs would be of the individual policies with no integrated measures by businesses.
- **Environmental policy can also benefit companies**, for example, by improving resource efficiency; and Environmental strategy has also helped improve performance.
- Three environmental policies – LCP (*Large Combustion Plants*) Directive, IPPC Directive and the Waste Framework Directive- had a significant influence on a company's investment in environmental technologies. The **LCP** and **Waste Framework Directives** are important in inducing companies to **invest in end-of-pipe technologies**, while the **IPPC Directive** significantly increased **investments in process integrated technologies**. LCP and Water Framework Directives strongly induced a company to use its resources more efficiently as these policies reduced the energy and water consumption per unit produced.
- Policies aimed at increasing the advantages from environmental strategy, e.g. labels for goods produced according to state-of-the-art Best Available Techniques, can contribute to increasing the impact of environmental regulations, and ultimately, deliver emission abatements or increased resource efficiency.

Data from Eurostat are used to provide a comparison between sectors annual Environmental Protection Expenditures (EPE). Sectoral environmental investments show several peaks, but are not higher than 1.5% of sectoral production values. Total EPE are higher in the sectors strongly related to energy policy (refineries, mining and power).

For the *oil refinery sector*, most of the environmental expenditures are attributed to the control of air emissions, both in terms of investments, operating and annual costs. The control of waste is the second most important environmental expenditure. The narrative case study on the oil sector revealed a trend towards more end-of-pipe rather than process-integrated investments. For this sector, on the EU level there still appears to be large differences in costs between Member States.

The *electricity producing sector* is also largely affected by environmental expenditures related to the prevention and control of air emissions, both in terms of investment and operating costs. Power suppliers control emissions by choosing new types of power plants such as the Combined Cycle Gas Turbine.

For the oil chain sectors and the electricity producers, the LCP and the IPPC Directives seem to be the key European regulatory drivers of the past years. Plants however perceive that they are also highly affected by the ETS (Emission Trading Scheme) Directive.

For the *textiles and leather industry*, pollution control (end-of-pipe) investment expenditure is mainly focused on wastewater followed by air. The investment for pollution prevention (integrated technology) is more evenly spread over the environmental domains with wastewater being the most important. Adding investments and operating costs into annualised costs, water is the dominant environmental domain, followed by waste.

Looking at the regulatory drivers for this sector, the IPPC Directive is considered as the key driver of the recent years, more than the Water Framework Directive and the Waste Framework Directive. The impact of the Dangerous Substances Directive varies considerably among plants. An interesting observation is that sector operators already indicate the REACH Regulation as very important with respect to environmental expenditures, although it has only recently come into force (June 2007).

Concerning the *base metals sector* (NACE 27), investment expenditures on the reduction of air emissions dominate. Regarding operating expenditures a large amount of money is spent on wastewater protection measures. The IPPC Directive proves to affect the respondents from the metals industry the most.

According to Dutch response in a related questionnaire- smaller installations contribute significantly to environmental pressure (around 50%) in terms of the following themes and emissions:

- Eutrophication/ nitrogen and phosphorous compounds;
- Dispersion of priority substances to soil/ copper, zinc;
- Ozone layer depletion/ CFCs;
- Volatile organic compounds;

The most important sectors (except Agriculture and livestock farming) in which SMEs assumed as polluting are:

- Construction, waste treatment and recycling (*relative high emissions of CFCs*);
- Food and drink industry (*ozone depletion, acidification, waste generation, dispersion to air, greenhouse gases*);
- The building products industry (*acidification, dispersion, ozone depletion, waste generation, greenhouse gases*); and
- The metal products industry and electro-technical industry consisted mainly of non-IPPC installations (*halogenated compounds*).

Furthermore, for the paint manufacturing industry, compliance with environmental laws is a significant cost.[54] Environmental compliance costs include permit fees; monitoring, reporting, and recordkeeping; operator training and waste transportation and disposal costs. It is noticed that unfortunately, environmental compliance costs are often lumped into overhead or indirect categories by conventional accounting practices. This hides true compliance costs, and hinders production managers from tracking cost savings that result from their waste reduction efforts. Manufacturers have stated that their environmental costs can range up to 1% of their total gross annual sales, but this percentage may vary for a SME, being higher. Pollution prevention can reduce or eliminate these environmental costs, and can change this 1% from a cost into a profit! In this sector, waste reduction efforts might be seen as opportunities to reduce operating expenses and reduced liability by avoiding waste generation, contributing to environmental improvement.

However, on the other hand many researchers claim that there is a growing awareness that complying with environmental regulations is often much less expensive than people think.[55] Case studies and retrospective analyses conducted for a variety of regulations show that, in all cases, emission reduction at the source is much cheaper than is generally expected. However, clean up beyond the source is often much more expensive than predicted.

4.2.4 THE USE OF MARKET-BASED INSTRUMENTS

Environmental policy design and assisting incentives to SMEs for their environmental compliance are supplemented from, 'Market-based instruments' (MBIs) — such as taxes, charges, subsidies and tradable permits -, which help SMEs to realise simultaneously environmental, economic and social policy objectives by taking account of the hidden costs of production and consumption to people's health and the environment, in a cost-effective way. Market Based Instruments (MBIs) are not necessarily a direct substitute for other policies and programs; rather they offer a complementary tool that can enhance the effectiveness of other regulatory mechanisms, policies and programs.[56],[57],[58]. Market-based instruments can be particularly effective tools for dealing with the four major areas of action of the EU 6th environmental action programme, namely: tackling climate change, preserving nature and biodiversity, protecting environment and human health, and through the sustainable use of resources and management of wastes. They do so by addressing the sources of environmental pollution most relevant to these areas such as:

[54] Paint Manufacturers can save money on environmental compliance costs (FACT SHEET, Dept. of Toxic Substances Control, Jan 1997

[55] FALLING PRICES - Cost of Complying With Environmental Regulations.Almost Always Less Than Advertised

[56] http://ec.europa.eu/environment/enveco/green_paper.htm

[57] EEA Report No 1/2006 Using the market for cost-effective environmental policy, Market-based instruments in Europe

[58] An Overview of Market-Based Instruments and Environmental Policy in Australia, Stuart Whitten, Martin van Bueren and Drew Collins

- emissions from power stations, industry, cars and aircraft (*tradable emission permits, fuel taxes)*;
- increasing waste generation by households and other actors (*waste disposal taxes, taxes on packaging, incentives for recycling*);
- emissions resulting from houses and offices (*incentives for improved insulation and energy efficient heating systems*);
- emissions resulting from agricultural activities (*fertiliser and pesticide taxes*).

MBIs have been classified into five main types as illustrated by the table below.

Table 38: Typology of market based instruments (MBI)

Instruments	Description
Tradable permits	Designed to achieve reductions in pollution (such as emissions of CO2) or use of resources (such as fish quotas) in the most effective way through the provision of market incentives to trade
Environmental taxes	Designed to change prices and thus the behaviour of producers and consumers, as well as raise revenues
Environmental charges	Designed to cover (in part or in full) the costs of environmental services and abatement measures such as wastewater treatment and waste disposal;
Environmental subsidies and incentives	Designed to stimulate development of new technologies, to help create new markets for environmental goods and services including technologies, to encourage changes in consumer behaviour through green purchasing schemes, and to temporarily support achieving higher levels of environmental protection by companies
Liability and compensation schemes	Aim at ensuring adequate compensation for damage resulting from activities dangerous to the environment and provide for means of prevention and reinstatement

Experience in recent years shows that the question of "which instrument is best" has changed to 'which **mix of instruments is best**', both in terms of using MBIs alongside other environmental measures such as regulations and in terms of using MBIs to meet environmental objectives in combination with economic and social objectives.

A range of other instruments are either planned or under serious consideration notably pricing policies for water by 2010 under the EU water framework directive, road charging systems, and the increased use of trading certificates for green electricity. These and other initiatives suggest that the use of market-based instruments is likely to increase further in coming years, possibly as part of wider initiatives on environmental tax and subsidies reforms.

4.2.5 ECONOMIC TOOLS FOR ENVIRONMENTAL COMPLIANCE IMPROVEMENT

In the recent years there has been a rapid growth in discussions of the economic framework for environmental compliance and enforcement. An interesting mix of different eco-

nomic tools, or good practice examples have been undertaken in order to facilitate SMEs in taking measures to comply with the environmental legislation.

For example, different good practice examples of public policies, programmes and initiatives ("framework conditions") have been undertaken to encourage the (voluntary) uptake of Environmental Management Systems (EMSs) in small and medium-sized enterprises (SMEs).[59]

The gained experience from EMS adoption as far as the economic benefits and consequently, cost savings, is summarized as follows:

- The adoption of an EMS (a formal nature – the EU's Eco Management and Audit Scheme EMAS and the international standard (EN) ISO 14001 – or of a less formal character) can help address environmental requirements and pressures. In addition, an EMS can also have a positive impact on companies' economic viability.
- Among the most environmentally significant SME-dominated manufacturing subsectors are metals; textiles, leather and clothing; plastics; timber, woodworking and furniture; printing; electronics; specialist chemicals such as dyes, paints and varnishes; as well as food, drink and tobacco.
- Cost savings from energy, fuel and material reductions, and better business relationships with customers, appear to be tangible benefits.
- Disbenefits are higher than expected staff and certification costs, unexpected capital expenditure, a lack of market rewards, too much emphasis on paper work instead of environmental improvements, and the overall complexity of the approach.

Summarizing, subsidy schemes for EMS-related activity are numerous and widespread in Europe. **SMEs, especially small and micro enterprises, face difficulties in implementing a formal EMS**. Not only is the language and terminology of formal EMSs alien to the average staff member, but also the emphasis on documented procedures is quite contrary to the informal, non-documented structures and systems often found in enterprises. Furthermore, some verifiers/certifiers for EMAS and EN ISO 14001 lack experience in dealing with EMSs developed by SMEs. They spend relatively greater time assessing smaller enterprises' systems than those of larger companies. This can mean that smaller companies bear a higher cost for their verification/certification. In addition, the compulsory annual re-validation of environmental statements in EMAS is sometimes perceived as overly bureaucratic and unnecessarily costly.

EMAS is a voluntary instrument established by the EU. It describes a standard way for organisations to measure their environmental performances and work to improve them. **The benefits of EMAS are that companies have recognised proof of their credentials as environmentally friendly and socially responsible organisations.** EMAS is a dynamic instrument for environmental protection and sustainable development. By optimising use of raw materials, transport, water and energy, and rationalising and recycling packaging,

[59] Public policy initiatives to promote the uptake of environmental management systems in small and medium sized enterprises

costs can be cut and significant savings can be achieved. Reducing the volume and toxicity of your waste, used water and air emissions not only reduces your waste management costs but also improves the environment.[60] Enterprises **can benefit from resource savings** and as such, a catalyst for innovation may be provided.

Companies wanting to qualify for EMAS must review the environmental impacts of their activities, products and services. They then set up a management system with fixed objectives and must conduct regular environmental audits and produce statements of environmental performance. In that way, they apply constantly regular monitoring and reporting procedures, covering in many cases the necessary monitoring and reporting imposed by EU environmental legislation. EMAS audits (as well as other EMSs audits) can determine any environmental failure in a very early stage, ridding the enterprise from possible fines.

The scheme has now been revised for a second time in order to reduce the administrative and financial burdens on participating organizations and to encourage others to use it. EMAS III places particular emphasis on small- and medium-sized enterprises (SMEs). Some of the important provisions, addressing the above difficulties, include:[61]

- Taking into account the characteristics of small organizations during verification. Environmental verifiers are required to carry out their reviews in a way that does not impose unnecessary burdens on small organizations.
- Possibility to extend the period between registrations from three years to four, or from one year to two, as appropriate.
- Option to reduce costs by registering in a cluster.
- Fairer fees: principle of proportionality.
- More support from the Member States to registrants.

EMS in general opens up the door to future public markets and eco-innovation, and as that it is a tool to greening enterprises (next Chapter of the Study).

As far as costs of implementing EMAS are concerned, it is derived from the literature that it depends on the size of the organisation and on its activities. Financial resources spent on setting up an environmental management system, including external consulting fees and associated communication and registration costs, are on average:[62] (figures do not integrate state aid)

- € 10,000 for very small companies (< 10 employees)
- € 20,000 for small companies (< 50 employees)
- € 35,000 for medium companies (>50 <250 employees)
- € 50,000 for large companies (> 250 employees)

[60] EMAS Toolkit for small organisations, International Network for Environmental Management (INEM), 2004

[61] http://ec.europa.eu/environment/sme/schemes/environment_management_en.htm

[62] EMAS Toolkit for small organisations

Additionally to the above findings it should be noted that, in the recent years there has been an open discussion of the economic framework for environmental compliance and enforcement.[63]

Very rarely government agencies consider the economic aspects of enforcement and non-compliance and inadequate attention is paid to answering the following fundamental questions:

—Why do firms comply (or not) with environmental laws? —What are optimal enforcement strategies and tools that can maximize environmental benefits and minimize costs to the regulators and regulated community? —What are the opportunities and limits in the choice, and calibration, of regulatory instruments to deter non-compliance?

Although the implementation of environmental policies has played an increasingly important role in many countries, the enforcement of these policies, and more specifically economic aspects of compliance assurance programs, has attracted less attention. Empirical findings reflecting this neglect include:

- inadequate consideration of enforcement problems in designing environmental policies;
- limited knowledge about actual compliance rates;
- absence of consideration of economic impacts of enforcement programs by enforcers; and
- lack of ex ante/ ex post cost-benefit analysis of compliance assurance policies and enforcement actions.

To pursue environmental improvements in an economically efficient way, the costs and benefits of compliance and enforcement need to be taken into account throughout the whole cycle of a policy design and implementation. There is also a need for designing policy mixes that are adapted to the specific context, combined with a greater use of economic instruments, when possible, to reduce the costs to the regulated community and also to approach the problems of small polluters (SMEs).

Further to this is the fact that lack of enforcement and penalties of non-compliance in some Member States creates an uneven playing field for companies who comply fully with environmental legislation. This is naturally a course for concern in high impact sectors, and the interviews with sector organisations and companies in the chemical sector in the UK revealed this indeed is the truth. There are also uneven playing fields within Member States, where local/regional authorities are responsible for enforcement through auditing and checks in companies.

[63] Economic Aspects of Environmental Compliance Assurance" a summary of the results of a Conference on Economic Aspects of Environmental Compliance Assurance, organized on 2-3 December 2004

4.3 ENVIRONMENTAL LEGISLATION REQUIREMENTS

There are a number of areas of EU environmental legislation relevant to SMEs, while the following predominate[64]:

- Air quality, emissions trading and noise (IPPC)
- Chemicals (REACH)
- Energy
- Environmental management (EMAS, Lifecycle Assessment, CSR)
- Waste
- Water
- Soil

In the Appendix a presentation of the main EU regulatory issues in the environmental field is provided (as they derive from specific legislative issues). A presentation is given for each of the above mentioned areas that influence SMEs' operation in terms of administrative or generic costs.

On the ground of the above literature review an overview is compiled relating the legislation with specific sectors, based mainly on the findings of the e-survey and country case studies. These sectors are:

- C: Mining and quarrying sector
- DA: Manufacture of food products, beverages and tobacco sector
- DE: Manufacture of pulp, paper and paper products
- DB: Manufacture of textiles and textile products sector
- DG: Manufacture of chemicals, chemical products and man-made fibre
- DI: Manufacture of other non-metallic mineral products sector
- F: Construction sector
- G: Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods
- I: Transport, storage and communication
- H: Hotels and restaurants sector
- Eco-industries.

It is noted that these sectors have been determined from the analysis of statistical environmental data in EU27 combined with suggestions from the focus group.[65]

A brief presentation of legislation effect on SMEs of studied sectors is given in Table 39. It can be concluded from the review of legislation presented in the Appendix, that environ-

[64] Environmental Compliance Assistance Programme for SMEsSmall, Clean and Competitive : http://ec.europa.eu/environment/sme/legislation/legislation_en.htm

[65] Focus Group: Meeting held in January 2010

mental legislation concerning waste and water management as well as REACH Regulation affects SMEs of almost all the sectors.

Table 39: SMEs Sectors affected by specific environmental legislation issues, according to legislation analysis

	Sectors	C Mining and quarrying	DA Manufacture of food products, beverages and tobacco	DB Manufacture of textiles and textile products	DE Manufacture of pulp, paper and paper products; publishing and printing	DG Manufacture of chemicals, chemical products and man-made fibres	DI Manufacture of other non-metallic mineral products	F Construction	G Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods	H Hotels and restaurants	I Transport, storage and communication	Eco-industry
	Legislation											
1	Emissions of atmospheric pollution				■		■		■		■	
	National Emission Ceilings ● *Directive 2001/81/EC* *Ambient Air Quality* ● *Directive 2008/50/EC on ambient air quality*											
2	Volatile organic compounds			■	■	■		■	■		■	
	● *Directive 94/63/EC on the control of VOC emissions resulting from petrol*											
	● *Council Directive 1999/13/EC on the limitation of emissions of VOCs due to the use of organic solvents* ● *Directive 2004/42/EC on the limitation of emissions of VOCs due to the use of organic solvents in decorative paints and varnishes and vehicle refinishing products*											
3	Emissions trading				■	■						
	Overview of the Emissions Trading Scheme											
4	Noise	■	■	■	■	■	■	■	■	■	■	■
	Directive 2002/49/EC relating to the assessment and management of environmental noise											
5	Chemicals)	■	■	■	■	■	■	■	■			

	Sectors	C Mining and quarrying	DA Manufacture of food products, beverages and tobacco	DB Manufacture of textiles and textile products	DE Manufacture of pulp, paper and paper products; publishing and printing	DG Manufacture of chemicals, chemical products and man-made fibres	DI Manufacture of other non-metallic mineral products	F Construction	G Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods	H Hotels and restaurants	I Transport, storage and communication	Eco-industry
	Regulation on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)											
6	Energy efficiency								■		■	
	Directive 2006/32/EC on energy end-use efficiency and energy services											
7	Energy label							■	■			
	Directive 92/75/EEC on the indication by labelling and standard product information of the consumption of energy and other resources by household appliances and amending acts											
8	Ecodesign								■		■	
	Directive 2005/32/EC of 6th July 2005 establishing a framework for the setting of ecodesign requirements for energy-using products											
9	Waste (General legislation)	■	■	■	■	■	■	■	■	■	■	■
	Directive 2008/98/EC 8 on waste											
10	Specific legislation on waste batteries	■	■	■	■	■	■	■	■	■	■	■
	Directive 2006/66/EC on batteries and accumulators and waste batteries and accumulators											
11	*Specific legislation on packaging*		■		■	■	■					
	Directive 94/62/EC on packaging and											

	Sectors	C Mining and quarrying	DA Manufacture of food products, beverages and tobacco	DB Manufacture of textiles and textile products	DE Manufacture of pulp, paper and paper products; publishing and printing	DG Manufacture of chemicals, chemical products and man-made fibres	DI Manufacture of other non-metallic mineral products	F Construction	G Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods	H Hotels and restaurants	I Transport, storage and communication	Eco-industry
	packaging waste and amending acts											
12	*Specific legislation on hazardous substances in electrical and electronic equipment*									■	■	
	Directive 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment and amending acts [RoHS Directive]											
13	*Specific legislation on oil waste*		■	■	■	■	■	■	■	■	■	
	Directive 75/439/EEC on the disposal of waste oils and amending acts											
14	*Specific legislation on PCB / PCT*											
	Directive 96/59/EC on the disposal of polychlorinated biphenyls and polychlorinated terphenyls [PCB/PCT]											
15	Water		■	■	■					■		
	Water Framework Directive and Directives on Water pollution from Industrial Wastewater –[IPPC]											
16	Soil	■						■		■	■	
	(Discharges of substances, Biodegradability and labelling of detergents, Elimination and minimisation of production, use and release of persistent organic pollutants (POPs), Mercury)											

As far as waste and water management legislation impact to SMEs is concerned, this conclusion is confirmed by the interviews and electronic survey conducted.

On the other hand, according to the results of interviews, SMEs of a very few sectors consider REACH as a main environmental issue related to their activities.

This can be explained by the low level of their information by national competent authorities. Where sectoral associations exist, the situation concerning knowledge communication seems to be much better.

A brief presentation of the results of the electronic survey provides some interesting findings (See Table 40):

- Legislation on **emissions of atmospheric pollution** is considered by SMEs organisations as affecting completely the activities of **SMEs in all the sectors**. 84% of surveyed organizations consider that this legislation affects the activities of SMEs in the sector "*G: Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods*". This can be explained from the point that Member States due to their obligations derived from Air Pollution Directives, set up both:
    - specific air emission limits to the most of SMEs sectors analysed through their Environmental Terms Approval procedures;
    - monitoring and reporting obligations.
- All the organizations of "*E: Electricity, gas and water supply*" sector consider that **legislation on VOCs** affects completely the activities sector's SMEs. For "*C: Mining and quarrying*" sector, 75% of the organizations consider that VOCs legislation poses specific environmental requirements. It is not clear why this high percentage of sector organizations consider that VOC legislation is affecting the activities of sector's SMEs. It is worth to mention that for "*D: Manufacturing Sector*" only 67.6% of surveyed organizations consider VOCs legislation as affecting SMEs operation, although many sub sectors of this sector are strongly affected by this legislation.
- Legislation on **Industrial Plants (IPPC)** considered posing environmental requirements to the SMEs of "*C: Mining and quarrying*", "*D: Manufacturing*" and "*E: Electricity, gas and water supply*" sectors. It i**s** impressive that organizations of "*H: Hotels and Restaurants*" sector in a percentage of 85.7% *consider that legislation on industrial plants* (IPPC) affects the operation of SMEs in this sector. There is n**o simple explanation** for this result. The most logical explanation is that they do not have a clear picture of what the specific legislation concerns, but at this case some doubts for the validity of e-survey data may arise. However, the most findings are in accordance to what is expected.
- According to the analysis of surveyed organizations data, **Emission trading legislation** *i*s affecting the SMEs activities of sectors: "*C: Mining and quarrying*" and "*E: Electricity, gas and water supply*".

- 100% of the surveyed organizations presume that SMEs of "*C: Mining and quarrying"* and "*E: Electricity, gas and water supply sector*" are affected by environmental requirements of **Noise legislation**. However it is assumed that noise is a concern for SMEs primarily in its Health and Safety dimension (to protect the health of employees), rather than its environmental one. Additionally, noise legislation is considered that affect SMEs activities in "*F: Construction"*, "*I: Transport, storage and communication"* and "*K: Real estate, renting and business"* sectors. Noise legislation and any derived requirement seem to be a second priority for SMEs in "*D: Manufacture*" Sector.
- An interesting result concerns legislation on **Chemicals** (REACH Regulation) that is considered as significant for all the sectors of economic activities. This finding is in contrary to the findings of Country Case Studies, where it seems that the most of interviewed SMEs are not aware of REACH Regulation and its requirements. It is believed that organizations representing SMEs are more familiar with the specific obligations imposed by REACH provisions.
- Legislation referred to **Energy Efficiency** is considered to affect SMEs in the sectors of "*C: Mining and quarrying*", "*D: Manufacturing*", "*E: Electricity, gas and water supply*", "*F: Construction*" and "*K: Real estate, renting and business activities*". It can be noticed that SMEs organizations consider energy efficiency as a priority issue for SMEs not only due to their environmental concerns, but also due to cost of energy.
- For the most of surveyed organizations **Energy label** legislation requirements affect SMEs acting in the sectors of "*E: Electricity, gas and water supply*", "*F: Construction*" and "*K: Real estate, renting and business activities*". At the same time **Ecodesign** requirements are strongly related only to SMEs of "*E: Electricity, gas and water supply*", although it could be presumed that both Energy label and Ecodesign legislation would affect the same sectors in a similar way.
- General legislation on **waste management** affects SMEs of all sectors. It is worth to mention that the percentage concerning "*H: Hotel and Restaurants*" sector is rather low, although waste management seems to be one of the environmental priorities according to the answers of interviewed enterprises and what is generally expected.
- Specific legislation on **waste batteries** is a major concern for SMEs in the sectors of "*G: Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods*", "*H: Hotels and restaurants*", "*I: Transport, storage and communication*" and "*K: Real estate, renting and business activities*".
- Specific legislation on **packaging** is a major concern for SMEs of all sectors.
- Specific legislation on **waste electrical and electronic equipment** is considered to affect the enterprises of all sectors except SMEs of "*C: Mining and Quarrying*", as well as "*D: Manufacturing*" sectors. This can be explained by the fact that SMEs of these sectors have other more significant environmental priorities and for the purposes of this Directive the only thing that they do is

to collect electrical and electronic equipment and dispose them to certified systems of alternative management of these materials.

- Specific legislation on **hazardous substances in electrical and electronic equipment** is a concern for SMEs in "*E: Electricity, gas and water supply*", "*H: Hotels and restaurants*» and "*K: Real estate, renting and business activities*" sectors.
- The same sectors seem to be affected by specific legislation on **oil waste.**
- Both, specific legislation on end-of-life vehicles and on PCB / PCT are significant for SMEs of "*E: Electricity, gas and water supply Sector*".
- Requirements of water environmental regulation (water use, wastewater treatment and management) are a major concern of SMEs in all sectors except "*C: Mining and quarrying*" and "*I: Transport, storage and communication*". Water use and wastewater management are not of prior concern for SMEs of these sectors, since they are not considered to be included in "water consuming" segment of SMEs.
- Finally, general requirements concerning **Soil protection and management** seem to be a concern for SMEs in "*C: Mining and quarrying*", "*D: Manufacturing*", "*E: Electricity, gas and water supply*" and "*G: Construction*" Sectors.

Table 40: Legislation affecting activities of economic sectors- Organisations opinion – e-survey

LEGISLATION	Mining and quarrying , C	Manufacturing, D	Electricity, gas and water supply, E	Construction, F	Wholesale and retail trade; G	Hotels and restaurants, H	Transport, storage and communication, I	Real estate, renting and business activities, K
Emissions of atmospheric pollution	100%	89%	100%	92%	85%	100%	100%	90%
Volatile organic compounds	75%	68%	100%	46%	46%	57%	73%	60%
Industrial plants	88%	92%	75%	62%	69%	86%	46%	70%
Emissions trading	75%	54%	75%	54%	46%	71%	55%	40%
Noise	100%	62%	100%	85%	62%	71%	82%	80%
Chemicals	88%	92%	100%	85%	77%	100%	100%	90%
Energy efficiency	75%	89%	100%	85%	69%	71%	73%	80%
Energy label	50%	41%	75%	77%	69%	71%	73%	90%
Ecodesign	50%	41%	75%	54%	46%	43%	27%	50%
Waste (General legislation)	100%	97%	100%	85%	77%	71%	82%	90%
Specific legislation on waste batteries	63%	32%	100%	69%	77%	100%	82%	90%
Specific legislation on packaging	75%	81%	100%	77%	92%	86%	82%	80%
Specific legislation on waste electrical and electronic equipment	63%	30%	100%	77%	69%	100%	82%	80%
Specific legislation on hazardous substances in electrical and electronic equipment	38%	30%	75%	46%	62%	86%	64%	80%
Specific legislation on oil waste	63%	46%	75%	54%	62%	86%	73%	80%
Specific legislation on end-of-life vehicles	38%	32%	100%	62%	54%	71%	64%	60%
Specific legislation on PCB / PCT	63%	32%	100%	39%	31%	43%	46%	40%
Water	63%	89%	100%	77%	77%	100%	73%	80%
Soil	75%	76%	100%	77%	62%	71%	64%	60%

4.4 IMPACT OF EU ENVIRONMENTAL MEASURES ON SMEs

4.4.1 ANALYSIS OF INTERVIEWS AND SURVEY

After the literature review on the impact of EU Environmental Measures on SMEs, in this section an analysis of data and information gathered by the electronic survey and country case studies is presented.

For the analysis of administrative burdens and business opportunities as well as toolkits implementation, more than 130 interviews with SMEs, sector organizations and other knowledge institutions have been conducted in 13 countries in order to generate concrete, bottom-up information; this field work has been supplemented by an e-survey addressed to SME organisation in EU 27 countries **covering all the economic activities**. In total 181 questionnaires were filled. A table of the countries and sectors targeted in the present study is given below. The sectors and countries were selected with the help of preliminary data from the Eurostat in the EIDSME database and an evaluation at an expert workshop in Brussels in January 2010.

Overview of interviews in sectors / countries for the country case studies found in the appendix

	C	DA	DB	DE	DG	DI	DJ	F	G	H	I	Eco- industries	Total*
Belgium					4							3	7
Bulgaria				4		4				4			12
Cyprus		4								5	4		13
Czech Republic				4		5							15
Denmark		3					3					3	9
France								5				5	10
Germany					3		3				2	1	9
Greece	4	5								3			12
Italy			7					3					10
Poland					4		2		1			1	9
Slovenia			2			2				1		1	7
Spain				2							2	5	9
United Kingdom		4			4			1				2	11
Total	4	16	9	10	15	11	8	9	1	13	8	21	133

* Including cross-sectoral organisations

C Mining and quarrying
DA Manufacture of food products, beverages and tobacco
DB Manufacture of textiles and textile products
DE Manufacture of pulp, paper and paper products; publishing and printing
DG Manufacture of chemicals, chemical products and man-made fibres
DI Manufacture of other non-metallic mineral products

DJ	Manufacture of basic metals and fabricated metal products
F	Construction
G	Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods
H	Hotels and restaurants
I	Transport, storage and communication

Eco-industries As defined by the OECD and Eurostat, eco-industries are "activities which produce goods and services to measure, prevent, limit, minimize or correct environmental damage to water, air and soil, as well as problems related to waste, noise and eco-systems.

The target group for the electronic survey were SME organisations in all of the EU 27 countries and from all the economic activities. Results and findings of both electronic survey and case studies were combined and analysed by sector, while the main and common results are presented in the end of the present section.

The pieces of legislation posing certain legislative requirements to SMEs of a sector have been determined by both interviewees and electronic survey answers.

4.4.2 C: MINING AND QUARRYING

4.4.2.1 EU ENVIRONMENTAL LEGISLATION AND ENVIRONMENTAL REQUIREMENTS

In this sector, the main environmental impacts are referred mainly to:

- environmental and aesthetic management of land under development

Directive 2006/21/EC of the European Parliament and of the Council of 15 March 2006 on the management of waste from extractive industries and amending Directive 2004/35/EC is the only European environmental legislation specific to the mining and quarrying sector. All the other obligations derive from general environmental legislation.

Concerning the specific environmental requirements of the EU legislation, the most significant issue is the approval of specific Environmental Terms for their operation, based on the related Environmental Impact Assessment (EIA) procedure according to the interviewed SMEs.

It is generally accepted by interviewed SMEs that their EIA incorporates all the environmental considerations into their activities, complying also with the specific requirements of European Environmental Legislation.

4.4.2.2 EU ENVIRONMENTAL LEGISLATION AND STEMMING COSTS

For mining and quarrying activities, the main EU regulatory measures in the environmental field that impact in terms of generic costs, is environmental and aesthetic management of land under development.

Most of the SMEs in the mining and quarrying sector have reporting obligations concerning their environmental impacts (waste, air emissions, noise, and use of natural resources soil) to the responsible authorities, stemming from national legislation requirements.

This is often done by an employee not specifically allocated to this task only, thus his effort is not presumed as administrative burden. As explained by a Greek quarrying company (Greece- Country Case Study), the allocation of one company employee's portion of time to collect and report environmental information requirements is not perceived as an administrative burden, since such cost does not entail cash expenditure.

Another important administrative cost of this sector is related to environmental permitting procedure and its renewal. Interviewed SMEs use always independent external consultants to undertake EIA work.

4.4.2.3 SIMPLER AND COST-EFFECTIVE ENVIRONMENTAL LEGISLATION

In the mining and quarrying sector, the need for one-stop-shop for permits is highlighted, recruitment of employees from relevant technical fields in permitting units, creation of a database so that responsible administrative bodies exchange information and codification of legislation. This specific need of course has to do mainly with the national administrative structure and organisation and less with the European environmental legislation requirements.

It is also noticed, that costs of environmental compliance could be reduced by initial good planning and by promoting best practices (e.g. underground mines techniques).

4.4.3 DA: MANUFACTURE OF FOOD PRODUCTS, BEVERAGES AND TOBACCO SECTOR

4.4.3.1 EU ENVIRONMENTAL LEGISLATION AND ENVIRONMENTAL REQUIREMENTS

The main environmental impacts of the Manufacture of food products, beverages and tobacco products sector, according to both literature and interviews are:

- Waste
- Wastewater management as well as
- Packaging and packaging waste (depending on their particular activities and products).

Electronic survey data covers the whole "Manufacturing" sector and therefore they cannot be used for this analysis.

In some cases, the lack of public infrastructure (i.e. central public wastewater treatment plants) is considered as a serious obstacle for SMEs wastewater management. For small businesses it is hard to implement a wastewater management system as the cost would be enormous compared to their production capacity.

A dairy company representative in Cyprus argued that "I think the waste on this sector depends on your product. We also have other waste that are harmless to the environment and are sold to pig farmers for a profit as well."

(*Cyprus Case Study*)

A significant issue for the SMEs of this sector is the lack of infrastructure and /or systems for separate waste collection for waste streams that could be recycled (such as paper, plastic etc). SMEs consider that, it may be very costly to cope with recycling requirements by themselves.

4.4.3.2 EU ENVIRONMENTAL LEGISLATION AND STEMMING COSTS

In the Manufacture of food products, beverages and tobacco sector, EU environmental measures that impact on SMEs are linked to their particular activities and products. For the dairy industry for example, the most exigent environmental legislation issue is wastewater management/whey management (specifically requirements of national legislation).

National legislation results in administrative costs for SMEs. However, "the cost is not significant" says the owner of a dairy company interviewed in Greece "*as no more than 30 minutes per day are needed for obligations reporting*" (Greece Case Study).

The major environmental regulation affecting the food & drink sector is packaging waste and waste (especially liquid waste products – by-products). The major costs are associated with separation of waste and storage, and especially the latter are associated with high costs. These also include wastewater management that adds compliance cost (both investment cost estimated, as well as operational costs) in most of the SMEs other than dairies, of food sector.

An important issue pointed out from case studies, is that SMEs usually get information about their environmental reporting information, during an environmental inspection of their premises. In parallel, public authorities often are not aware of the relevant legislation or of environmental recording obligations that the SMEs should follow, although inspector's body impose fines or they do not inform the related enterprises of their legislative obligations. The costs of maintaining a system of reporting is different in each sector or company. Location and size are important factors of reporting system cost, as large companies may consider these costs as minor, but for small businesses these can be huge.

However, in some Member States with a long history of sector organisations, such as the UK, these organisations play a vital role in supporting the companies in understanding and complying with legislation. They also act as the voice of the industry in negotiations with the national governments. This guidance and support is vital to the SMEs.

Enterprises of this sector usually should supply / sell their products in a variety of packaging, therefore they influenced remarkably by legislation on packaging

and packaging waste (European Parliament and Council Directive 94/62/EC of 20 December 1994 on packaging and packaging waste and amending acts).

> An SME in Greece that manufactures standardized olive oil and seed oil in a variety of packaging, mentions that it is influenced by legislation on packaging and packaging waste (European Parliament and Council Directive 94/62/EC of 20 December 1994 on packaging and packaging waste and amending acts). The company is affiliated to the Hellenic Recovery Recycling Corporation (HE.R.R.Co S.A.) and makes a financial contribution (smaller than 1% of product cost), so it can use the European "green dot" sign on its packaging.
>
> (*Greece Case Study)*

Eco-packaging, is also an important issue for food industry since it is an essential part of the production procedure. Eco-packaging involves an extra production cost, but this cost is not considered as environmental cost.

As far as waste deriving from the production procedures is concerned, some of them could be defined as *by – products* instead of waste, since they can be used as raw material in other sectors. For example, in dairy industry, whey may be used by pig farmers to feed the animals, giving profit to the industry.

4.4.3.3 SIMPLER AND COST-EFFECTIVE ENVIRONMENTAL LEGISLATION

Suggested measures by interviewed SMEs and other related authorities include:

- more simple procedures in the environmental impact assessment
- simple procedures in environmental reporting.

The costs of maintaining a system of reporting is different in each sector or company. Location and size are important factors as large companies may consider these costs as minor, but for small businesses these can be huge.

There are also suggestions for:

- training of the personnel in order to reduce the costs of maintaining these procedures;
- introducing procedures for information provision to SMEs regarding new legislation requirements or even ideas prior of legislation implementation;
- incentives and financing to SMEs in order to be prepared to implement new legislation requirements.

4.4.4 DE: MANUFACTURE OF PULP, PAPER AND PAPER PRODUCTS

4.4.4.1 EU ENVIRONMENTAL LEGISLATION AND ENVIRONMENTAL REQUIREMENTS

The main environmental impacts of the Manufacture of pulp, paper and paper products as well as the publishing and printing sector are:

- air emissions;
- greenhouse air emissions;

- wastewater management and disposal;
- waste management (mainly paper sludge) including specific waste like batteries;
- management of chemical substances.

The specific environmental requirements of the EU environmental legislation concerning air quality are related to the air pollution ceilings and associated Directive, as well as to the "Emission Trading System".

Many companies, some of them SMEs that produce paper and cardboard, must comply with the IPPC Directive and their environmental production standards are defined by their IPPC permit. IPPC requirements are out of the scope of the present study.

Air emissions are mainly caused by boilers, besides medium-sized sources of pollution coming from printing machines.

Management of chemical substances is covered by REACH Regulation. The pulp, paper and tissue industry are amongst them affected by REACH as a downstream of substances, etc.; Cellulose pulp is exempted from the obligation to register (CEPI – Issue Sheet April 2008, - REACH Implementation Issue Group).

4.4.4.2 EU ENVIRONMENTAL LEGISLATION AND STEMMING COSTS

Concerning the administrative burdens stemming from environmental compliance, the interviewed SMEs address all the necessary tasks to meet their environmental obligations to an internal employee on a full-time basis.

The interviewed SMEs of the sector are familiar with the legislation in the field of environment protection concerning their activities. However, the environmental legislation and its deriving requirements are assessed as too complicated and confusing because of continuous changes.

> An ecologist at a paper mill in Czech Republic notes that "the company has its own full-time ecologist and the environmental costs are quite high, about 4.4 mil. CZK per year." The legislation of environmental regulation is assessed as too complicated and confusing because of continuous changes, inconsistencies and cuckoo egg practices. The implementation expertise of the related state and public administration bodies is often insufficient to explain the issued regulations, however, the environmental inspection authorities are ready to punish with fines immediately, when they confirm an infringement. "
>
> (*Czech Republic Case study)*

Other costs stemming from environmental compliance requirements are related to wastewater management. The companies should take measures to ensure the safe management and disposal of the produced wastewater. In integrated solutions treated effluents of very high quality will be the final product of the treatment plant, which could be reused in some water usages in the company. According to an interviewed SME in Czech Republic, "the company went forward with the construction of a waste water treatment plant (further supplied with

biological processing stage); the investment totalled 47 mil. CZK or 1.8 mil € and was supported by the State Environmental Fund. The resulting emissions are continuously decreasing (further below the defined limits), as well as water consumption".

The most important kind of waste produced is paper sludge, which can be used in brickyards.

At our days an important - key requirement of the processes of the SMEs of this sector is the compliance to very strict hygienic parameters of cardboard processing as they are used for food packaging. SMEs are audited on continuous basis and must implement all the standards as defined by the customers. The costs of compliance are further increased in some Member States, due to the lacking cross-country validity of the related certificates issued by national authorizing bodies (e.g. the reference laboratory approvals in the Czech Republic are not recognized in other countries of EU).

In a Czech Paper Mill,. a new biological wastewater treatment plant was installed after 2002 and as a result the water quality indicators are estimated to be about 1/3 of the regulatory ceilings, which is also the case of air emissions (produced due to heat generation, but minimized after transformation from coal to gas boiler). The paper mill is allocated with the required number of CO_2 permits and holds IPPC permit (approved in 2006). Hazardous chemicals, the output of which is very low, are managed by the authorized contracted entity. The largest amount of waste (in the form of paper sludge) is used in brickyards. The environmental costs are quite high, about 4.4 mil. CZK per year or about 172,000 € per year.

(*Czech Republic Case study)*

Moreover, when there are alarming news published by some food producer on harmful substances identified in packaging, all the suppliers must check for their content in their products (instead of finding the causes at EU level).

Technology problems are related to the requirement on reduction of water consumption in paper production. This results in the worsened use quality of the cardboard for packaging purposes.

In addition, manufacturers of paper and paper and cardboard products prefer to work with businesses certified under the standard ISO14000, REACH, ISO 22000, such as big companies that can afford the administrative costs of certification. SMEs in the sector do not apply those standards.

Another topical issue in the sector, is that companies producing more than 20 tonnes of products per day are required **to verify their greenhouse gas emissions reports** once a year., i.e. **annual reports**. This requirement is related to EU ETS. Many SMEs in the sector are experiencing serious difficulties in applying the standard IS0 14000, facing serious difficulties to legalise their products and to overcome "ECO" ceiling limits.[66] The SMEs in the sector cannot afford (consider-

[66] Bulgaria Case Report

ing it "a luxury") the introduction of the standard ISO 14000, and they consider the standard ISO 22000 for the safety of food packaging as the most burdensome for SMEs.

Testing and cooperation with laboratories is also a burdensome cost item for SMEs. An undertaking of less than 50 employees cannot afford to set up its own laboratory.

> The Executive Director of a Bulgarian paper company considers that "the same laws and measures are applied as to large enterprises in the industry. Testing and cooperation with laboratories - it is also a burdensome cost item for SMEs. An undertaking of 26 employees cannot afford to set up its own laboratory and if the law required such measures, it will only burden the products with costs making them more expensive and practically uncompetitive".
>
> *(Bulgaria Case Study)*

A serious problem for the interviewed SMEs is that the provisions of environmental legislation are not clear and explicit. There are no specialised standards and strong communication between SMEs and the responsible administration bodies.

The current legislation provides for no levies to this production segment and it benefits no incentives. Small companies rely on the purchase of certificates for raw materials, but it is unbearable costs for them to investment in laboratories, while product fees also pose problems. Voting of laws and regulations introducing fines and penalties is done too hastily, while lacking clear rules for implementation.

4.4.4.3 SIMPLER AND COST-EFFECTIVE ENVIRONMENTAL LEGISLATION

The suggestions by the interviewed SMEs for simpler and cost-effective environmental legislation concern mainly:

- simplification of environmental permitting procedures (Environmental Impact Assessment), which can cover the entire SME sector with size related or temporal exemptions, privileged treatment of SMEs, trainings.

4.4.5 DB: MANUFACTURE OF TEXTILES AND TEXTILE PRODUCTS SECTOR

4.4.5.1 EU ENVIRONMENTAL LEGISLATION AND ENVIRONMENTAL REQUIREMENTS

In the "Manufacture of textiles and textile products sector", main considerations and problems related to environmental legislation and associated requirements refer to:

- waste management of the various industrial processes;
- energy efficiency;

- use /management of hazardous chemical substances according to REACH Regulation and
- waste water and air emission, in the finishing / dyeing sector.

Sustainability is an issue, mainly with reference to production of natural fibers that takes place upstream of the industry.

Interviewed SMEs in this sector seem to be aware of the environmental impacts associated with their activities, as well as of the environmental legislation and requirements, since these issues are nowadays affect the competitiveness of the companies. Although aware, usually SMEs are not able, or they don't need, to discriminate between EU legislation, and national or regional legislation.

The textile industry is characterized by a complex production chain. Although some vertical integrated companies and groups exist, SMEs usually are dedicated only to one specific phase of the process, often for only one type of fiber used for textile production.

In particular, phases with the main environmental impacts in textile-clothing sector are[67]:

- Spinning. Spinning is a highly automated, energy-intensive activity, with a low use of process water. In general, the effort of improvement is on energy saving / cogeneration plants, that however require a sizable production to be efficient. In companies of synthetic fiber sector, recycling is becoming more and more relevant.
- Finishing (preparation, dyeing, printing). Companies in the textile chemistry segment (dyeing and finishing) are questioning the environmental impact of their productions: some of them have started to produce environmental balance sheets. They produce major industrial waste which requires the creation of waste treatment plants. The main and most interesting strategies/innovations on this front are:
    - Energy: cogeneration and use of vegetable oil as an energy source, investment in energy efficient motors and lighting;
    - Recycling process water, cleaning with enzymes (which are effective and biodegradable)
    - Investment in precise measuring equipment – reduction in chemicals and water.

A significant and controversial issue regarding the environmental impact of textile companies is the role of *synthetic fibres* that are sometimes considered as harmful to the environment. *Natural* products also can weigh heavily on the environment in terms of water consumption, the use of chemical insecticides and weed killers. What gives polyester and other synthetic fibres their bad name as regards ecology is of course the fact that the raw material they derived from is

[67] According to interviewees, Italy Case Study

oil. No fiber itself is healthy or unhealthy: that depends mainly on the different chemical processes that the textile materials undergo.

The final segments of the textiles process chain have limited (*knitting*) or very limited (*clothing manufacturing*) impact on the environment.

Information on legislation requirements can be provided:

- by sectoral associations which play an important role in terms of information on environment legislation. It should be pointed out that this activity is geared mainly to their SMEs members. Specific SMEs' requirements to their associations relate to:
    - interpretation of the relevant legislation,
    - participation at determining the association position on environmental issues and promoting this point of view at national and European level.
- by consulting services.

4.4.5.2 EU ENVIRONMENTAL LEGISLATION AND STEMMING COSTS

Various EU environmental regulatory legislation cause different costs, in terms of investments, according to the affected process in production chain of the textile companies.

> The representative of an Italian firm states, that investment costs are related to:
> - the installation of wastewater treatment plants,
> - filters and filtering systems for air emission abatement,
> - more efficient / less pollutant production equipment,
> - use of less hazardous substances,
> - introduction of less environmental harmful processes.
>
> *(Italy Case Study)*

Most of these investments are classified as environmental friendly production technologies and end-of-pipe technologies. Monitoring of environmental issues, emissions and pollution, management of environmental aspects (solid waste, waste water, air emissions) is performed either by:

- dedicated employees of the SMEs, who perform these activities in parallel with other responsibilities; or by
- external consultants; consultants are involved mainly in procedures of environmental permits authorization or renewal.

Both approaches contribute to the administrative burden imposed by environmental regulations.

Whenever it is required by the production process, that is almost exclusively in the finishing / dyeing sector, *management of hazardous substances* within the in-

dustrial site (storage and handling) and subsequent *air emissions abatement or wastewater management*, are the environmental issues associated with remarkable environmental costs of SMEs.

Waste management is the issue contributing most to the administrative burdens of an SME. Further administrative costs are related to monitoring and certification procedures. Environmental certifications are often required by clothing industry and big distribution chains, according to the representative of a textile firm in Italy (Italian Case Study) –

It is not too difficult to monitor costs that are being added to the usual transformation cost as a consequence of new regulations – in terms of labour costs and costs for buying external services; but establishing the correct percentage of the costs of the new equipment to be attributed to environmental obligations, is almost impossible.

However it should be noticed that the low level of enforcement of environmental regulations by a part of SMEs gives unfair market advantages to them.

In the finishing / dyeing sector of the textile sector, environmental related costs are certainly higher, but also in this case difficult to ascertain exactly for the above mentioned reasons.

The spinning process has to be conducted in controlled context with a certain level of temperature and humidity. The process produces dust. The production department is cleaned and cooled with water which removes dust.

No waste of raw materials is produced in spinning process; these are recycled and used again to feed the process.

The main areas where legislation has an impact on the companies are wastewater, water and energy consumption, and waste. No specific EU legislation was mentioned as an administrative burden, or general burden, from any of the interviewed companies. It is supposed that SMEs are usually operating within the limits of both national and EU legislation, and the administrative costs are estimated as low.

However, it is generally accepted that if the environmental targets are not met by the companies, the implied costs are very high as penalties or required change of production processes.

Local conditions are possible to affect companies and result in additional costs related to environmental measures. In addition number of employees and volume of activities carried out may influence obligations in terms of derogations / simplifications, and therefore company size can result in some additional burden.

A local authority issued legislation about wastewater treatment[1] which has meant that a local textile company is forced to invest in modernising the wastewater cleaning facility and transportation to the cleaning station with a decreasing capacity from 85,000 PE to 46,500 PE. This will be a major economic burden on the company and no economic incentives have been made available to make these changes in the company.

(Slovenia Case Study)

Finally, it should be noticed that in some cases environmental regulations have certainly had a positive impact on companies, and to company costs: this is the case of REACH Regulation that has much improved the management of chemical substances, within the finishing dyeing sector.

4.4.5.3 SIMPLER AND COST-EFFECTIVE ENVIRONMENTAL LEGISLATION

The suggested measures by interviewed SMEs include:

- Reporting requirements regarding waste production/management and disposal would be more conveniently filled up electronically on the internet, rather than on paper, since the administrative costs are related mainly to the manpower needed for complying with administrative environmental obligations.

- Administrative coordination among the different public agencies and authorities, with the establishment of "one-stop shops".

- Simplification of the administrative obligations related to waste disposal

Companies in the textile chemistry segment (dyeing and finishing) are questioning the environmental impact of their productions: some of them have started to produce environmental balance sheets. The main and most interesting strategies/innovations on this front are:

- Energy: cogeneration and use of vegetable oil as an energy source;

- Recycling process water, cleaning with enzymes (which are effective and biodegradable);

- Unconventional dyeing techniques with supercritical CO_2 without using water (Politecnico of Torino experiment);

- Finishing through plasma treatments (though few companies actually use it);

- Printing: the replacement of plants in line with ink jet printing (originally designed for sampling but suitable for small productions, it consumes much less than standard one).

In some cases environmental regulations have a positive impact on companies, as well as to company costs: this is the case of REACH Regulation that improves significantly the management of chemical substances, within the finishing dyeing sector.

4.4.6 DG: MANUFACTURE OF CHEMICALS, CHEMICAL PRODUCTS AND MAN-MADE FIBRE

4.4.6.1 EU ENVIRONMENTAL LEGISLATION AND ENVIRONMENTAL REQUIREMENTS

The main environmental concerns of SMEs of the chemical sector, according to the interviewed ones are:

- Energy consumption,
- Waste and chemical waste management,
- Air emissions

However REACH Regulation imposes requirements to SMEs of this sector, which may be not well known to the SMEs, or maybe they identify its requirements as "chemical waste management".

4.4.6.2 EU ENVIRONMENTAL LEGISLATION AND STEMMING COSTS

For SMEs in the chemical sector, the highest investment costs stem primarily from compliance with REACH, IPPC and Directive 98/8/EC of the European Parliament and of the Council of 16 February 1998 concerning the placing of biocidal products on the market[68]

In the UK and Poland the chemical sector companies interviewed mentioned that REACH and IPPC is a modest burden, but also a burden incorporated as a natural part of the company's operation costs.

> The representative of a UK chemicals firm mentioned that 5-10% of operating costs is allocated to environmental control. This is seen as acceptable.
>
> *(UK Case Study)*

However, there is a concern about IPPC2/IED, which according to the SMEs interviewed would lead to increased monitoring and control, which would be a major cost burden to the SMEs.

The actual reporting for REACH is not seen as a major burden, but the data sharing collection scheme, the so-called SIEF groups[69], are on the other hand causing unnecessary costs. The groups have a lead registrar, who collects data and these are often very large companies with a lot of manpower allocated to reporting. The reporting is therefore frequent and often changing (when gaps occur) in the SIEF groups and this is a major issue for SMEs as they have very little or no direct staff to deal with this and the costs are therefore larger in comparison to large companies. However, SMEs in the chemical sector have to comply in order to compete on the global market; as it was mentioned, 'no data no market'. Especially niche markets are hard hit as this requires a lot of new information and this result in very high cost for the SMEs in the chemical sector.

[68] http://ec.europa.eu/environment/biocides/basic.htm

[69] http://echa.europa.eu/doc/reach/echa_08_gf_04_data_sharing_en_20080721.pdf

Also, one issue of concern is that compliance with REACH differs within the EU, which is causing an uneven playing field as the level of control and enforcement are far from even in all Member States. This is a cause for concern for the companies interviewed, but the threat is even larger from countries such as China and India, where their competitors, do not have to comply with the same rules. This is a large disadvantage for the companies complying with legislation such as REACH and could, according to several of the SMEs interviewed, drive jobs and manufacturing business out of the European Union.

The UK Chemical Industry Association (CIA) mentioned that the Directive 98/8/EC of the European Parliament and of the Council of 16 February 1998 concerning the placing of biocidal products on the market[70] is as a burden for a large range of SMEs. This view was supported by the SMEs.

> The Director of a UK chemicals firm mentioned that they had to take products off the markets as the cost of testing was too high and the company could not afford this. This is a major issue as SMEs get tested exactly like larger companies, but the SMEs do not have the same funds to allocate for testing
>
> Another chemicals firm in the UK has also moved some production to India because of the high capital costs associated with the use of chlorinated solvents in Europe.
>
> *(UK Case Study)*

The companies and also the CIA expressed that they see this directive as overcautious as many of the products have been tested on the market for a very long time.

SMEs have to use both internal and external consultants to cope with the environmental obligations. In general larger SMEs have appointed a full time Environmental Manager while smaller SMEs often rely on an external consultant. When he is an employee of the company this responsibility is often combined with other tasks and duties. The main advantage of external consultants is that they know the legislation and they can identify which regulations must be applied in the companies.

For the SMEs interviewed, the main environmental impact is related to energy consumption, chemical waste and air emissions. This latter is strongly related to the kind of activities done by the companies. Chemical waste handling and air emissions are both causing high operational costs. The main investment costs stem from the implementation of environmental monitoring systems, and all kinds of installations to lower the environmental impact.

4.4.6.3 SIMPLER AND COST-EFFECTIVE ENVIRONMENTAL LEGISLATION

The different interviewees have given a wide variety of suggestions for simpler and cost-effective legislation, but most of them were about the needed simplification of the environmental permitting procedure.

[70] http://ec.europa.eu/environment/biocides/basic.htm

Another issue which should be improved is the Information Obligations. A lot of duplicate data are submitted as reports to different authorities. It's almost impossible to retrieve information from the data bases.

National legislation is in some Member States stricter than in others, resulting in higher costs for the SMEs because they have to meet higher expectations and this is absolutely affecting negatively their competitiveness.

The lack of enforcement in some Member States, results in an uneven playing field. According to the SMEs and sector organisations, more pressure should be put on national Governments to ensure compliance with legislation.

There is also a need for one central point for info about subventions because now it's not clear for SMEs for which subventions they have the opportunity to apply.

4.4.7 DI: MANUFACTURE OF OTHER NON-METALLIC MINERAL PRODUCTS SECTOR

4.4.7.1 EU ENVIRONMENTAL LEGISLATION AND ENVIRONMENTAL REQUIREMENTS

All SMEs interviewed are aware of the main environmental impacts associated with their activities, and they monitor the environmental indicators imposed by national environmental legislation. This sector includes various types of industries and different processes. The environmental requirements of individual companies are related to the technological specificities of the production, along with its capacity and location.

For example for glass products [71]the variety of glass production processes *(even in one type of industrial activity of this sector*) reflects in a variety of environmental impacts of the sector's companies.

- The main environmental requirements associated with glass companies activities are derived from the IPPC Directive.

Other environmental issues posing environmental requirements to the industrial enterprises are:

- waste management and hazardous waste management;
- water and wastewater management;
- energy consumption;
- Moreover, another environmental requirement is related to the processing of lead substances (lead crystal glass). Lead glass is considered as a chemical substance according to the REACH Regulation.

[71] Czech Republic – Country Case Study

The specific environmental requirements in handmade glass production, include air pollution emissions ceilings (especially of fluorides), that are derived from glass production chemical polishing shop.

4.4.7.2 EU ENVIRONMENTAL LEGISLATION AND STEMMING COSTS

The specific environmental requirements of a glass company that specializes in handmade production, include air pollution emissions ceilings (especially of fluorides), that are derived from its chemical polishing shop. However, according to the Executive Manager the company's air pollution emissions make only 20% of the maximum allowed emission *ceiling*.

(Czech Republic Case Study)

It is remarkable that SMEs interviewed in this sector in different countries have completely different opinions and views as far the costs stemming by environmental legislation.

For example according to the findings of Czech Republic Case Study, the environmental regulatory burdens are considered high and threatening to SMEs economic viability.

The legislation is complicated and difficult to follow without adequate expertise (that means external services which is expensive). It also changes frequently and inconsistently. These changes must be implemented fast; no transitory period is allowed to support the adjustment.

Moreover, economic impacts and technology linkages of the new environmental regulations (and their applications) are ignored. The applied technology must be specified to the individual requirements, it is not readily available and the labour intensity is becoming problematic due to the rising labour costs.

The necessary knowledge capacity is missing, which would combine technology and environmental expertise – both in the company itself and in knowledge and regulatory institutions.

Geographical location does result in more stringent environmental compliance costs for some SMEs compared to other SMEs of the same sector.

In crystal manufacturing, costs stemming from EU environmental legislation compliance are estimated at "4% of the enterprises' turnover" (half of them are investment expenditures related to technological upgrades).

In a Glass SME located in Czech Republic, environmental costs are rather high as they include:

- disposal of acid water waste (1.2 mil. CZK per year or 47,000 €/yr),
- external service for all the reporting, auditing, consulting and other necessary procedures related to waste management (0,1 mil. CZK per year or 39,000 €/yr).
- The environmental agenda takes approximately 0.5 man-day per week of the company manager (with the external expert company on environmental and safety agendas).

On the other hand an SME, specialized in processing of flat glass estimates that "the environmental regulation burden is quite low, due to the applied cold glass processing and the related costs are estimated at 0.5-1 man-day per month".

On the other hand, according to Bulgaria Case Study:

- SMEs are aware of the legislation in the field of environment protection concerning their activities and in particular the most typical requirement derived from the energy efficiency measures and air polluting emissions;
- SMEs are aware of the requirements of EU environmental legislation, aware of the rules and National Framework, but 90% are not standardized upon ISO 14000, EMAS, consider it a cost;
- SMEs are using final disposal for hazardous materials and apply waste management systems.

Regarding the producers of non-metal mineral products, glass, bricks, concrete, issues and problems regarding the impact of the EU environmental legislation include:

- management of waste and final disposal;
- lack of investment for waste recycling– SMEs could not afford costs for investment in final disposal ; the problem is both investment and information;
- most of the producers even do not realize the necessity of awareness of the characteristics and quality of products and the purpose of ISO 9001 certification; For example, the Bulgarian SMEs in the sector are facing serious difficulties in Quality Certification considering it "a cost";
- presence of "grey" sector (unfair competition) not covered by any law, but still considers its products "unique" and never endured the ISO 9001 certification;
- calibration of measuring instruments (typical investment cost) control is not enforced; Testing and cooperation with licensed laboratories considered also burdensome and cost item for SMEs;
- water and wastewater management.

The administrative costs are not seen as a major burden. Burdens and costs are related to multiple reporting stemming from environmental reporting obligations in different datasets and formats to different national organisations in accordance to EU requirements.

4.4.7.3 SIMPLER AND COST-EFFECTIVE ENVIRONMENTAL LEGISLATION

In production of other non-metal mineral products sector, suggestions for simpler implementation of environmental legislation by interviewed enterprises and organisations include the need for:

- state administrative coordination in environmental information and permitting in an "one-stop-shop";

- streamlining of environmental data (measurements, indicators) reporting, in order to avoid reporting the same figures to several institutions in different forms and ways;
- reduced or simplified obligations;
- electronic services;
- financial support and knowledge support to SMEs in order to face better their environmental obligations;
- better reflection of the economic impacts and technology peculiarities posed by environmental legislation;
- a unified payment system for payments for packaging throughout the EU. This unification is proposed to streamline different obligations of an SME that activates both in national and European market;
- re-definition of recycled waste as secondary raw materials;
- support to the production based on recycled inputs.

4.4.8 F: CONSTRUCTION SECTOR

4.4.8.1 EU ENVIRONMENTAL LEGISLATION AND ENVIRONMENTAL REQUIREMENTS

The "Construction sector" is associated with the change of the living environment, and its "products" not only affect, but really constitute a relevant part of our natural environment; therefore environmental issues, as well as the related environmental legislation tend to be a primary concern for the SMEs of this sector.

In the "Construction sector" main issues causing significant environmental impacts are:

- Alterations/changes of the environment where sector's products (buildings, infrastructure etc.) are located. In this sense, the impact on environment is extremely relevant, and these aspects are covered by a number of regulations, that include Environmental Impact Assessment, as well as many national and regional pieces of legislation.
- Use of big quantities of natural resources: some of them are renewable – such as timber – or in relatively abundance (such as clay, chalk, and sand); in addition some materials can be re-used (or recycled easily) and are to some extent sustainable; some other materials, such as metals and other minerals, and some slow growing timber are not renewable, and they have to be considered as non-sustainable.

- Waste management. Waste disposal is considered to be the main environmental issue for the construction industry.
- Disposal of soil derived from excavation works and their usage in new development projects.
- Issues related to "end-of-life" of old buildings, particularly all issues related to asbestos management and disposal in restoration works.
- Wastewater management is usually not important, although management of water is important as far as the impact of construction on the construction area is concerned.

Energy consumption may be of some importance during the building process, but what it is certainly more relevant is the energy efficiency of the buildings that are produced, which is an environmental issue of remarkable concern in the Constructions Sector. This is mainly because of increasing demand on behalf of customers for eco–friendly buildings. In addition, building contributes significantly to CO_2 emissions and construction activity contributes about another 5-10% in Northern European countries: there is a serious underestimation of the reduction of CO_2 emissions that could be obtained by building energy efficient buildings. The real challenge in this area is the refurbishment of existing buildings.

Land use is obviously affected by the construction activity, but it is considered as out of the scope of the present study.

It should be noticed, that given the fragmentation of the production process, and the number of companies involved in each development project, companies tend to transfer the responsibility for compliance to environmental regulation to the companies in charge of the operations on the construction site.

Furthermore SMEs show a lack of interest regarding the legislation. SMEs depend, as far as their environmental obligations is concerned, to their professional confederations to take care of the regulatory monitoring, analysis, promotion and protection of their interests. Legislation instability and alteration affect significantly the enterprises of the sector and their development projects, while in some cases national environmental legislation is stricter than the related European one, according to France – Case Study.

4.4.8.2 EU ENVIRONMENTAL LEGISLATION AND STEMMING COSTS

In the construction industry, costs related to environmental legislation are not as evident as an additional burden, considering that the industry is in general heavily regulated, and environmental costs are not easily distinguished from other production costs.

According to an Italian sector representative, the expertise of a construction promoter includes the skill of understanding and managing regulations and requirements, and environmental regulations are part of the overall regulatory context.

(Italy Case Study).

Remarkable costs in renovation works can arise from the requirement concerning asbestos disposal: the necessity to take into account asbestos disposal can arise – in case of renovation works – after the start of the activity; usual contractual conditions do not foresee this case, and exclude revision of prices and contractual conditions in these instances.

According to interviewed SMEs the main issues adding costs for adjustment to environmental requirements are:

- the necessary training of professionals / employees (new materials and processes, new way of working) in order to be "acknowledged";
- training and preparation for the next 2012 Thermal Regulation regarding the Low Energy Building;
- an additional high cost investment for the supply of greener materials;
- additional personnel time for coordination of all building trades on site, for waste sorting, waste recovery, etc.

The costs of eco-building are considered to be 20% to 30 % higher compared to traditional building and/or to usual coordination between the different building trades on site. It is thus out of reach of many customers, although customers' willingness is real and increasing, and return on investment (RoI) is much higher in energy efficient buildings (by saving costs on the energy bill).

Environmental legislation itself is considered to be not enough as an incentive or restrictive for manufacturers "who will wait up to the last moment to get down to it". Then SMEs being at the end of the chain (craftsmen mainly) will have to manage with the situation.

4.4.8.3 SIMPLER AND COST-EFFECTIVE ENVIRONMENTAL LEGISLATION

In the construction sector, as it was underlined by an Italian sector representative, (*Italy Case Study*), bigger companies tend to transfer the responsibility and the pressure of environmental regulations to smaller suppliers and subcontractors. Much of it is also done, in both industries to the fragmentation of the process.

For the "Construction sector" the following suggestions are deriving from the country case studies and electronic surveys:

- simplification of public or private tender procedures, as SMEs encounter more and more difficulties in responding to the tenders : lack of administrative and legal skilled staff to prepare the offers, loss of production time (there

is no specific staff to work on the tenders) and currently, private market charges for the tender file;

- upstream: environmental criteria should be required in all public and private tenders;
- post-building: it should be controlled that all environmental criteria mentioned in the tender specifications are adhered to (control by a public inspector or independent expert);
- incentive measures for manufacturers of low energy buildings. Measures could concern SMEs (VAT decrease to reach the same one granted for renovation works for instance) or final customers (significant tax credit ...). These measures will affect prices of low energy buildings bringing them in comparable levels of the prices of traditional buildings;
- training of professionals/ employees in order to be ready for climate change mitigation measures or for new materials and processes, new way of working, in order to be certified / accredited in their work;
- better refunding of training costs;
- establishment of an information desk by related public authorities or associations, giving information, but also directly assisting interested parties on legislation, regarding environment and administrative reporting obligations, landscape, artistic and cultural heritage.

4.4.9 G: WHOLESALE AND RETAIL TRADE; REPAIR OF MOTOR VEHICLES, MOTORCYCLES AND PERSONAL AND HOUSEHOLD GOODS

4.4.9.1 EU ENVIRONMENTAL LEGISLATION AND ENVIRONMENTAL REQUIREMENTS

This sector comprises of enterprises with widespread, various and different activities. The determination of environmental legislation, its requirements and related impacts is very difficult.

In the sector of the repair of motor vehicles, the most significant environmental impacts are connected with:

- Waste management: separation and management of the different polluting components of motor vehicles (oil, brake liquid, tyres, paint, scrap metal, etc).

4.4.9.2 EU ENVIRONMENTAL LEGISLATION AND STEMMING COSTS

In the sub-sector of "Repair of motor vehicles and motorcycles", different items of cost resulting from compliance of EU environmental legislation are determined by interviewed SMEs:

- The cost to adapt the premises to law requirements, including permits, works, equipment and tools, etc. These costs relate to the most significant environ-

mental issue, which is waste management. There are costs related to the adaptation of SMEs premises to handle the produced waste, as well as to the waste management.

- The cost of consultancy services to the SMEs in order to ensure that they comply with the requirements of environmental legislation. Nearly all the SMEs operating in this sector have contracted such consultancy services to ensure they comply with the law. This is a direct result of the high bureaucracy they must face and the ever-changing regulatory framework.

- The direct fees that must be paid to external certification bodies to ensure that the company fulfils all applicable legislation. These include the administrative authorizations, registration in the relevant registers and other administrative procedures.

- The cost of person-days either of the owners of SMEs (mainly in the very small of them) or of appointed specific employee, to act as liaison with the external advisors and provide them with the necessary enterprise information. However, this activity actually causes a minor cost to the company, both in financial terms (salaries) and also in terms of opportunity costs.

> The owner of a car repair SME in Spain, refers to the costs derived from fitting out their premises as required by the Autonomous Community of Madrid. An initial investment of around 15,000€ to fit out a room capable of holding the different bins for polluting car components, together with an ongoing cost of around 5,000€ per year, paid to an external company, for the removal and disposal of such waste have been referred. These fees include advisory services with regard to the administrative tasks involved as well as legal advisory services
>
> *(Spain Case Study)*.

Advisors usually provide SMEs other relevant services such as training services and are normally responsible for the actual removal and management of waste.

4.4.9.3 SIMPLER AND COST-EFFECTIVE ENVIRONMENTAL LEGISLATION

A number of incentives aimed at facilitating the fulfilment of the environment legislation, have been suggested by interviewed SMEs.[72]. These are the following:

- One-stop shop for the provision of information and tools for the fulfilment of administrative requirements. The existence of several sources of information and complex administrative requirements is costly for SMEs.

- Simplification of the administrative requirements and avoidance of duplication of requested information.

[72] Spain Case Study

- Subsidies for alleviating the costs of complying with environmental issues. Again, a one-stop shop is essential not only to apply for these subsidies but to actually gather the criteria to access them.
- Control measures to ensure that subsidies are reaching the SMEs that need them.
- Free or subsidized advisory services to help SMEs comply with the legislation in force.
- Tax relief proportional to the size of the company.
- Training services.
- Subsidies for SMEs that wish to upgrade to energy-efficient machinery.
- Reduce costs related to the application for certifications.

4.4.10 I: TRANSPORT, STORAGE AND COMMUNICATION

4.4.10.1 EU ENVIRONMENTAL LEGISLATION AND ENVIRONMENTAL REQUIREMENTS

The most significant environmental issues in "Transport, storage and communication" sector are:

- Greenhouse Gas Emissions.
- Management of hazardous waste, according to the Restriction of Hazardous Substances Directive (RoHS)[73] which restricts the use of hazardous materials in the manufacture of various types of electronic and electrical equipment.
- Management of Electrical and Electronic Equipment waste, according to the Waste Electrical and Electronic Equipment Directive (WEEE)[74], aiming at reducing the amount of electrical and electronic equipment being produced and to encourage everyone to reuse, recycle and recover it.
- Handling of used Chemicals, according to the REACH Regulation[75].
- Saving and energy efficiency and use of renewable energies under the framework directive about ecologic design, related to the establishment of requirements of ecologic design applicable to products that use energy.

[73] Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS).

[74] Directive 2002/96/EC of the European Parliament and of the Council of 27 January 2003 on waste electrical and electronic equipment (WEEE).

[75] Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH).

All of these rules demand companies, including SMEs, certain environmental responsibilities in the use of energy (saving and energy efficiency and use of renewable energies), water, environmental management, green products or the management of the waste generated as a consequence of their main activity.

The level of requirements and exigency differs depending on the national and sometimes regional interpretation of EU environmental legislation.

4.4.10.2 EU ENVIRONMENTAL LEGISLATION AND STEMMING COSTS

Communication sector

The main costs stemming from compliance with the law in the sub-sector of Communication relate to waste management and the use of non-hazardous materials.

Waste management: the Directive on Waste Electrical and Electronic Equipment (WEEE) aims to reduce the amount of electrical and electronic equipment being produced and to encourage companies to reuse, recycle and recover it. SMEs are starting to understand that the optimization of energy usage of electronic equipment leads in the long run to a reduction of costs, but at this stage the initial investment is sometimes too costly for them.

Hazardous materials: the Directive on the Restriction of Hazardous Substances (RoHS) aims to restrict the use of hazardous materials in the manufacturing of various types of electronic and electrical equipment. This is a measure well accepted, and welcome, by SMEs but it adds costs, as safer components are sometimes more costly than traditional ones and may eventually not reach the same productivity levels.

The use of energy and water, the environmental management and waste management demand SMEs some adaptations in terms of the use of ecological bins, energy meters, water control systems, etc, that entail costs that are carried directly by the SMEs.

All these conditions, lack of resources in tools, human resources and, above all, shortage of financial resources, are the biggest handicaps for SMEs, according to the General Manager of a sector SME in Spain (*Spain Case Study).*

Costs stemming from EU environmental legislation compliance represent usually around 1% of the total operating costs of the SME in the communications sector, according to findings of Spain Case Study.

Green House Gas emissions are one of the hardest environmental problems connected with transport subsector. In January 2005 the European Union Greenhouse Gas Emission Trading System (EU ETS) commenced operation as the largest multi-country, multi-sector Greenhouse Gas Emission Trading System worldwide. The scheme is based on Directive 2003/87/EC, which entered into force on 25 October 2003. The goal of this scheme is to reduce by 8% the Greenhouse Gas Emissions in the period of 2008 to 2012, in all the EU Countries.

This requirement imposes obligations to the studied sector for replacement of old vehicles for professional use by vehicles of 4th Generation which have lower

emissions and less consumption. However, financial incentives are not connected often with this obligation, making unbearable the cost for SMEs to comply.

Another cost related to the activities of SMEs of this sector is the check by responsible authorities of the vehicles to determine if they are working properly and how high are the emissions of a vehicle. If a vehicle fails to comply with the legal limits, it has to be repaired or even removed from the streets. These costs of checking are considered minor to companies.

4.4.10.3 SIMPLER AND COST-EFFECTIVE ENVIRONMENTAL LEGISLATION

A number of incentives aimed at facilitating the fulfilment of the environment legislation have been determined by interviewed bodies. These are the following:

- One-stop shop for the provision of information and tools for the fulfilment of administrative requirements. The existence of several sources of information and complex administrative requirements is costly for SMEs.
- Simplification of the administrative requirements and avoidance of duplication of requested information.
- Simplification of procedures in the environmental impact reporting.
- Subsidies for alleviating the costs of complying with environmental issues. Again, a one-stop shop is essential not only to apply for these subsidies but to actually gather the criteria to access them.
- One-stop-shops to provide environmental information
- Control measures to ensure that subsidies are reaching the SMEs that need them.
- Free or subsidized advisory services to help SMEs comply with the legislation in force.
- Tax relief proportional to the size of the company.
- Training services to the SMEs to be environmentally friendly oriented.
- Subsidies for SMEs that wish to upgrade to energy-efficient machinery.
- Reduce costs related to the application for certifications.
- Application of government incentives for the environment management for SMEs, such as:
    - supply of tools which update environment legislation and permit procedures for SMEs to understand them and being up to date;

- control indicators of the environmental performance adopted to the SMEs;
- review of public tender processes to incorporate environment criteria.

4.4.11 H: HOTELS AND RESTAURANTS SECTOR

4.4.11.1 EU ENVIRONMENTAL LEGISLATION AND ENVIRONMENTAL REQUIREMENTS

The most significant environmental issues in "Hotels and restaurant sector" are:

- wastewater management;
- water management (use, saving);
- waste and hazardous waste management and
- Environmental Impact Assessment.

SMEs noticed that they comply with national environmental legislation and they consider that it is not their business to be informed for EU environmental legislation and derived requirements. Therefore, they are randomly aware of European legislation. They pointed also out the low level of information and lack of communication concerning environmental issues on behalf of the competent national authorities.[76]

4.4.11.2 EU ENVIRONMENTAL LEGISLATION AND STEMMING COSTS

Wastewater management (Directives: Directive 91/271/EEC on Urban Waste Water Treatment and Directive 98/15/EEC amending Directive 91/271/EEC) as embodied in the national environmental law of each Member State is the main issue adding cost to SMEs of "Hotels and restaurants sectors".

Hotels far from central urban wastewater management units are obliged to manage their wastewater according to the specific legislation requirements (secondary treatment, reuse, etc. according to various criteria). The cost of environmental legislation compliance is the investment cost for installation of adequate wastewater treatment systems. The operational cost stemming from EU environmental legislation compliance comprises mainly of the cost of monitoring and quality control of the output from the wastewater treatment system.

Training of employees allocated to the process of wastewater treatment is another major issue, since it is necessary to be assured that the quality of treated water has to be continuously above of the required level by the legislation. This requirement implies also costly monitoring procedures and very well trained personnel.

[76] Cyprus Case Study

However it should be mentioned that in some cases although hotels have installed their own wastewater management plant, reusing the treated effluents, after the construction of big central wastewater treatment plants, were obliged to lead their effluents to such plants. This creates an extra operating cost to the hotels due to:

- charges for the use of the central treatment plant, and
- cost for supply the necessary water quantities, since there is no availability of recycled water anymore, according to the Vice President of the Cyprus Hotel Association (*Cyprus Case Study*).

Administrative burdens are linked specifically to information that companies have to monitor and report because of environmental legislation requirements. This information is sometimes enormous compared to the size of SMEs and especially for hotels located out of the urban web.

The operating cost stemming from EU environmental legislation compliance for waste management has been quoted as 4,000 € per year, and for environmental monitoring as 1,000 € per year (findings of Bulgaria Case Study). In the Bulgaria Case Study is referred that the investment costs stemming from EU environmental legislation compliance for a small hotel are: for environmental friendly production technologies – initial costs of 10,000 € and 3,000 € per year, environmental monitoring systems – annual of 1,000 €, energy efficiency systems – annual of 1,000 €.

Another issue adding costs to the hotel and restaurants is imposed from the requirements of the Environmental Impact Assessment (EIA) and its associated approval of Environmental Terms of operation[77],[78]. The necessary studies for EIA are usually implemented by independent consultants and are usually of high-cost, especially in remote areas where the provision of consulting services is more expensive. Moreover, EIA can also entail significant paper work.

Geographical location may affect the cost of environmental compliance of hotels as well, since:

- tourist accommodation located in a sensitive environment may have to comply with stricter environmental terms of operation, resulting in increased costs for environmental protection;
- tourist accommodation located in more isolated areas is characterised by higher costs of environmental services provided by consultants, or equipment suppliers.

[77] Mrs. Agni Christidou, Director of the Hellenic Chamber of Hotels, Greece Case Study

[78] Mrs. Elina Kirova, Chairwoman of National Tourism Research Institute, Bulgaria Case Study

Another emerging cost in this sector is relating to the continuously increasing need for certification of organic products used in this sector, as a result of more environmentally aware clients.

Although the companies don't see administrative costs as a major burden, some of the companies mentioned that there is unnecessary reporting stemming from environmental reports to national organisations.

4.4.11.3 SIMPLER AND COST-EFFECTIVE ENVIRONMENTAL LEGISLATION

For the "Hotels and restaurant sector" the following suggestions are deriving from the country case studies and electronic surveys:

- simplification of the environmental permitting procedure:
    - reducing the permits' issuance time
    - requirement of less and unified certificates
    - internal communication between the various involved administrative authorities;
- one-stop-shop public services for the supply of environmental information to SMEs, and the electronic services.

  The above proposed facilitation of EIA procedure will result also to lower environmental costs to the enterprises, due to the reduction of consultant's fees.
- The environmental impact reporting also needs to be simplified. The costs of maintaining a system of reporting is different in each sector or company. Location and size are important factors in this as large companies may consider these costs as minor, but for small businesses these can be huge.
- Bureaucracy, related to required environmental reporting documentation has to be eradicated.
- Training and coaching services on behalf of public bodies or sectoral organisations provided to the personnel of SMEs in this sector seems to be a tool to assure both:
    - the environmental legislation compliance and consequent environmental protection, and
    - Reduction of environmental costs to the enterprises staffed with well trained employees.

4.4.12 ECO-INDUSTRIES

4.4.12.1 EU ENVIRONMENTAL LEGISLATION AND STEMMING COSTS

The eco-industries are widely defined; it's very hard to get an overall picture of this sector. Due to the type of their activities (eco-friendly) SMEs of this sector seem to be well aware regarding both: the national and the European legislation. However, SMEs agree that for implementing their activities, they need a high number of different environmental permits, related mainly to land use and exploitation.

The different activities of the enterprises result to very different environmental costs.

> For example, for a company which has built and exploits an off-shore wind park in the North Sea, the operating costs are mainly stemming from environmental monitoring: about 650,000 € per year. Moreover they are obliged to keep 57 M€ aside to ensure that at each moment the site can be restored in its original state
>
> *(Belgium Case Study)*.

For SMEs of this sector, geographical location is not considered to result in widely different environmental compliance costs, neither is it the size of a company that affects the environmental burden, but it is mainly the particular business operations that cause the major administrative burden.

Obligations for reporting, such as waste reporting, waste water reporting and reporting of air emissions create a significant administrative burden to SMEs. The main problem recognized is not the reporting obligations themselves, but rather the reporting to different authorities, with different guidelines. This causes a lot of red tape and is very energy absorbing while different authorities have to be aligned.

Both external environmental consultants and SME employees deal with obtaining new necessary permits, and performing environmental monitoring compliance imposed by the permits and reporting.

Electronic declaration of environmental reporting (where it is available), reduces significantly real administrative burden; however the declaration is quite complicated itself, causing burden.

Legislation can also be a barrier for innovation in the eco-industry. This was highlighted in Poland and in Slovenia, where the major obstacles is that the

> A Polish glass producer is using waste materials from other sectors to make glass products. The company would like to invest in a technology that enables them to use an increased amount of waste products in their production. With this new technology, the company would also be able to help other companies with their waste bi-products.
>
> However, because one particular type of waste would be left, Polish regulation will not allow this, despite the fact that the materials would have been waste anyhow. The company Director mentioned that this is a major issue and a huge barrier to develop the eco-industry, both the type of regulation and the large amount of bureaucracy.
>
> *(Poland Case Study)*

processing time for approval of applications by national authorities has been extremely long and complicated.

Renewable energy sources sector

Regarding the constraints, the interviewees are all unanimous. The "*regulation frame-work is very much restricting and limits the renewable energy development*"[79].

The main administrative environmental costs derive from complicated procedures to obtain the national, regional, local and sector-based authorizations. As a matter of fact, for the implementation of a wind power park or photovoltaic power station, even if authorizations have been granted, the involved parties in France may dispute these authorizations for a period of 6 years after the starting of installations.

The external administrative burden occurs mainly by using independent consultant firms to support the SMEs in their obligations. The legal context is harmful and places disadvantage on SMEs compared to large firms. For example, the additional costs for a full-time legal advisor or expert cannot be supported easily by a SME. Bank financing also is limited to SMEs. Furthermore SMEs point out the "unfair competition" according to the size of some eligible projects (specific power demand with a minimum of 5 wind powers with a specific power capacity). This excludes any small project within SMEs' possibilities.

Conversely, the so-called « niche » renewable energies sectors, with an important employment potential and eco-industry, such as micro-power pump, or even high temperature thermal solar energy production (ex. furnace solar), do suffer from a total lack of legislation. Without incentives and related measures or allocated budget, they do not exist neither for public authorities nor investors and thus do not exist for final customers only "influenced" by other specific energies.

Another important issue of eco – industry SMEs, is the cost stemming from complying with Environmental Impact Assessment procedures (according to national laws guided by the related Directive of EU), as well as the administrative burden caused by obtaining the necessary relevant permits for installing equipment and premises. These costs have a direct impact on the structure costs of the SMEs.

Other costs result from the disposal of obsolete material and the administrative authorizations required for such waste management.

4.4.12.2 SIMPLER AND COST-EFFECTIVE ENVIRONMENTAL LEGISLATION

The different interviewees have given a wide variety of suggestions for simpler and cost-effective legislation, but most of them were about the needed simplification of the environmental permitting procedure.

[79] France Case Study

Especially the interviewed companies from the eco-industries ask for:

- One-stop shop for the provision of information and tools for the fulfilment of administrative requirements. The existence of several sources of information and complex administrative requirements is costly for SMEs.
- Simplification of the administrative requirements and avoidance of duplication of requested information and reporting.
- Subsidies for alleviating the costs of complying with environmental issues. Again, a one-stop shop is essential not only to apply for these subsidies but to actually gather the criteria to access them.
- Information on possible subsidies in national and European level (again by one-stop-shops).
- Free or subsidized advisory services to help SMEs comply with the legislation in force.
- Tax relief proportional to the size of the company.
- Training services to experts of SMEs in order their companies to be able to comply with environmental requirements as well as to be aware of possible benefits derived from environmental challenges.
- Subsidies for SMEs that wish to upgrade to energy-efficient machinery.
- Reduce costs related to the application for certifications.
- Eco-fiscal policies as they have a direct impact on the SMEs profit and loss accounts, such as the adoption of fiscal deductions or bonuses.
- Creation of easy to understand guides which explain the main differences among legislations in a brief and concise document.
- More flexibility in permitting procedures.
- National legislation in line with EU environmental legislation and not stricter. Strict National legislation results to higher costs for SMEs because they have to meet higher expectations and this offends their competitiveness.

Especially for the renewable energy sector, the interviewees suggest specific measures for lightening the administrative cost. The following suggestions have been recorded:

- reduction of many requested authorizations and permits to only one authorization;
- “one-stop-shop” for information and authorisation;

- support of SMEs in RES sector by legislative obligation of a certain percentage of total RES in national level to be produced by local / regional SMEs (avoiding the exploitation of RES only by international big firms);

- integration of the new renewable energies or « niche energy » in the energy policy so as to give them an "acknowledgment". It will help final customers or SMEs to benefit from the same incentive measures (cash aids, tax credit, interest-free loan) as the other green energies.

4.4.13 SYNTHESIS OF RESULTS

Although all SMEs face the obligations due to common legislation, their activities have different environmental impacts, defining the major environmental concerns for each sector of SMEs. According to the literature analysis, legislation analysis and country case studies the following issues seem to be the most important for various sectors.

- For **H: Hotels and Restaurants Sector:**
    - wastewater management

is the predominant environmental issue of concern.

- For **I: Transport, Storage and Communication sector**:
    - Greenhouse gas emissions are of great concern
- For **DG: Chemical sector:**
    - energy consumption,
    - chemical substances waste,
    - waste management and disposal
    - Varied level of compliance to legislation creating an uneven playing field
    - IPPC2/IED
- In the **DA: Manufacture of Food Products, Beverages and Tobacco sector:**
    - wastewater management as well as
    - packaging and packaging waste (depending on their particular activities and products)
- For **C: Mining and Quarrying sector** activities:
    - environmental and aesthetic management of land under development
- Main considerations and problems identified for the **DB: Textile sector** refer to:
    - Waste & water management,
    - energy efficiency of the process – over the whole chain of sector's activities –

- management of hazardous chemical substances
- price and legislation on waste water
- air emissions,

in the finishing / dyeing sector. Specifically for this sector, sustainability is an issue, mainly with reference to production of natural fibres that takes place up-stream of the industry.

- In **F: Construction sector** main issues are:
  - waste management, and
  - particularly excavation soil disposal,
  - asbestos management and disposal in restoration work.
  - Energy efficiency of constructed buildings is also a relevant issue.
- The main environmental impacts of **DE: Manufacture of pulp, paper and paper products as well as the publishing and printing sector** are:
  - air emissions,
  - greenhouse air emissions,
  - wastewater management,
  - waste management (mainly paper sludge) and disposal and
  - management of chemical substances.
- The sector of **DI: Manufacture of Other Non-Metallic Mineral products** includes various types of industries and different processes. The environmental requirements of individual companies are related to the technological specificities of the production, along with its capacity and location. The main environmental requirements associated for example **with glass producing companies are based on** :
  - the IPPC Directive.
  - Other environmental issues posing environmental requirements to the industrial enterprises are waste management and hazardous waste management, water and wastewater management, energy consumption. Moreover, another environmental requirement is related to the processing of lead substances (lead crystal glass). Lead glass is considered as a chemical substance according to the REACH Regulation.

Common for all kind of SMEs seems to be the concern on the approval of specific Environmental Terms for their operation, based on the related Environmental Impact Assessment (EIA), which ensures that environmental impact is identified and assessed before authorisation is given.

National Environmental Legislation vs. European

A common characteristic of almost all the interviewed firms, either SMEs or sectoral associations or even scientific and knowledge institutes is that SMEs are

well aware of the main environmental national legislation and its requirements, as well as of the impact associated to SMEs specific activities, but

- ✓ the level of awareness of EU environmental legislation is considered low.

It is pointed out that most SMEs ignore EU environmental legislation since they are obliged to comply with the national legislation requirements (national framework). However, it is supposed that the National legislation incorporates European legislation requirements. In addition, it should be kept in mind that:

- ✓ most of European Directives impose specific requirements addressed to Member States, who have to interpret these requirements to national law specific requirements for SMEs;
- ✓ Directives are transferred to national law in various ways imposing differentiate obligations to SMEs;
- ✓ differentiate national legislation introduce different requirements for SMEs, therefore administrative burdens and derived cost differ from country to country;
- ✓ It should be mentioned that SMEs rely on their sectors' confederations to remain informed (strategic information and adaptation to the laws surrounding their sector)[80]. According to electronic survey data in all countries there are SME organisations which offer environmental services for their members. The organisations interviewed in Italy, Belgium, Luxembourg, Czech Republic and France had the highest diversity of environmental oriented services for their members. The organisations interviewed in Slovakia, Estonia, Slovenia, Hungary and United Kingdom had the lowest diversity of environmental oriented services for their members;
- ✓ It has been mentioned from some interviewees that national legislation is stricter that the European (i.e Slovenia, France);
- ✓ Only European Regulations such as the REACH Regulation have uniform application to all Member States – but there are major issues with compliance;
- ✓ Furthermore, EU environmental legislation is relevant to SMEs in a remarkable number of environmental issues, but sector-specific legislation (i.e. pulp and paper producers) is missing. Depending on the type of the SME and output of its activity (products, waste, emissions, natural resources consumption, etc.) a certain concern to one or another piece of legislation is given;
- ✓ Another concern determined is referring to the lack of adequate information and knowledge according to many interviewees (i.e. Bulgaria Case Study).

Differentiation of environmental legislation requirements

- ✓ The obligations imposed by environmental legislation, are the same for large enterprises and for SMEs. Simplifications provisions for SMEs are foreseen

[80] France and Cyprus Case Studies, e-survey

only in a few pieces of legislation. This creates sometimes unbearable environmental costs to SMEs making them to lose their competitiveness in relation to large companies of their sector.

- ✓ Geographical location and local conditions (such as residential, rural or industrial area) are sometimes posing requirements of different level for similar SMEs.
- ✓ National legislation is often changing, which makes it hard to keep track of what to comply with, add to the cost of compliance and can also lead to non-compliance (see for example Polish Case Study)

> In France, a strong discrepancy has been noticed between the French political commitments (Environment Round Table I and II), most of the time higher than those of EU, and the effective regulatory measures. These are found not enough restrictive or incentive to develop "true markets". Interviewed SMEs notice either a total lack of legislation which would allow to take environment into consideration or measures too often linked to administrative and legal charges/costs, too heavy for SMEs' to support. In other words the environmental legislation, when existing, is "killed" by cumbersome administrative procedures, public authorities piling up and legal risks.
>
> *(France Case Study)*

Administrative Burdens stemming from Environmental Legislation

- SMEs according to the findings of the present study are aware of the environmental impact associated with their activities normally because:
  - on the one hand, they are legally required to fulfil certain rules and regulations regarding environmental issues and,
  - on the other hand, due to the increasing awareness of the general public for climate change and its long-term repercussions.
- However the level of information and specific knowledge is still considered as low and insufficient. There is a lack of support for companies to implement the changes caused by new or existing environmental legislation. Therefore hiring external consultants and experts to provide the SME with all knowledge required is inducing extra cost.
- For that reason (lack of specific knowledge), it is a common practice for many SMEs to use independent external consultants to undertake EIA work, which entails lack of awareness about EU environmental legislation requirements associated with the activities.

  For example, lack of knowledge of REACH Regulation in the affected SMEs as derived from interviews results also to seeking consultancy services.
- Monitoring and reporting of environmental indicators causes also costs to the SMEs. This cost rises as reporting that has to be provided in many and different authorities and presented in different ways. In order to comply with reporting requirements, allocated man-hours differentiate a lot between SMEs, i.e. from 0.5-1 man hours per week (almost a month per year to one and a

half) or per month to full time allocation of an employee throughout the whole year.

- According to electronic survey results, on average in the EU 27 the organisations assess the man-hours needed for complying with environmental legislation to be a man month every year and the costs to be about 2 % of the annual costs of the average company. The figures vary from country to country. In Poland organisations estimates 3½ man-months (91 days) and 7 % of annual costs. In Germany the estimation is not even a week (4 days) and 1 % of annual costs. Thus, there seem to be considerable differences between countries – even if these figures should be interpreted with some caution, because it can be very difficult to give a simple answer to that.

Reducing administrative burdens and related costs.

Environmental legislation is a necessity. The enforcement of the legislation is considered as a very important aspect so that all SMEs are effectively required to comply with it (i.e. their competitive positions are equal as to the related eco-costs).

SMEs' expectations from European Union are strong and the identified possible improvements are numerous. The different interviewees have given a wide variety of suggestions for simpler and cost-effective legislation. The main suggested fields relate to:

- simpler and cost-effective environmental legislation, mainly improvement of environmental permitting procedures, namely:
  - *simplification of the environmental permitting procedure* by reducing the permits' issuance time, requiring less certificates, improving internal communication between administrative units;
  - creation of *one-stop-shops* for environmental permitting issuance;
  - *recruitment of employees from relevant technical fields in permitting units*;
  - creation of a *database* so that administrative units exchange information;
  - *codification of legislation*.
- The simplification of procedures and authorizations, will release SMEs from the necessity for external experts, consultants or lawyers; lowering thus the consultant's rates and the imposed environmental administrative cost.

- Streamlining of environmental measurements and indicators reporting. SMEs won't have to report the same data to several authorities in different forms and ways. Simplification of the administrative requirements and avoidance of duplication of requested information. Also, less frequent change in legislation, leaving the SMEs time to adapt to the legislation.

- One-stop shop for the provision of information (legislation in force, new requirements, criteria for applying to subsidies, contact details of advisors or

providers, available tools, fiscal treatment, etc.) and tools for the fulfilment of administrative requirements, and, in short formulation of systems to save time and avoid duplication of work. The existence of several sources of information and complex administrative requirements is costly for SMEs. Access to information and to tools to facilitate regulatory compliance requirements is an area that needs more work despite the continuous efforts by responsible authorities and the various sector associations.

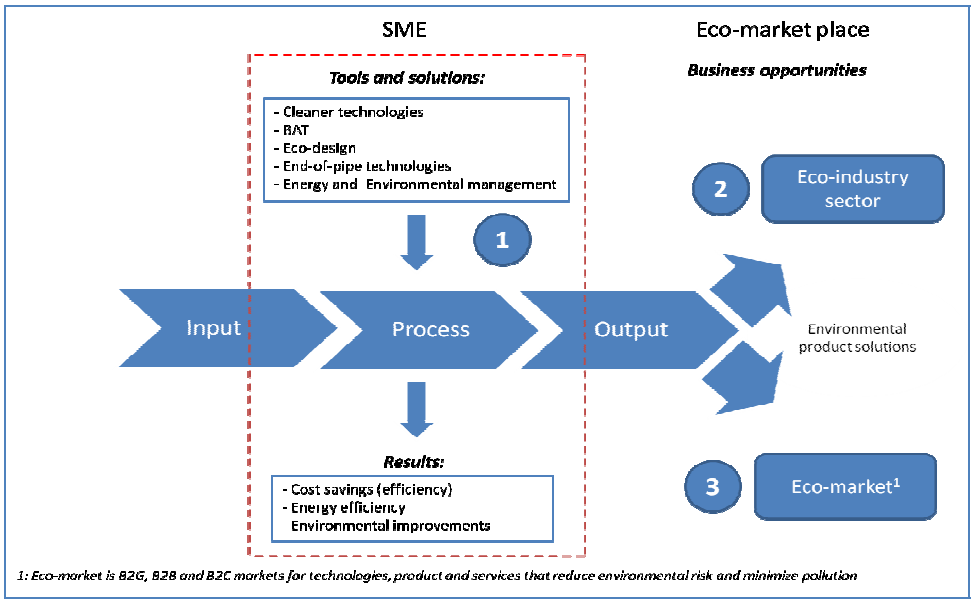
- Support for alleviating the costs of complying with environmental issues. Again, a "one-stop shop" is essential not only to apply for these subsidies but to actually gather the criteria to access them. Subsidies for SMEs that wish to upgrade their machinery to energy-efficient one.
- Free or subsidized advisory services to help SMEs comply with the legislation in force.
- Tax relief proportional to the size of the company.
- Training services.
- Reduction of costs related to the application for certifications.
- The qualified professionals who have integrated in their current practice (rather than in their politics) the environmental requirements should be given the "environmental compliance". Conversely, the non-trained professionals should not have the right to operate.
- Incentive measures for SMEs and/or their final customers when complying with environmental performances ("tracking system" rather than "certified") which would allow them to be competitive cost wise. As a matter of fact, due to the investment costs and organization constraints, an environmental efficient firm is less competitive than a non-virtuous one. The "cheaper" and not the "more qualified" being the main rule of the market.

5 BUSINESS OPPORTUNITIES FOR SMEs

5.1 BUSINESS OPPORTUNITIES

The previous section reviewed the *impact of EU environmental measures on SMEs* concerning environmental regulation and legislation. This section looks at the environmental and energy impact reducing tools and solutions for SMEs and the emerging business opportunities in the eco-market place, including both eco-industry and the eco-market in a broader sense.[81] The content will primarily be based on the interviews carried out with SMEs and organisations in the 13 Member States, the E-survey with organisations in all 27 EU Member States, but also the literature review that was carried out earlier in the project.

Figure 6: Cost reductions and green business opportunities for SMEs



The guiding objectives for this section can be divided into identification of business opportunities through internal *cost reduction opportunities* and *market opportunities on the eco-market/eco-industry*. However, we will not only provide a collection of good practice examples, we will also look deeper into motivational factors and barriers for applying and taking advantage of the opportunities arising in the two categories described below.

To provide useful recommendations, we have also made a company typology for the two categories mentioned below.

We find it useful to refer to two categories that describe the different types of business opportunities for SMEs related to the environment:

[81] Eco market is B2G, B2C and B2B markets for technologies, products and services that reduce environmental risk and minimize pollution.

1. Cost reduction, environmental impact reduction and energy efficiency (internal)
2. Eco-Industry/Eco-market opportunities (external).

Cost reduction, environmental impact reduction and energy efficiency

The first category is the opportunities that arise through investing in and applying internal tools and solutions that result in cost reduction and eco-efficiency (i.e., environmental improvement). These solutions can improve the competitiveness of SMEs mainly through cost savings (cheaper to produce products) and possibly take advantage of the fact that they have improved their environmental profile.

We will concentrate the findings in two areas:

- identify potential cost reduction solutions for SMEs related to energy and environmental management; and
- identify environmental and energy impact reduction solutions for key SME groups that have an important impact on the environment.

Eco-industry and Eco-market opportunities

The second category describes the market for technologies, products and services that reduce environmental risks and minimize pollution, i.e. the core eco-industry. The wider eco-market will typically be companies producing green products with eco-labels such as foods, furniture, consumer electronics, textiles, detergents, paper and stationary.

We will give a brief description of the size of the eco-industry and eco-market based on recent literature. We will look at the type of companies that are able to see opportunities in the eco-market and what these opportunities are.

We also look at some of the barriers and motivational factors that impact the decisions to enter the eco-market.

5.2 COST REDUCTION, ENVIRONMENTAL IMPACT REDUCTION AND ENERGY EFFICIENCY

5.2.1 INTRODUCTION

We have identified three SME surveys showing the level of awareness of environmental issues in SMEs.

Two studies[82] carried out by Danish Technological Institute surveyed 1,000 and 900 Danish SMEs respectively about their energy consumption and energy management. A third survey was undertaken by the Polish Environmental Partnership Foundation[83] in October 2009, where 107 members (SMEs) from their Clean Business Program answered questions about environmental issues.

The results of these surveys provide a good indication of some of the main issues when it comes to environmental and energy management and investment in environmental solutions.

In the two *Danish surveys* 35% of the SMEs did not know the size of their energy bill, and 60% of those who did know the size of their energy bill estimated it to be less than 5% of their overall costs. For these companies energy use is not interesting in terms of costs. However, in companies where the energy bill is more than 20% of overall costs, 72% work with energy savings.

Less that 19% had some type of energy management system in place, 60% took note of their energy consumption, and 21% did not do anything at all.

The main points from the *Polish survey* shows that over 60% of companies said they were willing to invest their funds in technology or organisational solutions as long as they were both environmentally friendly and generated financial benefits.

67% of companies indicated that their business have little impact on the environment. 7% of respondents said that they did not influence the environment at all.

Company typology

As the following section shows, different barriers and motivational factors impact SMEs when it comes to environmental investments leading to business opportunities.

We have identified three types of companies with different needs and conditions for working with environmental solutions. We mainly focus on the first two types.

1. high impact SMEs;
2. low impact SMEs; and
3. customer demand.

High impact SMEs

As the above surveys above shows, companies with high energy use or high environmental impact are more likely to invest in environmental tools and solutions because of business opportunities through cost reductions, but also in order to comply with environmental legislation.

[82] Danmarks Vækstlag and Region Syddanmarks Vækstbarometer

[83] http://www.environmentalpartnership.org/

These companies will often be companies with 50+ employees in sectors with a high environmental impact (cf. Section 2 – the green/brown segment), but there are scattered examples of small companies in sectors with a high level of environmental impact, for example high energy use.

Based on the surveys and the data analysis we estimate this segment to be around 40%-45% of SMEs.

Low impact SMEs

This group of companies have low energy and environmental costs and a very limited impact on the environment. These companies will rarely invest in tools and solution that reduce the environmental impact.

They are mainly micro and small companies primarily in less polluting sectors, but there is also a segment of companies with a significant environmental impact.

This is a very large proportion of companies, and we estimate this segment to be in the region of 55%-60% of all SMEs.

SMEs with customer demand

This group consists of companies from both high and low impact sectors. The special feature of this type of SMEs is that there is customer demand concerning environmental factors, such as certified environmental management systems or specialised products. In this instance, customer demand is defined as consumers (public) of products or members of the supply chain (companies).

This group appear to be small as only a limited number of customers demand environmental focus. The Danish survey supports this view where less than 10% of the SMEs said that they often or sometimes receive a demand for low energy use in their processes, products or services from customers. 75% of the companies had never experienced such a demand. As there is no demand from customers or regulation, SMEs see investment in energy-related management as an extra and often expensive cost and this was a major reported barrier.

5.2.2 COST REDUCTION, ENVIRONMENTAL IMPACT REDUCTION AND ENERGY EFFICIENCY - *ENVIRONMENTAL MANAGEMENT SYSTEMS*

Successful energy and environmental management evaluates all opportunities for saving costs. The most common benefits derive from a review of resource and energy utilisation and efficiency, forcing full consideration of alternative energy sources and their cost effectiveness. The other primary element is minimisation of waste and disposal costs. These elements also reduce the costs and environmental impact of companies.

However, both the literature and this project show that only a minority of the SMEs interviewed had a certified management system, such as ISO 14001. EMAS was not used by any interviewed SME. The main reason was that EMAS is very costly and difficult to implement and is seen as a tool for large companies with access to capital.

This is similar to the results from the Polish survey were only 11% of surveyed companies (who are already participating in the Clean Business Programme) hold an ISO 14001 certification, and more than 60% are not planning any action in this area. However, 56% of companies have documentation describing their environmental actions in simpler none-certified systems.

This is not surprising when we look at the number of certified registrations in Europe. An analysis of a 2009 count of the registrations by the European Commission shows that 3,551 SMEs were EMAS registered. 82% of the EMAS registrations are from Germany, Italy and Spain.

Compared to EMAS, an ISO 14001 certification requires less administrative work by the company. The most recent survey (2008) from the ISO organisation counted 38,419 ISO 14001 certified companies. This number also includes large companies with more than 250 employees.

Apart from ISO 14001 and EMAS, Section 2 under the Green segment mentions a number of different national or regional schemes. When we count the number of EMAS, ISO 14001 and other EMS systems a total of about 80,000 companies have a certified EMS system, and this figure also includes some large companies. The figure can be compared to the 20 million companies in the EU or 0.4% of European companies. Although the number of registrations is increasing, this is still a very small share.

In the interviews in the 13 Member States, we discovered that geography, sector differences, national financial situations and political systems do not appear to have a significant impact on the overall perception of ISO 14001 in particular. Broadly speaking it is seen as costly and irrelevant to customers. The costs and lack of demand (customers and legislation) seem to overshadow the possibilities for cost reduction.

In the following we show what the SMEs and organisations saw as barriers and motivation for acquiring and implementing the certified environmental management systems. We also look at non-certified environmental management systems used by the SMEs.

Why are certified environmental management systems not used by SMEs?

A large proportion of the interviewed SMEs without a certified EMS are still able to see positive aspects in for example ISO 14001. So why do they not have one?

The main barriers mentioned by the SMEs to obtaining and implementing a certified EMS are:

- *lack of information;*
- *lengthy time to apply;*
- *high implementing costs and running costs;*
- *no demand from legislation or customers; and*
- *other sector standards are more important.*

Lack of information

All the interviewed companies are aware of the existence of the certified EMS, especially ISO 14001, but in some countries there is a lack of information on how to obtain ISO 14001 certification. An example is Spain, where it was mentioned that SMEs do not know how to acquire the certificate, which is the main reason for relying on the work of advisors.

Another reason related to lack of information is that many SMEs do not regard themselves as having an impact on the environment, even if they do. However, the lack of knowledge about environmental impact means that companies see no reason to look for tools or solutions to reduce their environmental impact or reduce costs. These companies are what we refer to as "low impact SMEs".

Lengthy time to apply

Another hurdle for SMEs in obtaining a certified EMS is the time it takes from applying for a certified EMS and finally implementing the EMS. A few SMEs mentioned that it is an important strategic decision for an SME, not at least costly, to apply for a certified EMS. Often this decision is made because of demands from customers, but in many cases the companies have to wait a long time to get the certificate, in some cases more than a year. This is a major frustration for the SMEs, especially if the certificate is necessary to enter a new market or work with a new customer.

Although Spain is one of the countries with an above average number of ISO 14001 registrations, the perception amongst SMEs is that the process to acquire an ISO certificate is lengthy, cumbersome and costly and that the benefits are only noticeable in the long run, and the long perspective is often a problem for SMEs.

High implementing and running costs

One of the major barriers for SMEs is that a certified EMS is seen as costly. Often the SMEs do not have the skills to apply for a certified EMS and will therefore have to pay expensive consultant fees. Consultants also implement the system, which adds extra costs. Several Polish SMEs mentioned that they would like to see ISO 14001 implemented in SMEs by public authorities and thus save money on using expensive external consultant, as they are used to comply with the new national environmental legislation.

The other costs mentioned in the majority of the 13 Member States are the operating costs where external auditing is seen as a major additional cost. The cost of external auditing has resulted in SMEs with an ISO 14001 that have decided to abandon the certification but still continue with the implemented measures, sometimes even with more activities than when they had the ISO 14001. This was

for example observed in two of the Slovenian SMEs. Literature also shows that certified management systems are perceived as costly[84].

No demand from legislation or customers

The fact that ISO 14001 is a voluntary environmental scheme seems to be a major de-motivating factor, especially when there is no demand from customers or legislation. The problem with low attractiveness of voluntary instruments, including EMS and eco-labelling was explained by the Czech Ministry of Environment as a weak (economic and/or legislative) motivation for their implementation in the business sector. In the Czech Republic, new legislation is being prepared to increase the motivation through integration of voluntary instruments into the system of environmental legislation and regulation.

The article *A review of interventions to encourage SMEs to make environmental improvements*[85] supports this view and reveals a number of barriers for voluntary regulations aimed at engaging SMEs in environmental protection. The article, which is based on an in-depth literature review, reveals that "there is a broad consensus in the literature that voluntary regulations and standards (such as ISO 14001), self-management and even industry-driven approaches are ineffective interventions for promoting environmental improvement among all types of SMEs, because very few adapt them." (p. 289).

The Danish surveys mentioned above showed a very low use and a positive correlation with customer demand. However, only very few companies registered any demand from customers. Less than 10% said that they often or sometimes receive a demand for low energy use in their processes, products or services from customers. 75% of the companies had never experienced such a demand. As there is no demand from customers or legislation, SMEs see investment in energy-related and environmental management as an extra and often expensive cost and this was a major reported barrier.

This is supported by the findings amongst SMEs with an ISO 14001, where the main reason for applying a certified EMS is demand from customers or environmental legislation.

Other sector standards are more important

Another factor is that some sector standards are considered more important than a certified EMS. This is the case in the textile industry where the Eco-Tex 100 Standard[86] is seen as vital as a quality standard.

[84] European Commission, Commission Staff Working Document, Accompanying document to the Communication from the commission to the council, the European Parliament, the European economic and social committee and the Committee of the regions, Small, *Clean and Competitive*, A program to help SMEs comply with environmental legislation, Impact Assessment, 08.10.2007.

[85] Environment and Planning C: Government and Policy 2009, Volume 27, pages 279-301

[86] http://www.live-in-green.com/products/bedding/eco-tex.html

The textbox below provides an example of this issue and is also a good example of other uses of ISO 14001.

A Czech glass company, "… puts a strong stress on its environmental standards of production and is the only glass producer in the Czech Republic currently certified for ISO 14001". The implementation of ISO 14001 was motivated by the expected improvements in competitiveness; however, these expectations were not fulfilled as the foreign customers require other certificates. Nevertheless, the certification process has helped the company to improve the system and organisation of its activities related to environmental performance.

(Czech Republic Case Study)

The skills issue

The types of required or missing skills mainly differ according to the size of companies. *Management skills* are needed to identify the business opportunities either through cost savings using an EMS or other tools. In micro and small companies managers often have several tasks and are extremely busy with daily operations, and therefore they do not have the time to investigate new opportunities. In the interviews carried out with the micro- and small companies that are active in the eco-market or have invested in, e.g., clean technologies, it was clear that the skills, drive and mind-set of the owner played a very significant role. In medium sized companies several skills sets are available as more people have management roles and ideas can therefore be shared with other members of the management team.

Legal skills are needed to apply for funding, comply with legislation and auditing. Small companies often come with few legal skills as these play a minor part in the companies, but limited management skills (time) also means that they do not recognize the help they can receive in connection with legal issues. Often this type of advice is free, for example through the Polish Environmental Partnership Foundation or Envirowise (UK). In medium sized companies (50 to 250 employees) with many legislative obligations we generally observed two options: either having an internal expert or buying in the expertise when needed. As many of these high-impact companies are familiar with legislative obligations, no additional legal skills were required to understand new legislation or to comply with auditing in connection to, e.g., a certified EMS.

The last type of skills mentioned by the companies was the *technical skills* required to identify new and better (cost saving) technical options in the production process, as well as the implementation and handling of these technical options. The lack of technical skills seemed to be less of an issue for the companies, mainly because they had good relationships with their suppliers of machinery and substances (for example chemicals). Most of the companies had been offered new better technical solutions by their suppliers, which they considered a natural source of new technical ideas. However, it requires good management skills to decide and react to these suggestions, and unfortunately they appear to be miss-

ing in micro and small companies in particular. In addition, as it was the case with legal skills, many organisations offer technical support to SMEs, but this requires that the SMEs identify their need for technical support and this again relates back to the issue concerning managerial skills and capacity.

What motivates SMEs to get a certified EMS?

Although a certified EMS is not seen as an important tool for the SMEs, there were still a high number of the approximately 100 SMEs interviewed who had an ISO 14001 or intending to get one in the near future.

The main motivational factors highlighted by the SMEs are:

- *demand from customers;*
- *a good management tool (especially SMEs affected by legislation such as REACH); and*
- *a good brand especially for exporters.*

Demand from customers

The interviewed SMEs mentioned that the major motivational factor for acquiring a certified EMS is customer demand or that it gives them a competitive edge in the search for new customers compared to their competitors. Many SMEs mentioned that it was a quality stamp especially if their companies had foreign customers. The latter was especially evident in the New Member States, but it was also mentioned in France.

In a case from Germany, the company has been ISO 14001 certified since 2002. The company was certified because of demands from clients in the automotive industry. Becoming certified was quite an investment in itself for the company. The certification project ran for more than a year with extensive and expensive help from consultants. Rasche Umformstechnik estimates that about 90% of the certification work was carried out by consultants who also delivered the tools to continue a system that was tailor-made for the company. In the long term they estimate that the costs of external consultancy work related to the ISO 14001 certification exceed savings in i.e. materials and energy efficiency.

(Germany Case Study)

Another related trend is that a certified EMS is necessary to bid for public tenders. This is the case for companies bidding for public tenders in the construction industry in the UK; Spanish SMEs also mentioned this as a reoccurring trend.

Leading retailers, such as Tesco, already require that their suppliers have an EMS, and many of the SMEs think that they will have to be ISO certified in the future in order to supply the large retail chains.

A good management tool

Many of the SMEs with a certified EMS are high-impact SMEs that have to comply with several different types of environmental legislation. An example is the

chemical sector where the majority of companies have an ISO 14001 and other official environmental and safety certificates. The interviewed companies with an ISO 14001 regard the ISO 14001 as a useful management tool. It is a particularly good tool to identify areas where they can save money on their consumption of energy or materials. Many of the companies have used the ISO 14001 to identify and decide where to make investments in new technologies with the aim to reduce their environmental impact and save cost through energy savings or reduced consumption of materials.

A UK chemicals company mentioned that rising energy costs was a major reason for acquiring an ISO 14001 certification, and they have managed to reduce their energy usage by more than 30%. The company has also saved money on gas and steam by increasing the boiler efficiency and identifying and stopping smaller leakages.

(UK Case Study)

Some companies also used the certificate strategically when it comes to auditing, as they mentioned that fewer audits and checks are carried out when you have an ISO 14001. However, a relatively large proportion mentioned that having an ISO 14001 did not ease the number of audits.

However, as the textbox below shows, companies used the implementation of ISO 14001 to create an internal environmental management system, but as it has no particular value for the companies as a certificate (brand), some companies have done away with the certificate, but continue to live up to the requirements without the external auditing costs.

A Slovenian textile company used to have an ISO 14001, but decided not to maintain the certificate. This is because they apply all the steps and more, but do not want to pay a lot of money to external consultants for monitoring their progress and writing reports. Furthermore, their customers demand the sector specific Eco-Tex 100 Standard, which exceeds EU limits in some areas. A third reason is that some of their largest customers, for example Adidas, carry out annual audits at the plant anyway, ISO 14001 or not.

(Slovenia Case Study)

A Danish company, specialist in die-casting in aluminium and zinc, some years ago was ISO14001 certified. However, their experience is that costs are not matched by benefits. In their industry being a Danish company seems to be a hallmark in itself and this includes that the company environmentally responsible.

(Denmark Case Study)

Good brand especially for exporters

The interviews in France revealed that the companies have little interest in obtain a management system such as ISO 14001 or EMAS, as long as their market is national. Nevertheless, they understand that some manufacturers with interna-

tional markets have an ISO 14001. Yet, an interviewee points out that the "*ISO 14001 certification has a limited credibility, depending on the home country*."

In terms of branding and obtaining a quality stamp, ISO 14001 is seen as important especially by SMEs from New Member States that operate outside the national boundaries.

A Polish foundry company was one of the first companies in Poland to introduce ISO 14001. The reason for implementing ISO 14001 was twofold. First, the company was created out of the former Lenin Steelworks in Krakow and they had many environmental issues with which issues to deal. Second, many of their international customers require an EMS and ISO 14001is a well-known certificate.

(Polish Case Study)

In the chemical sector, ISO 14001 is also used to try to reverse the negative reputation of the industry, even though they have other initiatives, such as the Responsible Care Programme[87], where the companies follow guidelines and targets, exceeding measures required by the ISO 14001. However, ISO 14001 is more commonly known, and it is therefore good brand that shows that companies are committed to solve their environmental challenges.

Non-certificated environmental management systems

Although many companies have a negative perception of certificated management systems, a surprisingly large proportion of companies had an environmental policy or created their own system with support and guidelines from sector organisations or SME-oriented organisations. This is supported by the Polish survey where 56% of the surveyed companies have documentation describing their environmental actions in simpler none-certified systems. It should be noted that the Polish companies participated in a clean business programme, and the majority of the interviewed companies represent good examples from their respective sectors. Thus, the number of SMEs with an environmental policy should be expected to be well below 50%. Despite this, several examples were identified.

One good practice example is a Scottish food and drink company.

Food and drink industry: Turning waste into profit

The company is a world-leading producer of Scotland's national dish haggis. The company has produced two annual sustainability reports describing its environmental policy and the results of different initiatives. Key cost-saving measures were identified through an Ecodyn and Environwise audit in 2008, which helped the company to focus it environmental work.

The most striking change has been through waste management and recycling. In 2005, the company sent 90% of its waste to landfill and in 2009 this figure had been reduced to only 10%. This has been achieved through:

[87] http://www.responsiblecare.org/page.asp?p=6341&l=1

- compacting and baling of plastic barrels and cardboard packaging (since 2008) leading to savings;
- collection of spent fat and oil, which is then sold for processing of bio-diesel – leading to £4000 annual revenue;
- composting of organic waste by a third party (2009) – leading to savings; and
- Recycling of saline water, resulting in a 10% reduction in water consumption (from 2006-2008) – leading to savings.

The company used to pay for collection and disposal of fat. However it now works with a bio-diesel producer that buys the waste fat as a raw material. Other examples include the use of Best Available Techniques (BAT) by introducing more efficient cooking methods thereby reducing the gas bill by 15% from 2006 to 2008. Energy consumption and associated carbon emissions have also been reduced through a range of measures, including employee training; heat recovery units on refrigeration equipment; timers on ventilation, lighting and heating units; and energy efficient lighting systems.

While the company does not have a certificated environmental management system, its management commitment and environmental targets are clearly outlined in the publicly available sustainability report. The company have used the BEP environmental placement programme, where an environmental science student is placed in the company for eight weeks where they work on a specific environmental management task. The BEP programme has helped to progress some of the main environmental management initiatives.

(UK Case Study)

The questions related to environmental management systems in the E-survey for organisations showed that many organisations are developing alternative solutions to the certified environmental systems. The survey showed that 23% of the surveyed organisations have *developed environmental management tools for their members* and 22% of the surveyed organisations *offer guidance on non-certified environmental management systems in companies* and 25% *offer guidance on certified environmental management systems.*

However, according to the survey only 22% of the small and medium sized companies use the organisation's environmental services (not only environmental management systems).

The table below provides a summary of the different types of environmental management systems, the motivational factors and barrier, popularity and the types of companies to which they are relevant.

Table 40: Summary – motivation, barriers and popularity of different environmental management systems

EMS	Motivation	Barriers	Popularity	Relevant to:
EMAS	- High standards - Need to meet targets - Possibility of funding - Good management tool - Fewer environmental checks - Can be used in tenders with environmental requirements - Marketing tool, but less known compared to ISO 14001	- Hardly used - Not suitable for SMEs (complex) - Costly - No demand from customers - Although voluntary, more regular reporting - SMEs do not see themselves as having an impact on the environment (low energy bill)	Very low	High Impact SMEs - mainly medium sized companies
ISO 14001	- Easier to implement than EMAS - Possibility of funding - Good management tool - Less environmental checks from authorities - Can be used in tenders with environmental requirements - Marketing tool	- Costly for SMEs to obtain, implement and run - Low demand from customers – both public and private - Voluntary – less regular performance reports compared to EMAS - SMEs do not see themselves as having an impact on the environment – (low energy bill)	Low	High Impact SMEs SMEs with customer demand
Non-Certified	- Easy fit to needs -	- Some are not recognised by customers or authorities, and for those that are, this is limited to	High	High Impact SMEs

EMS	Motivation	Barriers	Popu-larity	Rele-vant to:
	o audits, fewer costs - Focus on own improvements (when the company is ready) - Often free	customers and authorities operating locally - Often not as effective as certified EMS (no third part proof if the system work or not) - Harder to get funding - Not accepted as EMS in tenders		
Sector specific	- Often relevant to company - Possible joint collaboration (cost savings) - Often free - Good possibility for funding through sector organisations if there is a cost	- Most competitors have it, so not a competitive advantage - Can be expensive and forced on SMEs	Medium	High Impact SMEs SMEs with customer demand

Conclusion and recommendations – Environmental management systems

The major *barriers* pointed out by the interviewed SMEs were:

- lengthy time to apply for certified EMS;
- high implementing and running costs;
- no demand from legislation or customers; and
- other sector standards are more important.

The certified management systems (such as EMAS, EMAS-easy, ISO 14001) are perceived as costly and when there is no demand from customers SMEs see this as an extra costly burden. The certified EMS has no real marketing value, whereas sector specific environmental standards are seen as very important.

The major *motivational factors* identified are:

- demand from customers;
- good management tool for high-impact SMEs.

Demand from customers is perceived as the most important factor for getting a certified EMS, and it is especially the high-impact companies with a large legislative burden that have an ISO 14001. However, hardly any customers demand a certified EMS.

Recommendations on Environmental management Systems

Recommendations	EU	Member States	Organisations	SMEs
Focus complex EMS systems (such as EMAS, EMASeasy) on medium sized and large companies	●	●	●	
EMS with more standardized reporting	●	●		
Create a simple low cost EMS for low-impact SMEs without external auditing				● ●
Ensure that SMEs with a certified EMS will have less audits and checks than companies without a certified EMS		●	●	
Sector specific guidelines for improving environmental performance				● ●

Certified EMS seem to be too costly and too complicated for most micro and small companies; the public shows no interest; there are rarely rewards from the authorities, and the customers rarely demand an EMS. When they do, they are usually asking for ISO 14001 systems. Perhaps systems like EMAS and ISO 14001 should be targeted more exclusively at medium-sized and large companies and high-impact companies.

Companies are asking for standards, so a more standardised way of reporting may be the answer here. Moreover, there should be an incentive to have a certified EMS, so it should be a quality standard resulting in less auditing compared to companies without a certified EMS.

For SMEs with low environmental impact, very simple and low cost systems for reducing environmental impact should be promoted. The Green Office system is an example of such a system. The system could be simple guidelines on how to improve the SME's environmental performance and most importantly, external auditing should not be necessary, since this adds extra costs and burdens.

For low-impact micro companies the value of the reductions is equally low and expensive systems are not attractive.

Organisations could play an important role by offering more sector specific guidelines for improving environmental performance. This could be an amended version of an EU-wide EMS for high- and low-impact SMEs.

5.2.3 COST REDUCTION, ENVIRONMENTAL IMPACT REDUCTION AND ENERGY EFFICIENCY – *TOOLS AND SOLUTIONS*

One of the main ideas behind having an environmental management system is to reduce the environmental impact of the company and save costs, e.g., through energy efficiency. Companies use different tools and solutions to meet the environmental challenges and turn them into business opportunities. Examples are more efficient production, energy efficiency, reduction in waste and closed systems, such as recycling and reuse of water where steam is used to heat up rooms through at heat exchanger/pump. For the interviewed companies cost savings are vital to stay competitive on the market.

Below we present some of the barriers and motivational factors for engaging in environmental activities and together with some of the different types of tools and solutions used by the SMEs in the 13 Member States. The latter will be done through small case studies, which also show the impact that these solutions has on the companies in terms of costs savings and competitiveness. At the end of the section we will summarise our findings using the company typology from the previous section and make recommendations.

Barriers

The message from the literature and organisations is that a large proportion of SMEs do not engage in environmental impact reducing solutions for the same reason they do not have a certified EMS. They do not perceive themselves as having an impact on the environment and their energy bills or environmental costs are small. Consequently, investments are just perceived as an extra cost. This is especially true for low-impact SMEs.

Many sector organisations and SME organisations offer services and tools to SMEs in form of projects, online tools, specialist advisors (in some cases they offer free visits at companies). These services seem to be limited or absent in some of the New Member States (for example in Slovenia), and when accessible the point from above means that the SMEs do not see these offers as relevant for them, especially the low-impact SMEs. The level of support varied greatly between countries, but also sectors. In the UK for example, the sector organisations play a significant role for the SMEs (in the selected sectors) in terms of setting targets, but also in terms of offering support.

Many of the interviewed companies have invested in some sort of environmental solution. That said, the SMEs in this project have been identified by sector organisations and many will be good practice examples in the sectors and not pro-

vide an overall picture. Nevertheless, the barriers except from the "no impact on environment" will be the same.

According to the Polish survey, the most serious obstacle for companies for using eco-innovative solutions is *lack of financial resources* (68%) and *very high implementation costs* (61%).

This view was supported in many Member States; especially in the New Member States where the companies often mentioned that what they need is financial support to invest in new technology. Relevant European funds are available in all countries, but lack of match funding is a barrier.

Some of the companies interviewed have participated in European projects, such as the 7th Framework Programme. One example from Slovenia is described in the textbox below.

A Slovenian textile company is engaged in the FP 7 project 'AquaFit4use'[88] where the overall objective is to develop new reliable, cost-effective technologies, tools and methods for sustainable water supply, use and discharge in the main European water consuming industries. The motivation for investing is that the cost of water has increased and that the company has already invested in other energy-saving solutions.

(Slovenia Case Study)

It was also mentioned that technical support was absent, but this was not really seen as a major issue according to the companies, as technical solutions were often were identified through suppliers of machinery and equipment.

Solutions such as cleaner technologies and Best Available Techniques (BAT) can be connected to environmental management in the sense that it is the aim of environmental management to define environmental goals for the operator's activities, ensure an environmental optimum operation as well as control of the compliance with these environmental goals. Literature suggests that not having a certified EMS is a major barrier to implementing cleaner technologies or BAT.

However, the interviews showed that this is not the case, although the companies with a certified EMS seem to have a better overview of where they need to invest in environmental solutions. Many companies with a non-certified EMS or just a simple environmental policy have made significant investments in cleaner technologies resulting in increased energy efficiency and reduced material costs. An SME in the UK with no certified EMS is one example (see textbox below).

[88] http://www.aquafit4use.eu/site/en/about.php

The company has an informal environmental policy resulting in focus on investment in new technologies which - despite the initial capital outlay - has significantly saved costs through increased energy efficiency and more efficient use of materials. One of the major investments was a CNC router, which means that the work that was previously carried out on several machines can be done automatically on one machine and this more effective. This saves energy and materials. Another energy-saving solution is a new exhaust system, which, unlike the old one, shuts down the vents when the machines are not operating. This saves energy as well, but the investment was more directed towards the well-being of the workers and the cost savings became an added benefit. As well as following their internal environmental policy to make savings – Elmwood make considerable investments in new capital equipment when the company has a profitable year. Other investments are more low-key, such as low-energy light bulbs and teaching the staff to turn off the light when they leave the building.

(UK Case Study)

The analysis of Observatory[89] data (2007) shows that in the EU-27, 29.5% of the companies report using simple rules and devices. This illustrates that around the core green segment there is a cloud of light green companies that use less complex and complete systems than certified EMS to reduce their environmental impact. As the example in the toolbox above shows, many companies using a simple system may be fully appropriate to achieve environmental improvements.

Motivation and incentives

The Polish survey of 107 SMEs from the Clean Business Programme showed that the main motives behind pro-environmental activities are a reduction of operating expenses (76%); the desire to improve the surrounding environment (without economic incentives); improve the corporate image (55%) and the need for technology upgrades resulting from existing legislation (43%). As many as 39% of the respondents believe that such activities are an opportunity to improve their market position.

The picture across the 13 Member States and sectors is slightly different. The two main reasons for investing in environmental solutions in the interviewed SMEs are either *rising cost of energy, water* or *materials and new environmental legislation* (both EU and national). In other words, the SMEs have more or less been forced into investing in solutions that can reduce the impact of the rising costs or complying with new environmental legislation. Although companies often see the potential and a return of investment in the long term, only few companies have invested in, e.g., clean technologies on a *voluntary basis*, i.e. not having to deal with rising costs of energy/water, compliance with environmental legislation or customer demand. The single most important reason for this is lack of financial resources through the SMEs' own capital stock or access to funding.

Rising costs of energy, water and other materials often result in companies making the decision to invest in environmental solutions. Some mentioned that the increasing cost of water in particular was out of proportion, and in some countries it actually meant they were forced to make investment in new expensive

[89] http://ec.europa.eu/enterprise/policies/sme/facts-figures-analysis/sme-Observatory/index_en.htm

technology, putting their business on the line, as they had to take expensive loans (no other sources of funding). Other companies mentioned that the increasing prices meant that they had decided to go ahead with the plans they had been considering for a while, and the third category of companies, especially those with good environmental management systems (certified or not), made the investments when it was economically feasible.

However, it is also important to note that the vast majority of the SMEs who have invested in environmental solutions have also saved money or will save money in the long run. It therefore arguable whether these factors force companies to invest or whether the companies can save money that is the greatest incentive.

Lack of support and initiatives from sector organisations, SME organisations and governmental institutions are seen as barriers, but in some countries and sectors this is also a major driver and motivation for companies to invest in environmental solutions. One example is the chemical sector, where the national sector organisations focus on changing the reputation of the industry and thereby set high environmental targets, but these targets are aligned with support activities. Many chemical companies are therefore committed to several environmental impact reducing programmes/projects offered by the sector organisations. Another example is the Scottish Whisky Association (SWA), who is an important player in the sector, and their environmental strategy[90] sets out targets for their members. As the SWA is agenda-setting, many companies participating in the projects offered by the SWA, and this provides a critical mass and thereby save SMEs a lot of money compared to finding effective solutions on their own. An example of such a project is shown in the textbox below.

A UK distillery participated in a SWA project where the aim was to reduce the amount of packaging and waste. The packaging project resulted in lighter bottles and shifting from hard case packaging to soft materials, and in this way the company saved money on materials and waste products.

(UK Case Study)

In some countries, the SMEs mentioned that one solution to cutting the high costs would be to participate in joint collaboration with other SMEs. One example is a Greek dairy producer who proposed that companies with similar activities be grouped in the same geographical region to cooperate in a joint effort and share the expenditure to manage similar waste products. Such collaboration could include investing in a common biological treatment system.

Another motivational factor, frequently used when the sector organisation had little support to offer, was ideas from suppliers of machinery and materials. Where the SMEs had good a relationship with their suppliers they mentioned

[90] http://www.scotch-whisky.org.uk/swa/files/EnvironmentalStrategy09.pdf

that the suppliers often informed the companies about new technologies or materials that could save costs through energy savings, but also how to be more effective and thereby save cost on materials. This close relationship with suppliers was seen as very important for the companies' search for new solutions, especially because the companies often lacked management capacity to find these solutions themselves, or even find project that could be beneficial for them.

The majority of companies find that investing in environmental solutions has increased their competitiveness mainly through cost savings, i.e. cheaper production than their competitors, but it is also a quality stamp for the company, which helps the company to keep market shares and be competitive on the export market.

These are the main motives for investing in the environmental solutions mentioned by the SMEs. More examples can be found in the annex with the country reports.

Examples of effective and popular solutions used by SMEs

The main types of solutions used by SMEs to reduce costs and/or reduce the environmental impact were:

- *investment in clean technologies/BAT;*
- *closed systems; and*
- *simple solutions.*

Below we give examples of the solutions used by the interviewed companies, except from the ones already mentioned in the textboxes above.

- **Investment in clean technologies/BAT**
    - A Slovenian textile company has invested in environmental solutions through BAT due to a need for and wish to save costs, but also due to legislative requirements from the local municipality in particular. The company has invested in a reduction in water use, chemicals, energy and wastewater. This includes investments in new technology to measure the amount of chemicals (dye) and water needed to dye the yarn. Before, the process was a manual process and less precise. Consequently, the automatic equipment has resulted in a *20% reduction in water consumption* and the *use of chemicals is down 6-7%*. Moreover, a heat pump has been installed to reuse the wastewater to heat up the building. The company has *reduced its energy consumption by 1/3* through investments in energy-efficient motors and lighting. Furthermore, panels are cleaned 2-3 times a year and this has resulted in *20% savings on electricity*. Overall, the cost of *energy has been reduced from 12% to 10%*, and the company's goal is that energy costs should only be 7% of total costs.

- A Greek microbrewery uses cleaner technology and has installed a high-efficiency propane boiler. Propane is more efficient and cleaner as a fuel, resulting in a reduction in energy consumption. However, *no reduction in operating costs was achieved since propane costs more than fuel oil*. However, the company still plans to introduce other tools and solutions to achieve eco-efficiency (aiming to receive investment benefit from state aid from the pertinent National Strategic Reference Framework (2007-2013) Operational Programme). Such plans include solar tubes (reduction in energy consumption), fans that will only use solar energy (reduction in energy consumption), packaging unification (reduction in raw-materials consumption) and cleaning foam machines (reduction in water consumption).

- **Closed systems**
  - Two Belgium textile companies collect and store all the waste from their production processes to recycle it in the company. The waste is melted again to make new products that do not need such a high quality. This is particularly true for the injection moulding because the quality standards for this product are not that high.

  - Two Polish companies use a heat exchanger in their production processes and use the heat (steam) to heat up their office space. This results in a reduction on the heating bill.

- **Simple solutions**
  - The owner of a Spanish SME mentioned that on their own initiative they had invested €3,000 in a brand new invoicing system that will dramatically reduce the consumption of paper and toner, whilst helping them to adequately store and control invoices. For a company with 23 employees, this is considered a large investment where the return on investment is long-term.

One example of a company choosing a green profile, with all three segments included, and an ISO 14001, is a Slovenian Spa/Hotel.

Eco-labelled hotel





Right from the hotel's beginning in 2001 the owners decided to have an environmental profile and since then the spa/hotel has received several national environmental awards. The company was crowned in 2008 when it received the European Eco-label. The motivation behind the company's engagement in environmental activities was both due to the nature surrounding of the spa/hotel and a wish to save money through energy efficiency and waste reduction.

- In 2004, *two heat pumps and solar system* were installed. The solar system is used to preheat the indoor and outdoor pools.
- In 2007, a 500 Kw wood *biomass boiler* was installed. The boiler was intended for the generation of thermal energy for heating water and spa facilities.
- The *water heating systems* also reuse the heat from the sauna to heat up the swimming pool
- The apartments and rooms in the complex are *intelligent rooms* fitted with all necessary heating and cooling systems where a system of "intelligent rooms" fully enables a rational use of heat and electricity. For example, all heating and air-condition switches off when the balcony door is opened.

These initiatives have resulted in four awards alone in 2008, the international Eco-Label, Effective Energy Company – 2008, Award for maintenance of clean air – 2008, Energy-efficient buildings -2008. The energy use and other impacts are closely monitored, and because of the tools and solutions applied the Terme Snovik *has achieved a 30% energy reduction from 2008 to 2009*.

(Slovenia Case Study)

Two types of tools and solutions mentioned in the literature are eco-design and end-of-pipe technologies. Eco-design was not seen as relevant for the majority of the SMEs. This view is supported in the literature.

A research report[91] suggests that in many companies, particularly SMEs, eco-design plays a very small role:

[91] JRC-IPTS: Eco-Design State of the Art, 2000

- Some SMEs have experience with eco-design in individual (demonstration) projects, but they rarely lead to implementation of eco-design in product development processes.
- Eco-design is not a management issue in SMEs and strategic goals for an environmental product policy are very rare.
- When eco-design is practised by SMEs, the focus is on the environmental redesign of products rather than the development of new product concepts (eco-innovation).

There are exceptions where SMEs have found market niches for their products, and are very conscious and advanced in marketing, developing and designing environmentally sound products (IPTS, 2000). The eco-market has grown since the research was carried out (2000) in the above-mentioned IPTS report, but the barriers still exist.

End-of-pipe technologies are seen as expensive and only relevant for the high-impact SMEs.

The table below shows the different types of solutions used by the SMEs in the project and the *relevance* and *impact* of those solutions based on the opinion of the 130 SMEs and organisations interviewed in this project.

Table 41: Relevance and impact of solutions

Type of solution	High Impact SMEs		Low Impact SMEs	
	Relevance	*Impact*	*Relevance*	*Impact*
Clean technologies/BAT	High	High	Medium	Medium
End-of-pipe technologies	Medium	High	Low	Low
Closed systems (recycling of waste, water (heat))	Medium	Low	Medium	Low/Medium
Simple solutions	Medium	Low	High	Medium
Eco-design	Low	--	Low	--
Certified EMS	Medium	High	Low	Medium
None-certified/sector specific EMS	Medium	High	High	Medium

There is a clear difference between the *high-impact SMEs* and *low-impact SMEs* when it comes to solutions. The *high-impact SMEs*, with high environmental costs will naturally achieve a higher cost benefit from investment in technology to reduce the environmental impact and because of increased use of energy/materials the closed system will have an enhanced effect.

Cleaner technologies/BAT were also relatively popular in *low-impact SMEs*, mainly because they saved the amount of input materials and thereby reduced costs.

Simple solutions will save costs for both type of SMEs, but the impact is limited. Most companies have already implemented simple solutions through an internal environmental policy.

Eco-design was not used by any of the companies, and many mentioned that it, like EMAS, was for large companies.

For both types of SMEs an EMS will have an impact, but the companies saw no reason to implement a certified EMS if they were not forced to do so. None-certified EMS are seen as equally effective with at least the same impact.

Conclusions and recommendations – Tools and solutions

A relatively large proportion of the surveyed companies have used some type of tool or solutions to reduce the environmental impact, but mainly in order to reduce their production costs.

The main motivational factor for investing in solutions that reduce the environmental impact is increasing costs of water/energy or new environmental legislation. In addition, collaboration with the supply chain has been a major factor for new ideas resulting in especially investments in clean technologies. Initiatives and projects from sector organisations have resulted in new environmental solutions, especially within waste management.

The major barrier is lack of financial resources and the high costs required to invest in new technology. One surprising finding was that SMEs with simple EMS or environmental policy were investing in tools and solutions in line with SMEs with a certified EMS.

Three main types of solutions used by SMEs were identified:

- investment in clean technologies;
- investment in closed systems (recycling of water or waste); and
- simple solutions.

Investments made in technology and closed systems mainly came from SMEs with a relatively high environmental impact, whereas simple solutions were seen in low-impact SMEs. The vast majority of companies investing in solutions reducing the environmental impact found have also saved costs. Furthermore, most of these companies are planning further investments.

Recommendations on tools and solutions

Recommendations	EU	Member States	Organisations	SMEs
High-cost solutions should be focused in high-impact SMEs	●		●	● ●
Promotion of tools and solutions should include good practice examples showing the economic effect as well as the environmental improvements	●	●	●	
Increase supply chain collaboration		●	●	●
Increase sector specific environmental projects for SMEs				● ●

Projects and initiatives promoting high-cost environmental solutions, such as investment in expensive technology with high potential for reducing the environmental impact, should be focused on SMEs with high environmental impact. The return of investment is too small for SMEs with limited environmental impact. Tools and solutions for low-impact SMEs should be simple and cheap to implement.

Environmental projects and initiatives for all SMEs should include concrete examples of the financial benefits as well as environmental benefits.

The companies interviewed in this study mentioned that one of the major motivational factors for investing in environmental solutions was close collaboration within the supply chain and with suppliers of technical equipment. Policy makers and organisations should focus on projects bringing together the whole value chain for exchange of ideas to reduce the environmental impact and at the same time save costs. The companies saw this as a cheap and effective way to get the latest information on technological and environmental solutions.

Finally, sector organisations should offer projects that focus on solutions to the main environmental issues in the sector leading to increased costs or problems with compliance. Collaborative projects with several companies will also reduce to R&D costs of many SMEs.

Other tools and solutions

The company examples in this section describe some of the reductions (cost and environmental) achieved by implementing different tools and solutions used by the SMEs interviewed in this study. More examples are presented in the country case studies.

There is a wealth of different projects and initiatives within the EU Member States aimed at reducing SMEs' environmental impact and at the same time reduce costs. We have therefore only mentioned those (here and in the country case studies) used by the SMEs interviewed for this study.

We have looked at some of the most quoted projects and initiatives promoting different types of EMS and tools, including *Environwise (UK)*[92], *Enworks UK*[93], *Ökobusinessplan Wien (Austria)*[94], *Money back through the window (Hungary)*[95] all of which have been very succesfull in reducing the environmental impact of companies and at the same time resulted in cost savings. Although SMEs have participated in these projects/initiatives, the overall effect from the programmes do not specify the impact on SMEs as they also offer support to large companies, where the effect will be larger than in small companies.

Many of the different projects and initiatives provide technical advice for simple solutions and systems, but as mentioned above many of the companies do not have the managerial skills, technical skills or capacity to identify their needs.

ENWORKS helps businesses to become more resource efficient, to reduce their costs and carbon impact and increase their productivity. This is achieved through a combination of practical advice, awareness-raising activities, tailored on-site support, plus training, all focused on creating cultural change throughout the business workforce.

The focus is on helping businesses to reduce the use of energy, materials and water, to make more with less, and to reduce the amount of waste going to landfill. Around two-thirds of the savings made are achieved through by simple, no cost or low-cost actions or changes in practice

A survey of 2,000 North West businesses supported by ENWORKS shows that one of the keys to success is the longevity of the support offered. One-off interventions or quick-fix solutions are not always effective for SMEs, for whom ongoing support for weeks, months or even years is usually necessary to achieve good results.

The aggregate cost and environmental savings identified for approximately 3,000 SMEs supported by ENWORKS is more than £40 million and 200,000 tonnes CO_2e annually, of which £8 million and 30,000 tonnes CO_2e annual savings have been achieved and support is ongoing to implement the remainder of the opportunities identified for these businesses

http://enworks.com/

More case studies and examples of projects and initiatives providing tools and solutions for SMEs can be found at

http://ec.europa.eu/environment/sme/cases/case_study_en.htm

[92] http://envirowise.wrap.org.uk/templates/custom/page/home.aspx

[93] http://www.enworks.com

[94] http://www.wien.gv.at/umweltschutz/oekobusiness/pdf/evaluation.pdf

[95] http://www.environmental-savings.com/

5.3 BUSINESS OPPORTUNITIES ON THE ECO-MARKET

This section looks at companies from the eco-industry as well as companies that have been seen to become 'greener' as a business opportunity in more traditional sectors (wider eco-market).

There has been many attempts at defining the eco-industry, but it is very difficult to measure the size of the industry, not least because many companies continuously invent new environmental solutions, which are very hard to identify.

However, the OECD and Eurostat define "eco-industries" as:

> *"Activities which produce goods and services to measure, prevent, limit, minimize or correct environmental damage to water, air and soil, as well as problems related to waste, noise and eco-systems. This includes technologies, products and services that reduce environmental risk and minimize pollution and resources*".

Two reports[96],[97] from the European Commission use the above definition to define the EU eco-industry. The sectors fall into two general categories, pollution management and resource management.

Table 42: General categories of the eco-industry

Pollution management	Resource management
• Solid Waste Management & Recycling • Wastewater Treatment • Air Pollution Control • General Public Administration • Private Environmental Management • Remediation & Clean Up of Soil & Groundwater • Noise & Vibration Control • Environmental Research & Development • Environmental Monitoring & Instrumentation.	• Water Supply • Recycled Materials • Renewable Energy Production • Nature Protection • Eco-construction.

The size of the eco-industry and eco-market

[96] *European Commission, DG Enterprise: Study on the competitiveness of the EU eco-industry, Final report, February 2009*

[97] *European Commission, DG Environment: Eco-industry, its size, employment, perspectives and barriers to growth in an enlarged EU, September 2006.*

The interviews showed that there are plenty of opportunities in the eco-industry and the eco-market. In the latter, the market opportunities depend a lot on the sectors to which the companies belong as well as the product and customers.

It is not possible to estimate the size of the eco-industry and eco-market on the background of the interviews of this project, but we can give an indication of what the companies see as opportunities now and in the future and also the incentives and barriers in the different sectors.

In the literature, the size of the eco-industry is based on the core eco-industry and OECD and EU definitions described above. The report *Study on the competitiveness of the EU eco-industry* (EC, 2009) provides a good picture of the development in the size of the eco-industry[98]. The study shows that the eco-industry of the EU27 had a turnover[99] of €232 billion (2.2% of GDP) in 2004 and €319 billion (2.5% of GDP) in 2008 (in current prices). This translates into a nominal compound annual growth rate of 8.3%. Corrected for inflation, the annual growth rate in the period was 5.9%.

The four largest subsectors take up roughly three quarters of the total eco-industry with waste management (30%) as the largest sector followed by water supply (21%), wastewater management (13%) and recycled materials (13%). The importance of these subsectors is very much aligned with the environmental challenges identified by the SMEs interviewed in the project.

Looking at the geographical distribution of turnover in the EU eco-industry, it is not surprising that France, Germany, Italy and the UK contributed with 58% of the total turnover for the EU-27 in 2008 (61% in 2004). In 2008, the distribution of turnover among the four countries had changed, with the UK and Italy being the most exceptional with annual growth rates of 9% and 8% respectively. Furthermore, the New Member States (EU27-15) experienced the highest annual growth rate of 10%.

The direct employment of the total EU eco-industry in EU27 was estimated at about 2.8 million and 3.4 million in 2004 and 2008 respectively with an annual growth rate of 7.0% over the years 2000-2008 (6.7% in real terms). The largest subsector in 2008 was *waste management* with 1.4 million employees (844,000 in 2000), followed by *water supply* with 700,000 (417,000 in 2000) and *recycled materials* with 512,000 (230,000 in 2000). Renewable energy and recycled materials were the fastest growing subsectors with 13% and 18% respectively in real terms.

[98] Figures quoted in literature from before 2009 are often based on the figures presented in the EC report *Eco-industry, its size, employment, perspectives and barriers to growth in an enlarged EU, September 2006.*

[99] Measured by environmental protection expenditures

A research project[100] carried out for the German Federal Environmental Agency investigated the innovative environmental growth markets from a company perspective. The study focused on six lead markets, namely, Power generation and storage, Energy efficiency, material efficiency, Sustainable mobility, Waste management and recycling, and Sustainable water management. The study highlighted that environmental technology already represents an important economic factor in a market estimated at around €1 trillion worldwide (p.3), and they expect this to reach a value of €2.2 trillion in 2020 (p.4).

Thus, the eco-industry and eco-market are indeed growing, but there are still barriers to entering the market.

What is creating the business opportunities?

In each region we have interviewed at least one eco-industry company in order to investigate the opportunities in eco-industry, but also companies working in the wider eco-market.

One of the questions in the E-survey (for business organisations) asked the organisations what they thought would create business opportunities for SMEs within the eco-market (see table below).

Table 43: Business opportunities in the eco-market

What do you think is creating the business opportunities for the small and medium sized companies in your organisation within the eco-market?					
	Very important		Somewhat important	Not important	Don't know	Total
Increased public sector demand for environmentally friendly products (green public purchasing)	49%	16%	5%	30%	100%
Increased industry demand for environmentally friendly products (demand from other companies)	27%	54%	11%	7%	100%
Increased consumer demand for environmentally friendly products (demand for eco-labelled products)	41%	45%	10%	4%	100%
Increased environmental legislation and taxation	31%	44%	18%	6%	100%
Demand for environmentally friendly solutions within transport, energy supply, water cleaning, air cleaning	32%	46%	17%	6%	100%
Demand for waste management, water and wastewater management, air protection?	32%	50%	10%	8%	100%

As the table above shows, the organisations point out consumer demand for environmental friendly products, such as eco-labelled products (41%), as the most important business creating opportunity. This opinion is *not* shared by the majority of SMEs that we interviewed. Many SMEs said that consumers are not envi-

[100] German Federal Environmental Agency, Innovative environmental growth markets from a company perspective, 2007.

ronmentally aware and many prefer 'normal' products compared to eco-products. In the New Member States this was a major issue and the companies in these countries mentioned that eco-labels or environmentally friendly products are mainly important for the export markets and not the national markets. However, in many 'old' Member States SMEs pointed out that only a small group of national consumers are willing to pay extra for an environmentally friendly product. This also means that the eco-label is not considered a major marketing tool at present. Below are a couple of eco-label examples from a Slovenia and the UK.

A Spa/Hotel in Slovenia uses their environmental profile and eco-label for marketing, but the effect is very limited. As the only eco-labelled hotel in Slovenia, Terme Snovik Spa/Hotel should have a competitive advantage, but the return on investment has mainly been through energy savings and a reduced environmental impact. Neither domestic nor international visitors have showed particular interest in the eco-label, but instead asked for changes to the actions implemented by the Spa/Hotel, such as more frequent changes of towels.

(Slovenia Case Study)

A UK food company has received many environmental awards and they are all used actively in promotion activities, especially for retailers, where it is a competitive advantage. However, they have decided not to put the labels that show that they are environmentally friendly on their products, as they do not think it will appeal to their consumers, as they prefer quality of the product (ingredients and taste). The products are not a cheap range of products, but this is because they are quality products, and the company do not want consumers to think that their products are expensive because they are environmentally friendly, as this will not sell products.

(UK Case Study)

It is important to note that with increasing focus on green products, for example through Green Public Purchasing, the eco-labels could become increasingly important. In some Member States, eco-labels have already proved successful. This is the case with Blue Angel[101] in Germany and the Nordic Swan Eco Label[102].

The e-survey also showed that organisations to a lesser extent (31%) see *increased environmental legislation* and taxation as a business opportunity. However, the interviews showed that this was very important for entering the eco-industry and that it is an area that companies are watching closely in order to find new opportunities.

The companies in the core eco-industry seem to be R&D intensive micro or small companies providing environmental solutions to companies affected by environmental legislation. These companies will often be university spin-offs or spin-

[101] http://www.blauer-engel.de/en/index.php

[102] http://www.norden.org/da/publikationer/publikationer/2001-516/at_download/publicationfile

offs from large companies seeing a business opportunity. Below are three examples.

A Danish company providing *treatment of effluent* has approx. 5 employees in-house, and some 15 employees working for the company in other companies. The company helps other companies with evaporation of aggressive effluent. They use different kinds of technologies to meet the needs of their customers. They have a niche market in treating oil-containing effluent. They are able to concentrate substances, which used to be a costly burden on their customers, into oil that can actually be sold. Their solutions can also be used for recycling solvents or transforming of slurry into biodiesel or bio-ethanol. They only operate in markets where the environmental legislation is strict. The company knows of the Water Framework Directive (Directive 2000/60/EC), but the directive concerns the actions of the national bodies and concrete plans and regulation are made at the national level. They are also aware that there is EU regulation concerning wastewater management (Directive 91/271/EEC on Urban Waste Water Treatment and Directive 98/15/EEC amending Directive 91/271/EEC). This regulation does not make a great difference today, but in the long term (10-15 years) they expect that there will be some harmonisation that and will also include the New Member States.

(Danish Case Study)

A Scottish company with 10 employees has taken advantage of EU environmental legislation and turned it into a business opportunity. Increased water prices and the EU Water Framework Directive are the main drivers for starting the company.

The main idea of the company is to recycle unusable wastewater, which means that companies will not have to pay for collection of wastewater and at the same time will not have to use expensive fresh water for industrial processes or ingredients. The idea came from collaboration with the Scottish Environmental Technology Network (SETN)[103], who helps SMEs to find innovative solutions to environmental problems and encourages companies to enter the eco-market through technological solutions. The Director of SETN is also involved in the company and in general the collaboration with SETN is of extreme importance for H2Ology, as it provides access to valuable knowledge.

Their main product is the Advanced Treatment System (ATS), which is a filtration system that removes silts, hydrocarbons, pesticides and heavy metals. The filtration system is used to decontaminate road water run-off, but the technology now also helps companies with high water use (for example discharge) to remove contaminants and recycle waste water. When companies implement this closed system, they save cost on waste (contaminated water) as this would otherwise have to be cleaned externally, and as the water is reused the company will have to use less fresh water.

(UK Case Study)

[103] http://setn.see.ed.ac.uk/index.php?option=com_content&task=view&id=12&Itemid=26

A UK based R&D company specialises in Metal Scavenger Technologies and Encapsulated Catalysts to establish easier, faster and cleaner chemical processes with reduced product and waste stream contamination and clean-up costs. EU environmental regulation in the pharmaceutical industry has been one of the major drivers for the company, as the customers need to comply and Reaxa's products can reduce the amount of dangerous chemicals going to waste, but also reduce the cost for the companies.

However, a major barrier is the high cost of registering new chemical products, where REACH is a major burden. For the company, the cost represents 30% of the turnover, as they do not have the expertise internally in the company. The burden on production of chemical products, which can actually help reduce companies' environmental impact, will prevent many R&D companies from entering the market and shift from R&D only to production and thereby grow their business.

(UK Case Study)

Barriers

There are some barriers that prevent SMEs from entering the eco-industry and the wider eco-market in particular related to approval from national authorities. A new product in the eco-market often requires approval from a national authority to prove that it lives up to environmental standards. These products are often complicated and this often results in a very long process, which is extremely costly for companies. Many different companies with new innovative solutions mentioned this as a major barrier.

In Germany the solutions of a company are well received with clients who appreciate their low-tech solution and the low maintenance solutions in contrast to other technologies. According to the company the main challenges for penetrating the market are neither the product nor reluctant customers – *the biggest obstacle has been getting the approval of implementation of the technology from the relevant authorities*. In effect, the company cannot exploit the business opportunities here – not for lack of demand but for lack of approval from the authorities.

(Germany Case Study)

Except from saving costs, a Slovenian company has developed a method to turn waste materials into artificial soil (see text box on next page), and according the company principal this could potentially be a business opportunity in the eco-market as it will be possible to use waste materials from other industrial processes to make the artificial soil. Furthermore, the artificial soil could be used by public authorities to repair sites where no vegetation growth is possible. *However, one of the major obstacles is that the processing time for approval of applications by national authorities has been extremely long and complicated.*

(Slovenia Case Study)

Another well-known barrier is the lack of capital to invest in development and marketing of environmentally friendly products. According to the Chairman of the Bulgarian Chamber of Pulp and Paper Industry co-financing of environment friendly (eco) industries by the authorities is necessary as an incentive to get companies to explore the opportunities.

Another barrier is that the eco-market can seem very distant for some companies, such as foundries, traditional chemical companies, and the textile industry, even though the latter use eco-friendly material. However, some companies from these sectors find that there is great potential in e.g. providing services (advice) to other companies that have to comply with the same type of legislation.

Green public purchasing could be a potential growth area. However, at present the interviewed SMEs did not see this as a major growth market for two reasons. One, the demand for green products in the public sector is still very limited and, two, when there is a demand it is normally from the large suppliers that public sector organisations use due to the size of the orders/contracts.

Conclusions and recommendations

The size of the eco-market is extremely hard to estimate, but the interviewed companies did not doubt that it is a growing market and most sectors saw opportunities in the future. The eco-industry was estimated at €319 billion (2.5% of GDP) in 2008, but the above-mentioned study by the German Federal Environmental Agency showed that in six lead markets, environmental technology already represents an important economic factor in a market estimated at around €1 trillion worldwide and expected to reach a value of €2.2 trillion in 2020.

Even though these are estimates, there is no doubt a large untapped potential in the wider eco-market.

Eco-industry

The interviewed companies from the eco-industry saw their best opportunities in providing technical solutions and services to companies trying to comply with both EU and national environmental legislation. Many of the interviewed companies from the eco-industry were highly R&D intensive micro companies. Some of these companies were spin-off companies from universities or larger companies seeing opportunities in providing environmental solutions and services for companies within the same sector as the larger enterprises. Many of the companies from high environmental impact sectors did not mention this as a business opportunity and many considered the market as distant and were more concerned with the day-to-day activities and actually understanding the legislation. The majority of the SMEs with high environmental impacts mentioned that they had no environmental experts and it is therefore difficult to see the opportunities.

The companies from the core eco-industry saw a growing market due to increased environmental regulation and legislation and this was often a major reason for starting the company.

The wider eco-market

Some of the interviewed companies saw an opportunity in more environmentally products, but also recognised a few significant demotivating barriers to entering this market.

The major barrier is that the process of obtaining certifications or getting products approved can be lengthy (often more than one year) and extremely complicated.

Another barrier for seeking opportunities in the eco-markets is that consumers are not ready for the products. This is especially the case in the New Member States where the supply of organic products is limited. In these countries the SMEs already in the eco-markets hoped for more public campaigns to increase consumer interest in greener products. This is also the reason for the limited success of the eco-labels as a marketing tool in sectors such as hotels and the food industry.

Green Public Procurement was seen as a potential source of opportunity in the future, but so far, this has not created a significant opportunity.

Recommendations on eco-market opportunities

Recommendations	EU	Member States	Organisations	SMEs
Support marketing campaigns for eco-market 'products'[104]	●		●	● ●
Simplify approval process for certification or environmentally friendly products				●
Sector specific events highlighting eco-industry opportunities in High Impact sectors	●			●
One-stop-shops for information and advice		●	●	

The main obstacle for many companies trying to enter the eco-market is the complicated and lengthy process of obtaining certificates or approval of new products at national level. There is a need to simplify this process to allow more SMEs to enter the eco-market as their resources are limited and a long costly process is therefore a major barrier.

In addition, although many campaigns in the individual Member States have promoted environmentally friendly products, there is still a very large group of

[104] We do not mean products as such, but more campaign for greener products in general, for example through campaigns for eco-labels.

consumers who do not choose these products, especially in the New Member States.

There is an opportunity for SMEs in sectors with a high environmental impact to turn the work carried in order to comply with especially new legislation into a business opportunity. This could e.g. include providing services for other similar companies trying to comply with the same set of legislation, in either the companies' own sector or other sectors. This could be done through an existing company or by creating a spin-off company. There are opportunities for SMEs to do so alone or in collaboration with their suppliers. Sector organisations should encourage this through awareness events showing the opportunities. Many of the interviewed companies have not noticed this opportunity, where others have created a new market for themselves. There seems to be many possibilities within providing services in the eco-industry in general, for both high R&D intensive and more traditional manufacturing companies.

6 OPERATIONAL CONCLUSIONS AND TOOLKITS

6.1 CONCLUSIONS

6.1.1 FINDINGS

SMEs ENVIRONMENTAL IMPACT

The EIDSME suggests that SMEs contribute with roughly 64% to industrial pollution in Europe

Although is widely accepted in the literature that it is complex and burdensome to determine the detailed contribution made by SMEs to pollution (e.g. air pollution) in terms of the environmental load from different types of pollutants (e.g. CO_2, SO_x, NO_x, etc.) in each Member State, the present study provides a detailed and coherent estimation of the environmental impact of European SMEs. Furthermore, it confirms that SMEs have an impact on the environment and account for about 64% of industrial pollution in Europe. That is in line with their contribution to production.

Environmental impact results from combined total rather than individual company impact across sector

While the environmental impact from an individual company can be very low, the environmental impact of a sector can be high if the number of companies operating in the sector is large. One prominent example is the NACE code *"G: wholesale and retail trade; repair of motor vehicles and motorcycles sector"*- which in many countries can be considered a high impact sector but the contribution from each company within the sector is relatively low. The most important insight here is that the discussion about the environmental impact from SMEs has to be specific to the sector and the enterprise size class.

Sectors of environmental priority

The analysis of the EIDSME database is completed by using environmental impact from sectors, from individual companies, the eco-efficiency and the potential for impact reductions to prioritise key sectors for action. Based on these data SMEs in the following sectors stand out in with an environmental priority: manufacturing of chemicals, basic metals, rubber and plastic, food, mining and quarrying, pulp, paper, coke, energy production, air and water transport and construction. But it is important not to jump to conclusions for several reasons: e.g. some sectors are already relatively eco-efficient while others are less efficient sectors such as the whole sale and retail sectors. The impacts considered are not weighted and not complete and the life-cycle perspective of products is not included.

SMEs AND ENVIRONMENTAL LEGISLATION

SMEs find it more difficult to comply with environmental legislation than larger companies

SMEs traditionally find it more difficult to comply with environmental legislation than their larger counterparts. In general, the smaller the company, the more difficult it is. Environmental legislation is based on environmental impacts and not on business size and imposes specific requirements concerning SMEs operation. In many cases: lack of awareness on environmental legislation on behalf of SMEs, lack of time and expertise to understand legislation and implement environmental measures, lack of clear, simple information, lack of financial resources to address environmental issues, make it harder for SMEs to comply with their obligations and create disproportionate compliance costs.

Environmental legislation requirements impose costs, which are not proportional to the size and production capacity of the enterprises, i.e. filling in a form takes a certain amount of time, and it makes no difference between a larger business and a smaller enterprise. Large companies can hire environmental managers to oversee regulatory compliance, while owners of small companies (the most valuable human resource of the enterprise) often manage these duties themselves.

Main Environmental legislation concerns for SMEs

There are a number of areas of EU environmental legislation relevant to SMEs' activities. The most affecting pieces of legislation concern waste and wastewater management, chemicals management (REACH), air emissions and emissions trading and energy efficiency. The main key findings of this study include:

Legislation on **emissions of atmospheric pollution** is affecting the activities of **SMEs in all the sectors**. Member States due to their obligations derived from Air Pollution Directives, set up specific air emission limits to the most of SMEs sectors analysed through their Environmental Terms Approval procedures and monitoring and reporting obligations.

General legislation on **waste management** affects SMEs of all sectors. Waste management is on the top of the environmental priorities and concerns, since it imposes, in many cases, high costs of waste treatment and disposal. Specific legislation on **packaging** is a major concern for SMEs of all sectors.

Specific legislation on **waste batteries** is a major concern for SMEs in the sectors of "*G: Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods*", "*H: Hotels and restaurants*", "*I: Transport, storage and communication*" and "*K: Real estate, renting and business activities*".

Specific legislation on **waste electrical and electronic equipment** is considered to affect the enterprises of all sectors except SMEs of "*C: Mining and Quarrying*", as well as "*D: Manufacturing*" sectors. This can be explained by the fact that SMEs of these sectors have other more significant environmental priorities and for the purposes of this Directive the only thing that they do is to collect electrical and electronic equipment and dispose them to certified systems of alternative management of these materials.

Requirements of **water environmental regulation** (water use, wastewater treatment and management) are a major concern of SMEs in all sectors except "*C: Mining and quarrying*" and "*I: Transport, storage and communication*, since they are not considered to be included in "water consuming" segment of SMEs.

Legislation on Volatile Organic Compounds (VOCs) affects the activities of SMEs of "*E: Electricity, gas and water supply*" sector. VOCs legislation affects SMEs operation from various sub sectors of *"D: Manufacture"*, although it is not one of the determined environmental concerns.

Legislation on **Integrated Pollution, Prevention and Control (IPPC)** in industrial plants imposes environmental requirements mainly to the SMEs of "*C: Mining and quarrying*", "*D: Manufacturing*" and "*E: Electricity, gas and water supply*" sectors.

Emission trading legislation *i*s affecting mostly the SMEs activities of sectors: "*C: Mining and quarrying*" and "*E: Electricity, gas and water supply"*.

SMEs of "*C: Mining and quarrying"* and "*E: Electricity, gas and water supply sector*" are affected by environmental requirements of **Noise legislation**. However, it is assumed that noise is a concern for SMEs primarily in its Health and Safety dimension (to protect the health of employees), rather than in its environmental one. Additionally, noise legislation is related to SMEs activities in "*F: Construction"*, "*I: Transport, storage and communication"* and "*K: Real estate, renting and business"* sectors. Noise legislation and any derived requirement is a second priority for SMEs in "*D: Manufacture*" Sector.

Legislation on **Chemicals** (REACH Regulation) is significant for all the sectors of economic activities. It should be noticed however, that according to the findings of Country Case Studies, the majority of interviewed SMEs are not aware of REACH Regulation and its requirements. On the contrary, organizations representing SMEs are more familiar with the specific obligations imposed by REACH provisions, and they support SMEs to their obligations due to REACH requirements.

Legislation referred to **Energy Efficiency** affects SMEs in the sectors of "*C: Mining and quarrying*", "*D: Manufacturing*", "*E: Electricity, gas and water supply*", "*F: Construction*" and "*K: Real estate, renting and business activities*". SMEs consider energy efficiency as a priority issue not only due to their environmental concerns, but also due to cost of energy.

Finally, general requirements concerning **Soil protection and management** are a concern for SMEs in "*C: Mining and quarrying*", "*D: Manufacturing*", "*E: Electricity, gas and water supply*" and "*G: Construction*" Sectors.

SMEs are aware of main environmental national legislation rather than that of the EU

SMEs are well aware of the main environmental national legislation and the relevant requirements. However, the level of awareness of EU environmental legislation is considered low. Most SMEs ignore EU environmental legislation since they are obliged to comply with the national legislation requirements. Member

States have the obligation to incorporate European legislation at the national level. Hence, for an SME it is local rules and legislation that is important; there's no motivation to know what EU legislation it comes from and what the original European directive requires.

SMEs lack knowledge regarding specific environmental legislation affecting them

The level of information and specific knowledge is still considered low and insufficient. Very few sectors consider REACH as a main environmental issue related to their activities. This can be explained by low level of available information from the side of national competent authorities. In cases where sector associations exist, the situation regarding knowledge dissemination seems to be much better. Nevertheless, there is a lack of support to companies in implementing the changes imposed by existing or new environmental legislation. Therefore a large number of SMEs are incurring extra costs stemming from their need to hire external consultants and experts to provide them with all required knowledge.

SMEs bear administrative burdens deriving from monitoring and reporting obligations

Monitoring and reporting of environmental indicators also imposes costs to SMEs. Such costs increase also due to reporting that has to be provided to many different authorities and be presented in different formats. In order to comply with reporting requirements, allocated person-hours vary a lot among SMEs, i.e. from the allocation of 1 person for 1-1.5 month per year in aggregate terms, to full time allocation of 1 person throughout the year. National legislation is in some Member States stricter than in others, resulting in higher costs for the SMEs because they have to meet higher expectations and this is affecting their competitiveness. The lack of enforcement in some Member States results in an uneven playing field. According to the SMEs and sector organisations more pressure should be put on national Governments to ensure compliance with legislation.

SMEs AND ENVIRONMENTAL PERFORMANCE

Environmental tools and solutions investment is mostly a priority concern in SMEs with high environmental impact

An estimated segment of 40-45% of SMEs, are companies with high environmental impact, usually with more than 50 employees and to smaller extent small companies in sectors with a high environmental impact. Companies with considerable impact on the environment are more likely to use environmental tools and solutions, due to both business opportunities through cost reductions and compliance with environmental legislation. A very large proportion of companies, estimated at 55- 60% of SMEs, are SMEs with a low impact on the environment. This group of companies, regardless of the type of sector where they operate, will seldom invest in tools and solution improving their environmental performance.

Certified environmental management systems (EMS) are more attractive solutions for medium and large sized as well as high impact companies

Certified EMS systems seems to be too costly and too complicated for most of the micro and small companies, the public shows no interest, there are seldom rewards from the authorities and the customers rarely demand an EMS. When they do they are usually asking for ISO 14001 systems. Perhaps systems like EMAS and EMAS easy should be targeted more exclusively to medium and larger sized enterprises and for high impact companies.

Non-certified environmental management systems can be easily applied by SMEs

For SMEs with a low environmental impact, very simple and low cost system for reducing environmental impact should be promoted. The Green Office system is an example of a simple system. The system could be simple guidelines on how to improve the SMEs environmental performance and most importantly, external auditing should not be necessary, since this adds extra costs and burdens to the company. For micro companies with a low impact on the environment the value of the reductions is low and expensive systems are therefore not attractive.

6.1.2 RECOMMENDATIONS

RECOMMENDATIONS REGARDING ADMINISTRATIVE PROCEDURES

Improvement of environmental permitting procedures & authorizations

As it has been proved through the elaboration of the present study, the Environmental Impacts Assessment (EIA) requirements and its associated environmental permitting procedures in Member States impose extra administrative burden to SMEs**.** Thus, streamlining these procedures amongst the Member States and simplifying them is a major expressed need for SMEs of all sectors. Streamlining and simplifying EIA and environmental approval procedures could include:

- *Reduction of the permits' issuance time*. This means, that public competent authorities should be obliged to proceed with EIA approval in concrete time periods, strictly maintained, giving clear guidelines in cases that some information from the part of the enterprise are missing.
- *Requirement of fewer certificates from the part of the enterprise asking for Environmental Impacts Approval*. Administrative public bodies should create improved internal communication system between them and exchange data concerning enterprises' operation, and not asking the enterprises to submit these data many times to different authorities.
- *Creation of a database so that administrative units can exchange information*. This database could be a part of the establishment of the internal communication system referred above. This database could contain historical and statistical data of economic activity and employment data and size of each enterprise, as well operation and environmental performance data. Since an enterprise begins its operation, all information concerning its operation should be accessible by public authorities involved in enterprises' issues permitting, in their performance monitoring and related reporting.

- *Creation of "one-stop-shop" for environmental permitting issuance.*
- *Recruitment of employees of public administrative bodies from relevant technical fields in permitting units*, so that these units could be more efficient and playing a more consulting and supporting role to SMEs.
- *Limitation of consultant's rates*. This is a requirement expressed by many SMEs during study's elaboration. However, this proposal is hardly feasible. A simple suggestion in this frame could be the definition of rates scales proportional to enterprises size and their monitoring through a system of Consultants' register.
- *Unified and simple codification of legislation*. Public bodies should codify all legislative requirements and present them in a unique and simplified way.

Streamlining of environmental reporting

- *Simplification of the administrative requirements and avoidance of duplication of requested information*. This suggestion relates to the above comments on internal communication system between various involved public administrative bodies and the creation of a database.
- *Creation of e-registration systems at national level* (except for the requirements stemming from the IPPC Directive and the REACH Regulation) in order to submit monitoring information electronically in a unified format and regular frequency.

Creation of one-stop shops for the provision of information & tools for the fulfilment of administrative requirements at national level

- The existence of several sources of information and complex administrative requirements is costly for SMEs. Access to information and to tools to facilitate regulatory compliance requirements is an area that needs more work despite the continuous efforts of the authorities in charge and the various sector associations. *SMEs demand one-stop-shop facilities to gather information* (legislation in force, new requirements, criteria for applying for subsidies, contact details of advisors or providers, available tools, fiscal treatment, etc), *fulfil administrative requirements and, in short, to save time and avoid duplication of work*.
- These one-stop-shops could also provide *training services* to SMEs concerning environmental legislation and its requirements.
- A suggestion would be to *create a network of affiliated one-stop- shops at national level* that could serve the regional or local level. SMEs could contribute a very small yearly subscription fee.

RECOMMENDATIONS REGARDING FINANCIAL SUPPORT

Support for alleviating the costs of complying with environmental legislation

- *Free or subsidized advisory services to help SMEs comply with the legislation in force*. Support to SMEs is a measure that can always constitute a solution

for mitigation in cases where no other mitigation measure could be implemented. For example, this is the role of the Environmental Compliance Assistance Programme for SMEs.

- *Tax relief proportional to the size of the company*

Incentives to improve environmental performance beyond existing standards

Subsidies for SMEs that wish to upgrade to energy-efficient machinery or overall to improve their environmental performance with simple solutions other than applying an Environmental Management System

Certifications costs should be proportional to the company's size, number of employees and turnover

Voluntary certification according to environmental standards (national, European, international) imposes costs to SMEs. The cost of certification could take into account all of the following three parameters: company's production size, number of employees as well as turnover in a rational way. The Obligatory Registration system under REACH Regulation takes care of the company size.

Standardised EMS reporting should improve the cost and the time needed to comply with reporting requirements

Companies are asking for standards and a more standardised way of EMS reporting might be the answer here. This is currently being done within EMAS through the development of sectoral key indicators. The approach remains voluntary, but the reporting will be standardised.

Concrete examples of financial benefits of environmental initiatives should be provided

Environmental projects and initiatives for all SMEs should include concrete examples on the financial benefits as well as environmental benefits.

Collaboration within the value chain should be promoted for improving environmental performance

One of the major motivational factors to invest in environmental solutions is close collaboration within the supply chain and with suppliers of technical equipment. Policy makers and organisations should focus on projects bringing together the whole value chain for exchange of ideas to reduce the environmental impact and at the same time save costs. Companies see this as a cheap and effective way to get the latest information on technological and environmental solutions.

The cost of environmental solutions should be proportional to the environmental impact of a company

Projects and initiatives promoting high cost environmental solutions, such as investment in expensive technology with high potential for reducing the environmental impact, should be focused on SMEs with high environmental impact. These SMEs could be derived from any of the economic sectors, however SMEs of Manufacture sub sectors and Mining and Quarrying sector could be SMEs

characterized by high environmental impacts. The return of investment could be considered too small for SMEs with limited environmental impacts. Tools and solutions for low impact SMEs should be simple and cheap to implement.

Actions to improve environmental data quality could be undertaken at the EU, Member States and SME organisations levels

Environmental data quality improvement actions include:

- Improve knowledge of impact distribution between size categories (EU, Member States, SMEs organisations);
- Improve quality of selected indicators i.e. Energy (EU, Member States);
- Improve LCA data on products to be compatible with NACE (EU);
- Include environmental indicator questions in EU finances observatory studies (EU).

RECOMMENDATIONS TO SMES AND SUPPORT ORGANIZATIONS

Strong support is required on behalf of sector organisations

Sector organisations should offer projects with focus on solutions to the main environmental issues in the sector leading to increased costs or problems with compliance. Collaborative projects with several companies will reduce R&D costs for the SMEs.

Sector specific environmental guidance is required

Organisations could play an important role by offering more sector specific guidelines for improving environmental performance. This could be an amended version of a EU-wide EMS for high and low impact SMEs.

Certain tools and solutions can be easily implemented for improving environmental performance

Three main types of tools and solutions for cost reduction through increased eco-efficiency due to environmental expenditure were identified:

- Investment in clean technologies and to lesser extent end-of-pipe technologies;
- Investment in closed systems (recycling of water or waste);
- Simple solutions.

These tools and solutions result in:

- reduction in energy consumption;
- reduction in environmental resources (e.g. water, soil, raw- materials) consumption;
- reduction in waste generation.

Business opportunities as regards the environment should be facilitated

Business opportunities as regards the environment include:

- Environmentally friendly products. Many of the companies interviewed saw an opportunity in more environmentally friendly products, but also recognised a few barriers, such as lengthy certification procedures, which have a significant de-motivating effect to enter this market.
- Green-life style products and services.
- Environmental management services. The companies interviewed from the eco-industry saw the largest opportunities in providing technical solutions and services to companies trying to comply with both EU and national environmental legislation.
- Environmental consulting services.

6.2 OPERATIONAL TOOLKITS

The aim of the Toolkits is to support primarily two perspectives/key actors, both crucially engaged in the development of SMEs towards meeting the objectives of the EU in terms of environmental policy design, as well as adoption and exploitation of business opportunities as regards the environment. Namely, the Toolkits include the following two perspectives:

- **Policy makers perspective**; actors involved are European Policy makers, whose primary interest in this perspective is expected to have a primary deployment of these Toolkits in supporting them to develop environmental policy and legislation that is simple and cost-effective in its implementation by the SMEs across Europe.
- **SMEs perspective**; SME Networks and other groups or associations at the European or national level, as well as potentially individual SMEs are expected to have a primary deployment of these Toolkits to determine actions with a vested interest in supporting a sustainable development of SMEs towards a more environment-friendly and economically attractive business context.

To meet the above demand, the Toolkits (Policy makers and SMEs perspective) were developed on the basis of the experience of SMEs, SME representatives and professionals active in the SME field that was documented in the country case studies and the online e-survey. Experience gained through this bottom-up approach was supplemented by field literature resources, databases and expert input.

The Toolkits are **knowledge-driven** with the purpose to facilitate the transfer of knowledge accumulated and/or generated in the context of the present study, covering the following areas:

- **Introduction** that includes information concerning the development framework of the Toolkits as well as instructions on how to use the Toolkits**.**

- **The Policy makers Perspective.** This section includes references to the findings of the present study in terms of the priority areas emerging for further action in the context of environmental policy for SMEs in Europe. Also included in this section is the simulator tool that gives the possibility to setup and try different scenarios of policy outcomes.
- **The SMEs Perspective** consists of the:
    - ***Sector Perspective*** of identified incentives that could increase SMEs eco-efficiency and foster SMEs participation in the eco-industry (Good Practices Knowledgebase, Tools and Methods) presented sector by sector.
    - ***Good Practice Knowledgebase.*** This knowledgebase documents and categorizes in the form of case references, good practices identified in the course of the Consultant's work across several dimensions that emerge from the country case studies showing the potential for broad applicability in issues such as immediate opportunities for costs saving and business opportunities from "greener" activities. The aim of this section of the Toolkits is therefore to provide suggestions to SMEs on how to achieve cost reduction through increased eco-efficiency on the one hand and on the other hand on how to turn their environmental challenges into business opportunities.
    - Tools and Methods. This section includes a commented list of tools and methods that the Consultant encountered during the country case studies, as suggested by SMEs, sector organisation and knowledge organisations/public authorities. The list also contains web links to relevant tools and methods.
- **EIDSME Database.** In support to policy makers as well as SME interest groups, the Quantitative Information Database provides a multidimensional quantitative perspective on economic, geographic and environmental metrics related to the subject matter. Access to the database is made possible through a graphically rich and interactive environment which makes easy to interested parties to navigate and visually explore the available information across all the above-mentioned dimensions. Namely the database includes the:
    - ***Geographic Perspective*** that presents information derived from the EIDSME database in graphical format with primary dimension the geographic perspective.
    - ***Sector Perspective*** that depicts information derived from the EIDSME database in graphical format with primary dimension the sector perspective.
- **Basic Knowledge**. This section consists of the:

- ***Terms and Concepts Dictionary*** that includes definitions and information on important terms and concepts related to the subject matter (e.g. BAT, eco-design, environmental management system and other terms/concepts), including links in cases where further reference was deemed useful.
- ***Legal Compendium*** that comprises of a catalogue of relevant active EU legislation, with a direct link to Eur-Lex "Access to European Union law" for downloading documentation in all official European languages, while the English language document is already included in the Toolkits in pdf format. Among others, the catalogue includes the Integrated Pollution, Prevention and Control (IPPC) Directive and the Regulation on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH).
- ***Country Perspective*** that categorises identified legislative priority areas for action and good practices per country.

The format of the Toolkits supports **ease and diversity of access to the hosted information**, hence it is developed as a web accessible content that may be incorporated /hosted as needed by the sponsoring authority. Of course in addition to the above, all content of the Toolkits is made available on printable document form as an alternative means of access, excluding the environmental indicators database whose printed form includes aggregated information for practical reasons.

As stated earlier, these Toolkits are not envisaged as a static representation of the subject matter situation at a given point of time, but rather as **a dynamic space to host updated information** that should be incorporated in the progress of time.

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9 LITERATURE

A review of interventions to encourage SMEs to make environmental improvements; Environment and Planning C: Government and Policy 2009, volume 27, pages 279 ^ 301; published online 24 December 2008

BERR, Better Regulation Executive, Applying the Compliance Code, An Implementaion Workshop for Regulators, 27 February 2008

Centre for Strategy & Evaluation Services LLP, Study on Environment Related Regulatory Burdens for SMEs, 25 October 2007

Commission for Environmental Cooperation, Successful Practices of environmental management systems in SMEs – A North American Perspective, 2005

Cowi, "Promoting Innovative Business Models with Environmental Benefits". 2008. http://ec.europa.eu/environment/enveco/innovation_technology/pdf/nbm_report.pdf

Craig M Parker, Janice Redmond, Mike Simpson, A review of interventions to encourage SMEs to make environmental improvements; Environment and Planning C: Government and Policy 2009, volume 27, pages 279 ^ 301;; published online 24 December 2008

Craig M Parker, Janice Redmond, Mike Simpson;,

Eco-design: Strategies for Dissemination to SMEs - Part I: Overall Analysis and Conclusions, JRC-IPTS, 2000 "Ex-post estimates of costs to business of selected pieces of environmental legislation" http://ec.europa.eu/environment/enveco/others/index.htm#ex_posthttp://ec.europa.eu/environment/enveco/others/index.htm#ex_post

ECOTEC Research & Consulting, REport on SMEs and thr Environment, Analisis of the replies given by 6 european Union Member States to a European Commission's questionnarie on Small and Medium-Sized Enterprises (SMEs) and the Environment, 17 Februar 2000

EEA Report No 1/2006 Using the market for cost-effective environmental policy, Market-based instruments in Europe

EMAS Toolkit for small organisations, International Network for Environmental Management (INEM), 2004; http://ec.europa.eu/environment/sme/schemes/environment_management_en.htm

Environment and Planning C: Government and Policy 2009, Volume 27, pages 279-301

Environmental Compliance Assistance Programme for SMEs: Small, Clean and Competitive; http://ec.europa.eu/environment/sme/legislation/legislation_en.htm; http://ec.europa.eu/environment/sme/programme/programme_en.htm

Environmental impact of products: http://ec.europa.eu/environment/ipp/pdf/eipro_report.pdf

Environmental impacts of sectors: documents on www.popa-ctda.net and www.ectp.org

Environmental Innovation and Global Markets, OECD, 2008c

Environmental Performance, Competitiveness and Management of Small Businesses in Europe, Journal of Economic and Social Geography, Volume 96, December 2008, Issue 5.

EU Commission, DG Environment, Promoting Innovative Business Models with Environmental Benefits, November 2008.

Europe Innova, Eco-industries, May 2008.

European Commission and Institute for Prospective Technological Studies, Environmental Improvement of Passenger Cars (IMPRO-car), 2008

European Commission, Action Programme for Reducing Administrative Burdens in the EU

European Commission, Commission Staff Working Document, Accompanying document to the Communication from the commission to the council, the european parliament, the european economic and social committee and the committee of the regions, Small, clean and competitive A program to help small and medium-sized enterprises comply with environmental legislation, Impact Assessment, 08.10.2007

European Commission, DG Enterprise and Industry, Action Programme for Reducing Administrative Burdens in the EU : Cutting red tape: Workshop session 1: Environment; 2008

European Commission, DG Enterprise and Industry, Action Programme for Reducing Administrative Burdens in the EU : Cutting red tape;2008

European Commission, DG Enterprise and Industry, Action Programme for Reducing Administrative Burdens in the EU : Cutting red tape: Workshop session 4: Burden Reduction; 2008

European Commission, DG Environment, Comparative Analysis of the environmental Management, Performance and Innovation of SMEs and Larger Firms, August 2006.

European Commission, DG Environment: Eco-industry, its size, employment, perspectives and barriers to growth in an enlarged EU, September 2006

European Commission, DG Environment; Green Paper on Market Based Instruments;http://ec.europa.eu/environment/enveco/green_paper

European Commission, DG Environment; Green Paper on Market Based Instruments; http://ec.europa.eu/environment/enveco/green_paper.htm

European Commission, Enterprise and industry publications, The new SME definition User guide and model declaration

European Commission, Enterprise and Industry, Joint European Commission / Industry Workshop on Access to Finance for Small and Medium-sized Biopharmaceutical Companies in Europe, 1 December 2009

European Commission, Enterprise Directorate-General ;Public policy initiatives to promote the uptake of environmental management systems in small and medium sized enterprises; Final Report of the BEST Project Expert Group; January 2004

European commission, Impact Assessment on the ECAP programme: http://ec.europa.eu/environment/sme/pdf/impact_assess_906_en.pdf

European Commission, Proposal for a Regulation of the european parliament and the council on the voluntary participation by organisations in a Community eco-management and audit scheme (EMAS), COM(2008) 402/2

European Commission, Reducing Administrative Burdens in the European Union Annex to the 3rd Strategic Review on Better Regulation

European Commission, Sectoral Costs of Environmental Policy, Final Report, 2007: http://ec.europa.eu/environment/enveco/industry_employment/pdf/sectoral_costs_report.pdf

European Commission, The effects of environmental policy on European business and its competitiveness a framework for analysis, SEC(2004) 769

European Commission, Unit B.1 "Development of Industrial Policy" of the Enterprise and Industry Directorate-General, European Industry: A Sectoral Overview Technical update - 2006

European Commission: Public Policy Initiatives to promote the uptake of environmental management systems in small and medium-sized enterprises, Final Report of the BEST project expert group, January 2004

European Commission: Study on the competitiveness of the EU eco-industry, Final report: February 2009

European Compliance Assistance Programme for SMEs : 2_ecap_bedo_en.pdf

European Environment Agency Report No 1: Using the market for cost-effective environmental policy, Market-based instruments in Europe, 2006

European Environment Agency Report No 2: Effectiveness of environmental taxes and charges for managing sand, gravel and rock extraction in selected EU countries, 2008

European Environment Agency, Technical report No 54: Business and the environment: current trends and developments in corporate reporting and ranking, Project manager: David Gee, February 2001

European Foundation for the Improvement of Living and Working Conditions, Trends and drivers of the change in the European construction sector: Mapping report, 2005

European Patent Office, "Patenting Trends in Eco-Innovation", European Patent Office, 2008

Eurostat (2009) The Environmental Goods and Services Sector, a Data Collection Handbook http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-RA-09-012/EN/KS-RA-09-012-EN.PDF

Ex-post estimates of costs to business of EU environmental legislation; Final report, Edited by Frans Oosterhuis (IVM); April 2006

FALLING PRICES - Cost of Complying With Environmental Regulations. Almost Always Less Than Advertised; by Hart Hodges, Economic Policy Institute: Briefing Paper

Fraunhofer Institute Systems and Innovation Research, German Council for Sustainable Development, Research and Technology Competence for a Sustainable Development in the BRICS Countries, Study of the Fraunhofer Institute for Systems and Innovation Research for the German Council for Sustainable Development, May 2008

Gadenne, Kennedy, McKeiver, Journal of Business Ethics, An empirical study of environmental awareness and practices in SMEs, 2009

German Federal Ministry for the Environment, Ecological industrial policy, Nature Conservation and Nuclear Safety, Berlin, October 2006

German Federal Ministry of the Environment , "Wirtschaftsfaktor Umweltschutz: Vertiefende Analyse zu Umweltschutz und Innovation", Nature Conservation and Reactor

GHK, A study to examine the benefits of the End of Life Vehicles Directive and the costs and benefits of a revision of the 2015 targets for recycling, reuse and recovery under the ELV Directive; Final Report to DG Environment; GHK, Bio Intelligence Service; Date: May 2006

GHK, A study to examine the benefits of the End of Life Vehicles Directive and the costs and benefits of a revision of the 2015 targets for recycling, reuse and recovery under the ELV Directive; Final Report to DG Environment; GHK, Bio Intelligence Service; Date: May 2006

IEA (2005), "Energy Statistics Manual), http://www.iea.org/textbase/nppdf/free/2005/statistics_manual.pdf

IMPEL, Doing the right things II, Step-by-step guidance book for planning of environmental inspection, final November 2008

Institute for European Environmental Policy, Environmental Compliance Assistance for SMEs: Analysis of Specific Initiatives at National and Local Level and Identification of Best Practices, Final Report, 20 June 2006

IVM , "Innovation dynamics induced by environment policy" IVM 2007, http://ec.europa.eu/environment/enveco/policy/pdf/2007_final_report_conclusions.pdf

Journal of Business Ethics (2009), Springer 2008, An Empirical Study of Environmental Awareness and Practices in SMEs

JRC-IPTS: Eco-Design State of the Art, 2000

McKinsey: Global Greenhouse Gas Abatement Cost Curve: January 2009 http://globalghgcostcurve.bymckinsey.com/

MEME/06/244 Brussels, 22 June 2006, Examples of reducing administrative burdens on enterprises

MEMO/09/474 titled: "Cutting red tape – Overview of reduction measures and illustrative examples", 22.10. 2009

Michalak, Krzysztof and Schucht, Simone, Economic Aspects of Environmental Compliance Assurance. A summary of the results of a Conference on

Economic Aspects of Environmental Compliance Assurance, organized on 2-3 December 2004, Environment Directorate, OECD

Minimum quality standards For environmental inspectorates In the Netherlands, Confirmed by the State Secretary of the Environment, November 2002

Models to reduce the disproportionate regulatory burden on SMEs; http://ec.europa.eu/enterprise/policies/sme/business-environment/administrative-burdens/index_en.htm

NISP, About NISP - Approach & Achievements, 2007

OECD report on environmental indicators: http://www.oecd.org/dataoecd/20/40/37551205.pdf

OECD, "OECD environmental Outlook to 2008", 2008b

OECD, "OECD Sustainable Development Studies: Measuring Sustainable Production", 2008a

OECD, 2008 Annual Report on Sustainable Development Work in the OECD

OECD, Working Party on Global and Structural Policies, Environmental Innovation and Global Markets, 22-Feb-2008

Paint Manufacturers can save money on environmental compliance costs (FACT SHEET), Dept. of Toxic Substances Control, Jan 1997

Products with the greatest potential for environmental improvement http://ec.europa.eu/environment/ipp/implementation.htm

Promoting Environmental Technologies in SMEs: Barriers and Measures, JRC – IPTS, 2004-2005

Promoting environmental technologies: Sectoral analyses, barriers and measures, JRC-IPTS, 2004 http://ftp.jrc.es/EURdoc/eur21002en.pdf

Reforming Environmentally Harmful Subsidies; A report to the European Commission's DG Environment; Institute for European Environmental Policy (IEEP;); Carolina Valsecchi, 77. Patrick ten Brink, Malcolm Fergusson, Samuela Bassi, Ian Skinner and Marc Pallemaerts;19 March 2007

Regional Council of Etelä-Savo, EcoStart – a Finnish Environmental Management System for SME's, 2004.

Report on SMEs and the Environment: Analysis of the replies given by 6 European Union Member States to a European Commission's questionnaire on Small and Medium-Sized 69. Enterprises (SMEs) and the

Environment, ECOTEC RESEARCH AND CONSULTING, February 2000

Roland Berger Strategy Consultants ,"Innovative environmental growth markets from a company perspective", , Dessau-Rosslau, November 2007

Sectoral Costs of Environmental Policy, FINAL REPORT; P. Vercaemst, S. Vanassche, P. Campling, L. Vranken (VITO), P. Agnolucci, R. Salmons, B. Shaw, (PSI), J. Jantzen, H. van der Woerd (TME), M. Grünig, A. Best (Ecologic), December 2007

Selih, Jana in Jounal of Civil Engineering and Management, Environmental management systems and construction SMEs: a case study for Slovenia, September 2007.

Sigmar Gabriel Advocates "New Deal" of the Economy, Environment and Employment, BMU-Pressedienst No. 279/06

Streamlining and simplification of environment related regulatory requirements for companies; Final Report of the BEST project Expert Group; May 2006, http://europa.eu.int/comm/enterprise/enterprise_policy/best / best_procedure.htm

Stuart Whitten, Martin van Bueren and Drew Collins, An Overview of Market-Based Instruments and Environmental Policy in Australia ,; Presentation at the 2003 AARES Symposium

Stuart Whitten, Martin van Bueren and Drew Collins, An Overview of Market-Based Instruments and Environmental Policy in Australia ,; Presentation at the 2003 AARES Symposium

Study on Environment Related Regulatory Burdens for SMEs, Final Report, October 2007 http://ec.europa.eu/enterprise/environment/reports_studies/studies/finalrep_impact_env_reg_sme_oct07.pdf

Study on Environment Related Regulatory Burdens for SMEs; Centre for Strategy & Evaluation Services LLP; October 2007

Study on the Economic and Environmental Implications of the use of environmental taxes and charges in the European Union and its Member States, ECOTEC, April 2001

The Contribution of Good Environmental Regulation to Competitiveness Paper by the Network of Heads of European, Environment Protection Agencies; November 2005

The Fabricator, Achieving cost-effective environmental compliance: How outsourcing waste management can help; http://www.thefabricator.com/CEOs/CEOs_Article.cfm?ID=422

The Fabricator, Achieving cost-effective environmental compliance : How outsourcing waste management can help; http://www.thefabricator.com/CEOs/CEOs_Article.cfm?ID=422

UK Government, Commission on Environmental Markets and Economic Performance (CEMEP), Commission on Commission on Environmental Markets and Economic Performance, November 2007

UNEP, Green jobs: Towards decent work in a sustainable, low carbon world, UNEP, 2008