PwC Sustainability

Collection of statistical information on Green Public Procurement in the EU

Report on methodologies

SIGNIFICANT ECOFYS PRICEWATERHOUSECOOPERS

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January 2009

Contents

Glossary of Terms

Central government	Governmental organisations that have responsibilities concerning the whole country *(e.g. ministries and governmental agencies)*
CO_2	Carbon Dioxide
CO_2 ratio	The ratio of CO_2 emissions of a green product as compared to the CO_2 emissions of a non-green product
Comprehensive criteria	Criteria that result in purchases of the best environmental products available on the market, which may require additional administrative effort or imply a certain cost increase as compared to other products fulfilling the same function
Confidence interval	An interval that provides insight in the accuracy of an estimator. A 95% confidence interval implies that the estimated interval will contain the true value in 95% of the cases.
Confidence level	The desired level of confidence determines how likely it is that the confidence interval contains the true value. *In this study, the confidence level is taken to be 95%*
Core criteria	Criteria that result in purchases that address the most significant environmental impacts with minimum additional verification effort or cost increases
Cost ratio	The ratio of costs of a green product as compared to the costs of a non-green product
Cost structure	The various elements and its relative percentages that make up the total Life Cycle Costs (LCC) of a product
Non-central government	All public organisations that do not fall under the definition of not central government *(e.g. semi-public organisations, municipalities, provinces, public administration bodies)*
ECF	Elementary Chlorine Free
FSC	Forest Stewardship Council
Fuel mix	Mix of energy sources that are used to generate electricity in a specific country
Functional unit	The unit that defines a single unit of a product within a product group *(e.g. vehicle, kg textile, m^2 cleaned surface)*
GPP	Green Public Procurement
Green-7	Seven best performing EU Member States in terms of GPP
Gross sample size	The number of organisations that are invited to give response for individual observations within a certain population
KJ	Kilojoules
LCA	Life Cycle Analysis – *the analysis of the environmental impact of a product throughout its entire life cycle*
LCC	Life Cycle Costs – *this only includes costs that can be attributed to the user of a product*
L-RES	Localised Renewable Energy Sources - *RES generating capacity within a building site itself (e.g. solar panels, biomass boilers, wind turbines etc.)*
Net sample size	The number of individual observations within a certain population
NPV	Net Present Value
PEFC	Pan European Forest Council
Precision level	The width of the confidence interval of the estimated percentage of the core/comprehensive level of GPP as an outcome of this study
Ratio	A ratio between two *A* and *B* is their *A*/*B*. A ratio is a way of expressing the of *A* to *B*.
RES-E	Electricity supplied from Renewable Energy Sources
Sampling	Selection of individual observations within a certain population, in order to yield knowledge about the entire population
TCF	Totally Chlorine Free
TED	Tenders Electronic Daily

1 Introduction to the study

In 2006 the European Council announced its ambition to bring the average level of Green Public Procurement (GPP) in Europe up to the standards currently achieved by the best performing Member States. In preparation for this ambition set for 2010, a methodology needs to be developed to collect statistical data and monitor the level of GPP in each Member State. This methodology can be implemented in the seven best performing Member States which have been identified as frontrunners in GPP.

1.1 Objective and scope

The main objective of this study is to develop and implement a methodology for measuring Green Public Procurement in Europe. There are three sub-objectives:

1. To develop a suitable methodology for measuring quantitative levels of GPP
2. To develop a suitable methodology for measuring the CO_2 and financial impact of GPP
3. To measure the current level of GPP in the seven best performing Member States by implementing the developed methodologies in these Member States

The seven best performing Member States include Austria, Denmark, Finland, Germany, The Netherlands, Sweden and the United Kingdom. Known as the Green-7, these Member States are currently implementing more elements of GPP than the other twenty Member States. This means that they consistently have more tenders with green criteria than the rest of the twenty-seven European Member States.[1]

The focus of the study is on the public sector. Public and semi-public, central and de-central (i.e. regional and local) institutions are included. Per Member State the types of public institutions may differ, depending on the structure and properties of the public sector. A detailed overview of the type of public institutions included in this study can be found in section 4.1.

Ten product groups are subject to measurement in each of the participating Member State. The selection procedure of these ten product groups is described in section 1.3.1.

1.2 Context

The study was conducted in 2008. This report describes the methodology that has been developed. It gives insight into how the level of GPP is calculated, as well as on definitions used and selection criteria applied. It also includes a detailed description of the instruments developed for implementing this methodology through a survey in the seven Member States. The survey ran from the beginning of June 2008 until the end of August 2008. The survey results are presented in a separate report.

1.3 Methodology

A suitable methodology for measuring Green Public Procurement (GPP) calls for robust indicators and calculating methods which allow Member States to effectively monitor and report on their level of GPP. Therefore, the first step in this study is to define these indicators and develop appropriate calculating methods (sub-objectives 1 and 2). Secondly, a methodology is developed for the collection of relevant statistical data in the current best performing Member States (sub-objective 3).

1. Indicators and calculating methods for measuring the quantitative level of GPP.
   Indicator 1: The % GPP of total public procurement, in terms of monetary value.
   This indicator gives the percentage of the amount spent on green public procurement contracts, compared to the total amount spent on public procurement contracts.
   Indicator 2: The % GPP of total public procurement, in terms of the number of contracts.
   This indicator gives the percentage of the number of green public procurement contracts, compared to the total number of public procurement contracts.
   The definitions and calculating methods for indicators 1 and 2 are explained in chapter 2.
2. Indicators and calculating methods for measuring the impact of GPP.

1 Bouwer M., de Jong K., Jonk M., Berman T., Bersani R., Lusser H., Nissinen A., Parrika K. and Szuppinger P., 2005. Green Public procurement in Europe 2005 – Status Overview. Virage Milieu & Management bv, Haarlem, the Netherlands. http://www.gpp-europe.net

Indicator 3: The % environmental impact of GPP, in terms of CO_2 emissions.
This indicator gives the percentage of the environmental impact of green public procurement in terms of CO_2 emissions, compared to the impact of non-green public procurement.
Indicator 4: The % financial impact of GPP, in terms of the product Life Cycle Costs.
This indicator gives the percentage of the financial impact of green public procurement, compared to the financial impact of non-green public procurement.
The definitions and calculating methods for indicators 3 and 4 are treated in chapter 3.

3 Methods for data collection and measurement of the levels and impact of GPP in seven Member States.
The methodology for collecting data in seven Member States includes population and sample methods, the development of a questionnaire and methods for identifying contacts and increasing potential response rates. These methods are described in detail in chapters 4 and 5.

1.3.1 Selection of product groups and related product types

An important step in the development of the methodology is to identify the ten product groups and related product types. The European Commission has identified ten product groups that are most suitable for greening under Green Public Procurement, based on their importance in terms of financial and environmental impact, scope for improvement, example setting function, availability of criteria and political sensitivity[2]. These include the following product groups: cleaning products & services; construction; electricity; catering & food; gardening; office IT equipment; copying & graphic paper; textiles; transport and furniture. For each of these product groups, the extent to which green criteria are used in public purchasing is measured. A set of GPP criteria per product group is included in a questionnaire for data collection (see also section 1.3.2).

To facilitate the relevant data collection per product group, one (set of) product type(s) is selected to represent the overall product group. The reason for this is that most product groups cover a great variety of products. If no pre-selection is made, each respondent is expected to come up with different product types for each product group. This would make it more difficult to compare the collected data on product group level. The selection of product types per product group is based on three criteria:

- The relevance of the product type for purchasing entities
- The characteristics of the product type are representative for other products in the same product group
- The availability of relevant data for indicator 1 & 2 (green criteria) and indicator 3 & 4 (CO_2 and financial impact) for that product type

Based on these criteria, the following product types per product group were selected:

Table 1.1: Product types per product group

	Product group	Product type
1	Cleaning products & services	Cleaning services (including cleaning products)
2	Construction	New buildings & offices
3	Electricity	Electricity
4	Catering & food	Catering services (including food)
5	Gardening	Gardening services and machinery
6	Office IT equipment	Computers (desktops & laptops) and monitors
7	Paper	Copying & graphic paper
8	Textiles	Clothing
9	Transport	Passenger cars and light duty vehicles
10	Furniture	Office furniture

1.3.2 Selection of green criteria

The extent to which procurement of public institutions is defined as ‘green’ depends on the level and type of green criteria used in procurement contracts. Desk research was performed in the seven best performing Member States on existing green criteria for each product group.

2 See the Commission Communication on “Public Procurement for a better environment” of 16 July 2008 COM(2008)400

Two types of criteria were found:

- Criteria established by national authorities on green procurement for specific sectors, such as timber or energy.
- Eco-labels such as the EU eco-label (the Flower), Nordic Swan or Blue Angel, whose criteria are used to establish a certain level of sustainability in the procurement process.

The resulting overview showed different sets of criteria and labels per country and per product group, some more specific than others. For certain product groups, however, no criteria could be identified at all. In most countries no distinction was made between different levels of criteria.

Based on this conclusion it was decided to use the green criteria, divided into 'core-green' and 'comprehensive-green', that had been developed only recently for the so-called 'GPP training toolkit'[3] developed by the Commission services. These core and comprehensive green criteria are used as the framework for the definition of green in this study. However, since the criteria were not publicly available yet at the time the contracts subject of our survey were concluded, the criteria used for the purpose of the study are not strictly copy/pasted from the toolkit criteria, but broadly based on these criteria. It should also be taken into account that, as our earlier desk research showed, this distinction between core and comprehensive levels of green procurement was- at the time of this survey - not yet available in most countries. Therefore, the distinction between core and comprehensive criteria is not made in the questionnaire.

Not communicating the difference between core and comprehensive level criteria to respondents also has a methodological advantage. By presenting all criteria as belonging to the same level of green, there will be no tendency to provide socially correct answers. For the same reason the criteria questions in the questionnaire do not include the amounts or percentages used for defining a product as green. For example, instead of asking "does 50% of the supplied electricity come from renewable energy sources?", the question is formulated as follows: "does the supplied electricity come from renewable energy sources? – if yes – what is the percentage?".

Further, only a selection of the GPP training toolkit green criteria is included in the questionnaire in order to limit

Table 1.2a: Green criteria per product group

	Product group	Product	Core criteria	Comprehensive criteria
1	Cleaning products & services	Cleaning services (including cleaning products)	• Use of cleaning products without hazardous substances	• Training of employees • Use of reusable microfiber cloths and/or dry-cleaning techniques
2	Construction	New buildings & offices	• Consideration of energy-saving measures in design and usage phase of building • Water-saving technologies in kitchen and sanitary facilities • Use of materials without hazardous substances • Use of timber from legal sources	• Use of localized renewable energy sources
3	Electricity	Electricity	• 50% or higher electricity from renewable energy sources	• 100% electricity from renewable energy sources
4	Catering & food	Catering services (including food)	• Organic production of food products • Use of seasonal fruit, vegetables and fish	

3 For the GPP training toolkit please go to http://ec.europa.eu/environment/gpp/toolkit_en.htm

	Product group	Product	Core criteria	Comprehensive criteria
5	Gardening	Gardening services and machinery	• Fuel type use of gardening machines • Use of soil improvers without peat and sewage sludge	
6	Office IT equipment	Computers (desktops & laptops) and monitors	• Energy star standards • Accessibility and changeability of memory, hard disks and/or CD/DVD drives	
7	Paper	Copying & graphic paper	• Production from recovered paper fibres • Use of ECF/TCF paper • Pulp production from sustainably managed forests for paper based on virgin fibres	
8	Textiles	Clothing	• Öko-Tex Standard 100	
9	Transport	Passenger cars and light duty vehicles	• Maximum CO_2-emissions per vehicle segment • Euro 5 standard	
10	Furniture	Office furniture	• Use of wood from legally sourced timber and sustainably managed forests	

the time for filling out the questionnaire. For each product type the most relevant criteria in terms of environmental impact in general and CO_2 emissions specifically (for calculating indicator 3) were included. Table 1.2a lists the set of criteria per product group that are specifically asked for in the questionnaire for data collection. For all product groups, it is also asked whether a product or service is certified by a label or whether it meets the underlying criteria, and if so, which. In case these labels comply with the corresponding criteria in the

Table 1.2b: Labels and standards per product group

	Product group	Labels classified as core	Labels classified as comprehensive	Labels or quality standards classified as not core or comprehensive
1	Cleaning products & services	• EU Ecolabel[4] • Nordic Swan • Bra Miljoval • Blauer Engel		• Veneco • AGF • ISO 14001
2	Construction	• FSC (for criterion concerning timber) • BREEAM Standards		
3	Electricity	• Blauer Engel • Nordic Swan • Grön el • Certiq • Bra Miljoval		

4 The EU Ecolabel only applies to cleaning products and not to cleaning services. Therefore it does not include the use of microfiber cloths which is one of the criteria needed for comprehensive level.

	Product group	Labels classified as core	Labels classified as comprehensive	Labels or quality standards classified as not core or comprehensive
4	Catering & food	• "Fairtrade, ethical Tea Partnership, Organic, Marine Stewardship Council, Soil Association" • Ekologiskt • KRAV • Eco keurmerk • Austrian organic certificate (Bio-Zertifikat) pursuant to EU-Eco-regulation • Norcic Swan • Danish eco-label • Ama BioZeichen		
5	Gardening		• EU Ecolabel (concerning soil improvers)	
6	Office IT equipment	• EPEAT Gold	• EU Ecolabel • Blaue Engel • Nordic Swan • TCO 05	• Delvis ROHs • GEA Keurmerk • TÜV-GS/TÜV Ergo/ISO 13406-2
7	Paper		• EU Ecolabel • Blaue Engel • Nordic Swan	
8	Textiles	• Öko-Tex Standard 100 • KRAV • Nordic Swan	• EU Ecolabel	• ISO 14001
9	Transport			• Energy class A • ISO 14001 • Energylabel • Euro 4
10	Furniture	• FSC • Nordic Swan • Bra miljöval • Green guard • Blauwe Engel • SenterNovem		• Triple A • EQMS 2008 • ISO 14001 • WWF forest 2000 • EMAS

questionnaire, respondents might be marked 'core' or 'comprehensive' (see table 1.2b).
Moreover, respondents are asked whether the product or service complies with any other green criteria, and if so, which. Labels and standards mentioned by participants in this category 'other criteria' have been classified by sustainability level (core or comprehensive) in table 1.2b.

Some of the labels or standards mentioned by participants attribute to a core or comprehensive level, but do not comply with all necessary criteria. These labels and standards have therefore not been categorised as core or comprehensive.

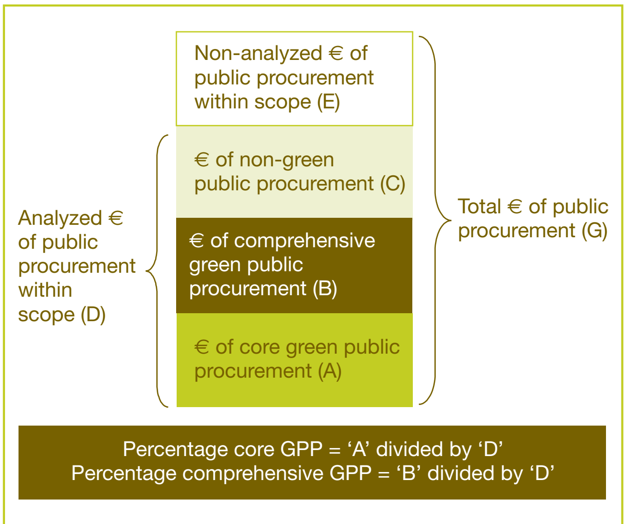
2 Indicators for the level of Green Public Procurement

In this study we develop indicators on the % GPP of total public procurement in terms of monetary value (indicator 1) and the % GPP of total public procurement in terms of actual number of contracts (indicator 2). In the following sections the definitions and methods for calculating these indicators are explained in detail.

2.1 Indicator 1: % GPP of total public procurement in terms of monetary value

Indicator 1 provides us with the percentage of the amount spent on green public procurement, compared to the total amount spent on public procurement. Apart from green and non-green, a distinction in two levels of green is made based on core and comprehensive criteria. The figure below gives a schematic illustration of indicator 1.

Figure 2.1: the % GPP of total public procurement in terms of monetary value (€),



In order to calculate indicator 1, information is required on the results of public procurement procedures, not just the intention of the contracting authority to buy green. Consequently, the study focuses on green criteria that were included in contracts (actual purchase), and not just in tender documents (intention).

This study aims to collect data on green public procurement from 2006 and 2007. The contracting authority is asked to refer to the most recent contract[5], as being representative for all purchases within that product group over the last two years. In addition, the contracting authority is asked to provide the total annual value of contracts (€) within each of the ten priority product groups. As a result, if the most recent contract is considered as 'core green' or 'comprehensive green', then 100% of the total annual value is considered 'core green' or 'comprehensive green'. The reverse holds true as well, i.e. a 'non-green' contract results in a 'non-green' total annual value.

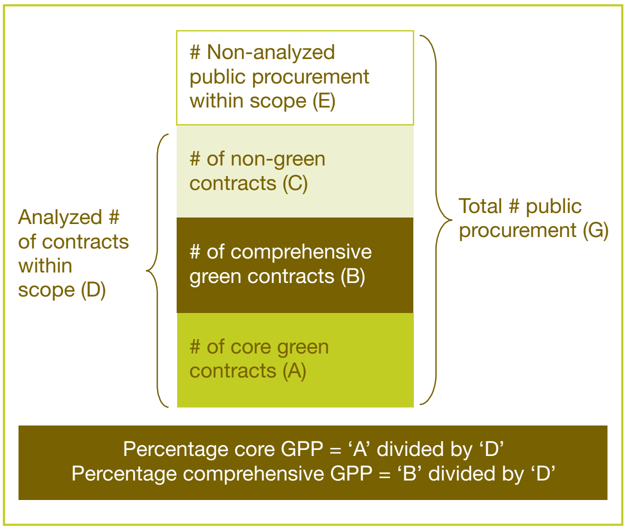
In general, the most recent contract provides us with the most up-to-date information on GPP in a governmental organisation. Individual deviations (for example, the most recent contract is 'non-green', while all earlier contracts are 'green' or the other way around) are expected to cancel each other out. Asking about the most recent contract only, reduces the work load for respondents who participate in the survey.

2.2 Indicator 2: % GPP of total public procurement in terms of # of contracts

An indication of the number of green purchases will complement the statistics on indicator 1, as purchases of higher value may not have an equally large environmental impact as purchases of lower value. To measure the number of actual green purchases we use the number of contracts, not tenders. This means that every completed questionnaire will be counted as 'contract' within the product group concerned. Depending on the criteria included, a certain contract will be indicated as 'non -green', 'core green' or 'comprehensive green'. The figure below gives a schematic illustration of indicator 2.

5 The value of this contract being above some product group specific threshold (in €).

Figure 2.2: % GPP of total public procurement in terms of the number of contracts



2.3 Generalisation of sampling results

The calculation of the levels of GPP is performed on the basis of sampling. The sample populations allow us to calculate the levels of GPP for the whole population, without having to retrieve data for all organisations in the population. The reader is referred to chapter 4 for details on how the total population is defined, the number of organisations within the sample population, and how we take into account the statistical uncertainties that come with sampling.

This section describes how the sampling results are extrapolated to the population. Starting point is a dataset that contains, for every sample respondent, the amounts of comprehensive level GPP, core level GPP and total purchase amount. Respondents deliver these amounts for the most recent purchases in several product groups. The data in table 2.1 serves as an example of what may be the result for one specific respondent. This organisation has provided us with insights of three contracts. Furthermore, the organisation has indicated how much is annually spent on procurement per product group (2nd column). From the criteria used in the questionnaire, we can deduct for every product group whether the contracts of this organisation can be classified as no GPP, core GPP or comprehensive GPP.

These results are used as an input for the generalisation of the results to the whole population.

Table 2.1: Example of amounts of comprehensive / core level purchases for one respondent

Product group	Total purchasing amount	Comprehensive level GPP	Core level GPP
Electricity	€ 200.000	-	-
Paper	€ 50.000	-	€ 50.000
Cleaning services	€ 300.000	€ 300.000	-

2.3.1 Estimating indicator 1: % GPP of total public procurement in terms of monetary value

To estimate the levels of comprehensive and core levels of GPP for the total population, a so-called ratio estimator is used per product group. The estimate of this percentage can be obtained by dividing the total amount (€) of comprehensive and core level purchases in the sample by the total amount (€) of purchases in the sample (for a product group). Using this method, automatic weighting on the basis of monetary value is applied. This means that an organisation with a higher procurement budget has a higher impact on the final percentage. An example of the calculation is shown in table 2.2 for three product groups.

Table 2.2: Calculation example for estimating indicator 1 per product group

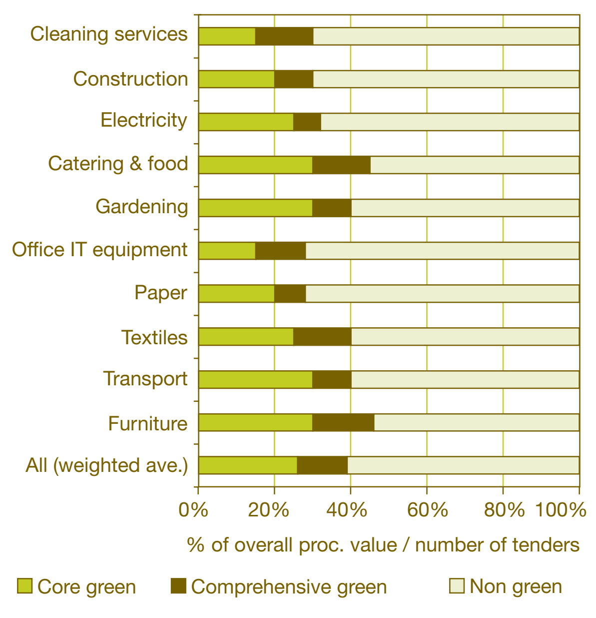
"Country X"	Total purchasing amount (x 1.000)			Indicator 1	
Product group	Total	Core	Compr.	Core	Compr.
Cleaning products & services	€ 8.000	€ 2.200	€ 900	28%	11%
Electricity	€ 11.000	€ 5.800	€ 3.000	53%	27%
Furniture	€ 14.000	€ 3.200	€ 1.050	23%	8%
Total	**€ 33.000**	**€ 11.200**	**€ 4.950**	**34%**	**15%**

The underlying assumption with respect to this estimation method is that, for each respondent, the level of GPP within the most recent contract is representative for the total contract amount in the product group (see section 2.1). A confidence interval may be derived to provide more insight in the accuracy of the estimator. The width of the confidence interval (i.e. the precision level) depends on the total population amount of public procurement (per product group). More details can be found in chapter 4.

The estimated percentages per product group can be combined into one weighted percentage of comprehensive / core level contracts covering all ten product groups. In order to do so, the weights of the different product groups are estimated from the sample product group proportions (larger product groups – in € - outweighing the smaller ones). If needed, we may apply a correction to the sample proportions to correct for any dominant effects of individual (groups of) respondents.

The figure below visualises the possible outcome of this step for a certain country (all numbers being fictitious). The overall results per country will be split up into separate percentages for central government and other governmental organisations[6]. We refer the reader to the separate results report to take note of the actual survey results.

Figure 2.3: GPP percentages per product group country X



2.3.2 Estimating indicator 2: % GPP of total public procurement in terms of the # of contracts

For every product group, an estimator for the population percentage of core level contracts can be obtained by dividing the total number of core level contracts in the sample by the total number of contracts in the sample. The estimated comprehensive level percentages may be obtained analogously. An example of this calculation is provided in table 2.3.

Table 2.3: Calculation example for estimating indicator 2 per product group

"Country X"	Number of respondents			Indicator 2	
Product group	Total	Core	Compr.	Core	Compr.
Cleaning products & services	100	25	13	25%	13%
Electricity	110	43	25	39%	23%
Furniture	70	18	7	26%	10%
Total	**280**	**86**	**45**	**31%**	**16%**

The underlying assumption, with respect to this estimation method is again that the most recent contract is representative for all of the contracts by the respondent. Moreover, it is assumed that the probability of a contract being core or comprehensive level GPP is independent of the purchase amount. More specifically, every contract will have the same impact on the estimator, regardless of the size of the purchase amount. Again, a confidence interval may be derived to give more insight in the accuracy of the estimator.

Just as for indicator 1, the estimated percentages per product group can be combined into one weighted percentage for all ten product groups. In order to do so, the weights of the different product groups are estimated from the sample product group proportions. If needed, we may apply a correction to the sample proportions to correct for any dominant effects of individual (groups of) respondents. For example, if the proportion of central governmental organisations in the sample population is much higher or lower than in the actual population, the overall figure will need to be corrected for a certain country. This step will result in a similar figure like the one in paragraph 2.3.1.

6 If, despite all measures taken, the actual response rates fall short of expectations, the figures are presented on a higher level of aggregation (for example one percentage per country, without splitting up into central and non-central government, or splitting up into a couple of product groups only).

3 Indicators for the CO_2 and financial impact

In the previous chapter, we have described the calculation of the % of GPP in terms of monetary value (indicator 1) and in terms of the actual number of contracts (indicator 2). In this chapter, we describe the methodologies for the calculation of indicators focussing on the net CO_2 and financial impacts delivered by GPP. The resulting information will primarily be used for communication purposes by the Commission.

3.1 Indicator 3: CO_2 impact of GPP

3.1.1 Focus on CO_2 emissions

Public awareness on the impact of human behaviour on climate change has grown worldwide over the last few years. Numerous studies have illustrated that radiative forcing by greenhouse gases[7] is the primary cause of earth's global warming. When linked to the impact of human behavior, CO_2 can be considered as being the most important greenhouse gas. It is estimated that 60% of the human impact on the earth's climate is determined by CO_2 emissions[8]. Other greenhouse gases that influence the earth's temperature are methane (CH4), troposperic ozone (O3), nitrous oxides (N2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF6).[9] They also contribute to the human impact on the climate, however to a lower extent than CO_2.

In this study we will give an indication of the differences in CO_2 emissions between a green and non-green product. CO_2 emissions from human activity are mainly a result of the burning of fossil fuels or vegetable manner. Furthermore, deforestation due to human activity leads to less removal of CO_2 from the atmosphere by trees and other plants. The CO_2 emissions of a product can best be measured through its energy requirements during its production and/or or use phase.

As indicated in paragraph 1.3.2, in this study the core and comprehensive green criteria from the GPP training toolkit are used as the framework for the definition of green. In order to assess the CO_2 impact of the green vs. the non green product, it has been necessary to identify those toolkit criteria which are most relevant in terms of CO_2 emissions (see table 3.2 for an overview of selected indicators for the CO_2 impact of GPP per product group).

3.1.2 Limitations of calculating the CO_2 impact of GPP

Obviously the focus on the CO_2 impact has its limitations. In this paragraph we will list three main limitations that have to be taken into account when interpreting the outcome of indicator 3.

1. Climate change is only one of various environmental impacts

There are various environmental aspects that need to be taken into account in order to assess the environmental impact of products. The table below shortlists various environmental themes and their impact on nature.

Table 3.1: Environmental impacts of products[10]

Environmental theme	Impact on nature
Climate change (enhanced greenhouse effect)	The global rise in temperatures caused by greenhouse gases influences the spread of plants and animals (including humans). Major consequences can be expected as a result of, in particular, the rising sea levels.
Eutrophication and acidification	The substances that cause eutrophication are nitrogen and phosphate originating from manure and fertilisers. These substances make the environment more nutrient-rich and more acid. The increase in nutrient levels and acidity has a major impact on nature[11]
Spread of environmentally-hazardous substances	Hazardous substances such as pesticides, heavy metals, PCBs, dioxins and fuel oil, can be harmful for plants and animals (including humans).

7 Greenhouse gases are gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of thermal infrared radiation emitted by the Earth's surface, the atmosphere itself, and by clouds (Wikipedia)

8 http://www.milieuennatuurcompendium.nl/indicatoren/nl0163-Werking-van-het-broeikaseffect.html?i=9-53.

9 IPCC, febr 2007

10 Source: CBS/EDC/July04/0329

11 Eutrophication is a slow aging process during which a bay, estuary, lake, river, stream, or other shallow body of water deteriorates into a bog or marsh, and eventually 'dies'. Acidification is the process whereby air pollution – mainly ammonia, sulphur dioxide and nitrogen oxides – is converted into acid substances.

Environmental theme	Impact on nature
Desiccation (extreme dryness)	Water extraction can lead to a decline of species if it causes a sharp reduction of water sources that plants and animals (including humans) depend upon.
Fragmentation (depletion of natural sources)	One of the threats to the survival of plants and animals is the fragmentation of the suitable biotope. Fragmentation can have a considerable impact on species that depend on large uninterrupted areas and species with limited migration options.

It is far beyond the scope of this study to calculate the overall environmental impact of GPP and address all impacts listed above. The necessary data for such a calculation would require a separate long-term and in-depth study. There is a need however to communicate on the impact of GPP in environmental terms. It was therefore decided to narrow down the focus and calculate the impact of GPP on climate change in terms of carbon dioxide (CO_2) emissions.

By focussing only on the CO_2 emissions of a particular product, other production or consumption effects which can have an even greater impact on the environment stay out of the picture. This can give an imbalanced perception of the actual environmental impact of purchasing a certain green or non-green product. For most products the difference between a green and non-green is not only determined by CO_2 emissions. There are also products for which the green and non-green version doesn't differ in terms of CO_2 emissions. Other determining effects could for example be soil and water pollution, bioaccumulation and effects on aquatic organisms due to hazardous substances in a product. In order to put the calculations of indicator 3 into perspective, we will include information of the other (most relevant) determining environmental effects and impacts for each product group (see Appendix D).

2. CO_2 equivalents are not included

As indicated before, there are several greenhouse gases that contribute to global warming. Methane (CH_4) and tropospheric ozone (O3) emissions are two examples. The contribution to global warming of non-CO_2 greenhouse gases is often measured by using the carbon dioxide equivalent (CO_2 equivalent). The CO_2 equivalent for a gas is derived from multiplying the tonnes of the gas by the associated global warming potential (GWP). The GWP is a relative indicator that estimates the warming influence of the gas compared to same mass of carbon dioxide (of which the GWP is by definition equal to 1). Taking into account the scope of this study, CO_2 equivalents are not included in the calculation for indicator 3.

3. The study does not take into account a full Life Cycle Analysis

An effective way of exploring the CO_2 impact of products and services, both manufactured and consumed, is by using a Life Cycle Analysis (LCA). A LCA addresses the CO_2 impacts throughout a product's life cycle. The several phases of a product life cycle are[12]:

1. Raw material acquisition
2. Production
3. Usage
4. End-of-life treatment
5. Recycling
6. Final disposal

It is beyond the scope of this part of the study to perform a full Life Cycle Analysis for each of the ten product groups in order to determine the most relevant phase in the life cycle of a product in terms of its CO_2 emissions. However, the various life cycle phases of a product have been taken into account when selecting the most relevant criteria (in terms of CO_2 impact) for each product group. If for one product type more than one criterion in the GPP training toolkit relates to CO_2 emissions, the criterion related to a product's life cycle phase that has most impact on CO_2 emissions has been selected, where sufficient data were available (in some cases however, the criteria used for this part of the study might not be related to the product's life cycle phase with most CO_2 impact, because of a lack of data on CO_2 impact of the different life cycle phases). A more detailed argumentation for the selected criteria can be found in Appendix D. The majority of the selected criteria for this study relate to the usage phase (phase number 3 in a product life cycle) of the product.

12 ISO 14040:2006(E) Environmental management - Life cycle assessment - Principles and framework (ISO 14040:2006, IDT)

3.1.3 CO_2 impact calculation – the methodology used for this study

Taking into account the focus on climate change/ CO_2 emissions and (wherever possible) the most relevant life cycle phase of a product, the following steps are taken to calculate the CO_2 impact of Green Public Procurement:

1. **Selection of one or more green criteria per product (group) which have relevant CO_2 impact**
   The GPP training toolkit[13] gives an overview of green criteria per product (group). Based on available data, market knowledge and internal expertise on CO_2 emissions[14], those green criteria which have most relevant CO_2 impact have been selected.

   For all product groups except electricity, construction and cleaning services, the GPP training toolkit does not make a relevant distinction between core and comprehensive levels of GPP for this part of the study, because the distinguishing toolkit criteria (the criteria that distinguish between core and comprehensive) are not related to the emission of CO_2. In these cases, only a distinction between 'green' and 'non-green' products is made. For more details, we refer the reader to appendix D.

2. **Integration of the selected criteria into the questionnaire**
   The selected criteria have been integrated in the questionnaire, to make sure that we receive relevant data on these criteria from the respondents. For this, it is important that the questions are formulated in a sufficiently detailed or specific way so that all relevant data is received on energy saving measures.

3. **Selection of a representative green and non-green product which meets this (these) criterion (criteria)**

4. **Determination of the ratio of CO_2 emissions of green and non-green products per country**
   CO_2 emissions of a green and a non-green product are estimated and the ratio of the two is calculated. For this step we have used available data, in particular from the Ecoinvent database[15]. The following steps have been carried out[16]:
   a Selection of a functional unit for every product group (e.g. number of computers or m^2 floor cleaned);
   b Determination of CO_2 emissions per functional unit, both for the green and a non-green product within each product group;
   c For those product groups of which the calculation of the CO_2 emissions is partly based on energy use[17], we make use of country-specific CO_2 emissions per kWh for all countries under scope. The reader should note that the estimated CO_2 emission of green and non-green products is merely indicative. A more accurate calculation would involve a quantification of CO_2 emissions for each criterion, in all phases of the product's life cycle. This quantification is not within the scope of this study (see also under 3.1.2).

5. **Calculation of the CO_2 impact of GPP of a product (group) per country**
   We have chosen to express the CO_2 impact in terms of a difference in percentage as compared to the situation in which no green criteria are applied. To this end, we use relative numbers (based on the ratios between green and non-green procurement by the sample organizations) instead of absolute numbers for the calculation of indicator 3. The calculation of the CO_2 impact of GPP will be explained in more detail in the next section, by means of an example.

13 http://ec.europa.eu/environment/gpp/toolkit_en.htm

14 In particular the expertise of Ecofys / Professor K. Blok, director of Ecofys is used. Professor Blok is an expert on energy analyses. Among others, he is author of Introduction to Energy analysis. 2007. See also: http://www.technepress.nl/publications.php?id=17

15 Ecoinvent is related to the Life Cycle Assessment tool SimaPro, developed by available from PRé Consultants in Amersfoort, Netherlands http://www.pre.nl/ecoinvent/

16 The exact data necessary to calculate the ratios will be included in the final report for this study.

17 These product groups are: construction (electricity use of a building), electricity, office IT equipment (electricity use of a computer or monitor, paper (electricity use during pulping process).

3.1.4 Example: calculation of CO_2 impact of GPP for office IT equipment

For the product group 'Office IT equipment', for which we have chosen to focus on computer, laptops and monitors, a schematic representation of the calculation flow is shown in figure 3.1. The basic idea behind the calculation is that the results per functional unit are linked to the results of indicator 1 of 2006/2007, in order to determine the CO_2 impact of GPP in 2006/2007. Please note that the numbers used in this figure are fictitious. On the left side of the flow diagram, we have listed the input parameters for the calculation.

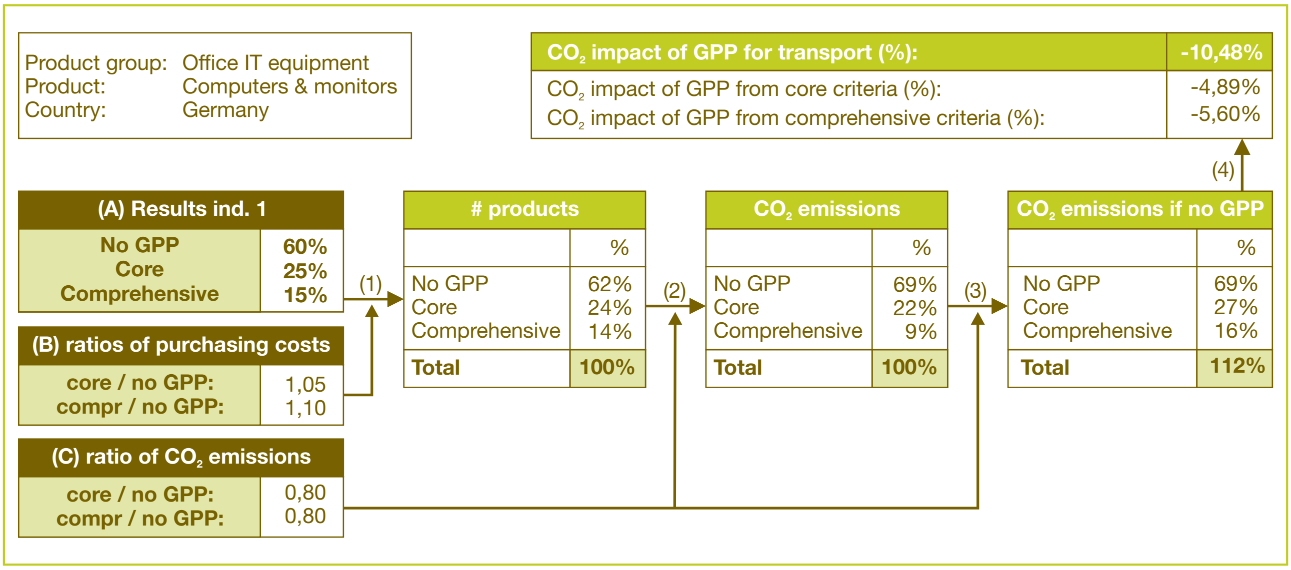
The input parameters are:

A. **The results of indicator 1.** This indicator includes the % of green levels of GPP and the % of non-green GPP within a product group for a given country. In this example, the corresponding levels are 60% non-green purchases, 25% core green purchases and 15% comprehensive purchases of the purchased computers in Germany.

B. **Ratio of purchase prices.** The ratio of the purchase price of a computer with a green level of GPP as opposed to the purchase price of a computer with no level of GPP is determined. The reader is referred to section for further details on the calculation of this ratio. In the example, a core green computer is 1,05 times as expensive as a non-green computer, and a comprehensive green computer is 1,10 times as expensive.

C. **Ratio of CO_2 emissions.** The ratio of CO_2 emissions of a computer with a green level of GPP as opposed to the CO_2 emissions of a computer with no level of GPP is estimated. This estimate is based on the CO_2 criteria that are set for indicator 3. In the example, a computer with a core green level of GPP has 0,80 of the CO_2 emissions of a computer with no level of GPP. A computer with a comprehensive green level of GPP has 0,60 of the CO_2 emissions of a computer with no level of GPP Details on how these ratios are calculated are described in Appendix D.

Figure 3.1: Example calculation of CO_2 impact of GPP. A description of the various steps in the calculation can be found in section 3.1.4. Please note that these numbers are fictitious.



The indicated steps 1 to 4 in the figure are described in more detail below. Following the diagram from left to right, the calculation steps are:

1. **Determining the relative number of purchased computers for the various levels of GPP.** For this, we use the results of input parameters A (indicator 1) and the ratio of the purchase prices of a green and non-green computer (input B). Since in this example, a green computer is more expensive than a non-green computer, the percentages of green products are lower than the percentages of green expenditure. The result is the relative share of the number of purchased 'green' and 'non-green' computer.
   The example calculation might clarify this step even further: say, an organisation has procured 100 computers for € 100. In our example, 60% of the money spent on those 100 computers is spent on non-green purchases. If we want to calculate the percentage of actual non-green computers out of the 100, we have to take into account that a non-green computer is more expensive than a green computer. Hence, the percentage of non-green computers is not 60% but a bit more, i.e. 62% (with a lower purchase price one can purchase more computers from the same budget).

2. **Determining the relative CO_2 emissions of the purchased computers for the various levels of GPP.** For this, we use the estimated ratio of CO_2 emissions (input C) and the outcome of step 1 (relative number of purchased 'green' and 'non-green' computers). This results in the relative share of the CO_2 emissions of non-green (69%) core green (22%) and comprehensive green computers (9%) purchased by public institutions.
   Again, the example calculation might give further clarification: say, an organisation has procured 100 computers and these 100 computers emit 100 kg of CO_2. In our example, 62% of those 100 computers are non-green purchases, as determined in the previous step. If we want to calculate the percentage of CO_2 emissions from non-green computers, we have to take into account that a non-green computer emits more CO_2 than a green computer. As a result, the percentage of CO_2 emissions from non-green computers is not 62% but a bit more, i.e. 69%.

3. **Determining the relative CO_2 emissions of the purchased computers if all purchases would have been non-green.** For this, again we use the estimated ratio of CO_2 emissions (input C). The result of this calculation is the relative level of CO_2 emissions of non-green purchases compared to composition of purchases (green and non-green). It must be noted that the result of this calculation is purely a hypothetical case. In the previous step, we found that the non-green computers emit 69% of the CO_2, core green computers emit 22% of the CO_2 and comprehensive green computers emit 9% of the CO_2. Now, if all of the purchased computers would be non-green, then the computers which were core and comprehensive green before now emit more CO_2, namely 27 kg and 16 kg respectively. The total CO_2 emissions are increased from 100 kg to 112 kg. This is our reference case that we can use to relate the CO_2 impact of GPP with.

4. **Determining the CO_2 impact of GPP for this product.** The final step in our calculations is to determine the CO_2 impact of GPP. For this, we divide the total value of the relative CO_2 emissions of green and non- green products (step 2), by total values of CO_2 emissions if all products would have been non-green (step 3). In our example: (100% / 112%) -1 = -10%.This means that the application of GPP criteria by public purchasers has led to a decrease of CO_2 emissions by 10% for this product group. The division is performed in order to calculate the factor how much less CO_2 is emitted because of GPP. A value of one is subtracted in order to arrive at the actual CO_2 impact of GPP in percentages. Also the CO_2 impact from the two levels of GPP (core and comprehensive) can be calculated. These are shown below the overall impact.

3.1.5 Estimation of CO_2 emissions per product group

A similar calculation as above can be performed for all product groups. In table 3.2 we give, per product group, an overview of the related LCA phase, the relevant CO_2 criteria we use for indicator 3 to make a distinction between a green and a non-green product, the functional unit that we use for the calculation (input C in our example), the actual CO_2 ratios for core and comprehensive levels and finally the factor that allows us to express indicator 1 in terms of the functional unit (input B in our example). **It should be noted that the CO_2**

ratios for electricity, construction and paper are country-specific. The figures presented in the table below are averages of the seven countries under scope.

As mentioned before, the CO_2 ratio is defined as the ratio of CO_2 emissions of green product as compared to the CO_2 emissions of a non-green product. A CO_2 ratio of 0,31 for construction can be interpreted as follows: it means that a green building emits 1-0,31 = 69% less CO_2 than a non-green building. Thus, its CO_2 impact is -69% per building. Furthermore, a CO_2 ratio of zero implies that 100% CO_2 per functional unit can be saved. It is a result from the fact that a green product has zero CO_2 emissions. A CO_2 ratio of 1 means that GPP has no impact in terms of CO_2 (i.e. the CO_2 impact per functional unit is 0%). In this case, the CO_2 emissions of a green product and a non-green product are equal.

Figure 3.2 shows the CO_2 impacts per functional unit for core and comprehensive levels. The reader is referred to Appendix D for details on the selection of green criteria for CO_2 emissions and the calculation of the CO_2 emissions of green and non-green products. **No results are shown for furniture, since no reliable CO_2 data was found concerning the criteria that were included in the questionnaire (i.e. criteria concerning the use of wood)**.

Figure 3.2: Average CO_2 impact of GPP per functional unit. Negative numbers imply CO_2 reductions

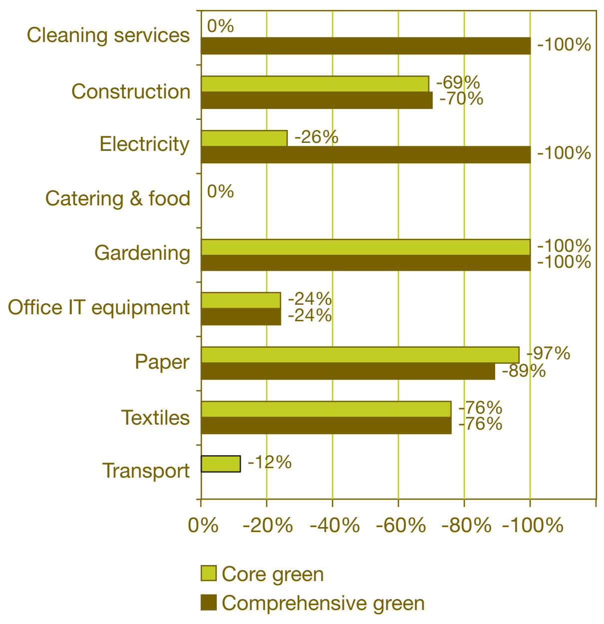


Table 3.2 Overview of indicators for the CO_2 impact of GPP per product group

	LCA relevant phase	Most relevant CO_2 criterium/criteria	CO_2 / functional unit	CO_2 ratios		from indicator 1 or 2 to functional unit
				core / no GPP	compr / no GPP	
1. Cleaning products and services - *cleaning services*	usage	**compr** use of microfibre cloth	kg CO_2 / m^2 floor cleaning	1,00	0,00	euro / m^2 floor cleaning
2. Construction - *new buildings & offices*	usage	**core** energy efficiency of a building **compr** presence of localised renewable energy sources (L-RES) in buildings	kg CO_2 / building	0,31	0,30	euro / building
3. Electricity - *electricity*	production	**core** 50 % use of RES-E **compr** 100% use of RES-E	kg CO_2 / kWh	0,74	0,00	euro / kWh
4. Catering and food - *catering services*	raw material acquisition	organic production of food	kg CO_2 / lunch prepared	1,00	-	euro / lunch prepared
5. Gardening - *gardening services and machinery*	usage	use of peat	kg CO_2 / m^2 gardening services	0,00	0,00	euro / m^2 gardening services

	LCA relevant phase	Most relevant CO_2 criterium/criteria	CO_2 / functional unit	CO_2 ratios		from indicator 1 or 2 to functional unit
				core / no GPP	compr / no GPP	
6. Office IT equipment - *computers (desktops & laptops) and monitors*	usage	energy star standards	kg CO_2 / computer	0,76	0,76	euro / computer
7. Paper - *copying & graphic paper*	raw material acquisition and production	**paper from recovered paper fibres** paper from 100% recycled fibres **paper from virgin fibres** fibres from sustainably managed forests	kg CO_2 / kg paper	0,04	0,11	euro / kg paper
8. Textiles - *clothing*	raw material acquisition	use of organic cotton	kg CO_2 / kg textile produced	0,24	0,24	euro / kg textile produced
9. Transport - *passenger cars & light duty vehicles*	usage	CO_2 emissions of a vehicle	kg CO_2 / vehicle	0,88	-	euro / vehicle

3.2 Indicator 4: Financial impact of GPP

3.2.1 Life Cycle Cost approach, cost structures and cost ratios

In order to measure GPP in terms of its financial impact, we compare the user costs of a green product to those of a non-green product using the criteria from the GPP training toolkit. To this end, we make use of the concept of Life Cycle Cost (LCC)[18], insofar as relevant data is available. In an LCC analysis, various cost elements in the user life cycle of a product are taken into account. This means that not only purchase prices are analysed, but also other cost elements for the user, depending on the nature of the product or product group. For example, these can be costs for energy use of the product, installation costs or maintenance costs. The LCC elements can be grouped into three main categories:

1. purchasing and installation costs
2. operating costs
3. disposal costs

It must be stressed that an LCC analysis is fundamentally different from a Life Cycle Analysis (LCA), which has been described in the previous section. Apart from the fact that an LCC deals with costs and an LCA deals with environmental impacts (in our case only CO_2 impact), the viewpoint of the analysis is also different. In an LCA, the viewpoint is the product itself. In an LCC, however, the viewpoint of the analysis is the viewpoint of the user of a product. Hence, we only take into account those costs that can directly be attributed to the user of a product.

A common perception of green products is that they are generally more expensive than non-green products and therefore have an economic disadvantage. However, when Life Cycle Costs are taken into account, a green product may be cheaper than a non-green product due to decreased costs in other stages of the life cycle. For example, energy-efficient computers have lower operating costs (through decreased energy use), which can compensate for (sometimes) higher purchase prices.

In this study, we only focus on those life cycle elements that are most relevant to the user of a product. In the table below, these elements are listed for all product groups covered by the study. The relevance of an element is determined in two ways: either it comes from a non-negligible difference in costs between green and

18 For a more detailed description of LCC, see for example: Costs and Benefits of Green Public Procurement in Europe. Part 1: Comparison of the Life Cycle Costs of Green and Non Green Products. Öko-Institut e.V. and ICLEI, July 2007.

non-green products, or an element is important because it accounts for a substantial part of the user's total costs. As mentioned before, we calculate the financial impact of GPP by comparing the price of a green product with that of a non-green product, in all stages of the user life cycle. For every relevant cost element, we determine these so-called cost ratios (the ratio of green and non-green prices), both for core green and comprehensive green levels of GPP. This means that, for example in the case of computers, we calculate how much more expensive a green computer might be, while at the same time taking into account the lower prices in energy cost of a green computer.

However, it must be noted that the relevant elements do not account for the same percentage of the total cost for the user of a product. For example, the purchase price of a computer may be 5 times as high as the total costs from energy use during its 4-year life time. Therefore, we need to calculate the so-called cost structures for every product group, in which we determine the percentages that every element contributes to the total costs (see table 3.3).

3.2.2 Calculation of cost ratios

One of the important input parameters for the calculation of the financial impact of GPP is the calculation of cost ratios (i.e. the ratio of costs of a green product to the costs of a non-green product). For every relevant element of the cost structure, the ratio is calculated for the core level of GPP and, if applicable, the comprehensive level of GPP. Naturally, there may be elements in the cost structure (e.g. labour costs) where the use of green criteria has a negligible financial impact. The cost ratios of those cost elements for which no green criteria are applicable are equal to one.

In this study, the cost ratios are not country-specific. All calculations involving cost ratios are performed with percentages or ratios, which allow us to ignore country-specific correction factors such as VAT and average wages. The underlying assumption is that country specific factors are the same for green and non-green products. For example, in the Netherlands, standard VAT rate on products is 19%, regardless of the product being green or non-green[19]. When applying a

Table 3.3: Relevant elements of Life Cycle Cost per and macproduct group

	LCC relevant costs
1. Cleaning products and services - *cleaning services*	Labour costs
	Cleaning products
	Other costs
2. Construction - *new buildings & offices*	Investment cost
	Costs for heating
	Costs for electricity use
	Costs for water use
	Maintenance costs
	Disposal costs
3. Electricity - *electricity*	Purchase price
4. Catering and food - *catering services*	Labour costs
	Procurement of food
	Other costs (e.g. kitchen equipment)
	Management fee
5. Gardening - *gardening services and machinery*	Labour costs
	Transport costs
	Machinery costs
	Other material costs
	Procured matter (soil improvers)
	Other procured matter
6. Office IT equipment - *computers (desktops & laptops) and monitors*	Purchase price
	Electricity use
	Maintenance costs
7. Paper - *copying & graphic paper*	Purchase price
8. Textiles - *clothing*	Purchase price
9. Transport - *passenger cars & light duty vehicles*	Purchase price
	Road tax
	Fuel costs
	Maintenance costs
10. Furniture - *office furniture*	Purchase price

19 Although there has recently been some political debate that VAT on green products could be decreased (see e.g. http://www.guardian.co.uk/politics/2008/mar/13/greenpolitics.eu), EU countries currently have to abide by Council Directive 2006/112/EC (http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32006L0112:NL:NOT), which states that countries cannot cut rates unilaterally. For an overview of VAT rates in the EU, see e.g. www.globalvatonline.com

correction factor to the ratio in order to make the ratio country-specific, the factor is applied to both the nominator and the denominator of the ratio. As a result, the ratio remains the same.

In conclusion, the ratio of prices of a green product and a non-green product is assumed to be the same in all countries. The only exceptions to this approach are the product groups electricity and transport for which we do calculate the country-specific costs, because of the very country-specific differences that exist as a result of diverging electricity prices and road taxes.

In table 3.4, we provide an overview of the cost ratios between green and non-green products for all product groups. It is clear that the cost ratio of those cost elements for which no green criteria are applicable (e.g. labour costs) is equal to one. The details behind the calculation of these ratios are provided in Appendix E. **No results are shown for furniture, since no reliable financial data was found concerning the criteria that were included in the questionnaire (i.e. criteria concerning the use of wood).**

Table 3.4: Cost ratios between green and non-green products in the relevant element of the user life cycle. A cost ratio smaller than one implies cost reductions and a cost ratio larger than one implies costs increases. For the weighted average impact, negative numbers imply costs reductions and positive numbers imply costs increases.

	LCC relevant costs	cost ratios	
		core / no GPP	compr / no GPP
1. Cleaning products and services - *cleaning services*	Labour costs	1,00	0,90
	Cleaning products	1,39	1,15
	Other costs	1,00	1,00
	weighted average impact	1%	-9,0%
2. Construction - *new buildings & offices*	Investment cost	1,02	1,02
	Costs for heating	0,38	0,38
	Costs for electricity use	0,25	0,23
	Costs for water use	0,70	0,70
	Maintenance costs	1,00	1,00
	Disposal costs	1,00	1,00
	weighted average impact	-10%	-10%
3. Electricity - *electricity*	Purchase price	1,01	1,03
4. Catering and food - *catering services*	Labour costs	1,00	-
	Procurement of food	1,04	-
	Other costs (e.g. kitchen equipment)	1,00	-
	Management fee	1,00	-
	weighted average impact	2%	-
5. Gardening - *gardening services and machinery*	Labour costs	1,00	1,00
	Transport costs	1,00	1,00
	Machinery costs	1,40	1,40
	Other material costs	1,00	1,00
	Procured matter (soil improvers)	1,00	0,90
	Other procured matter	1,00	1,00
	weighted average impact	2%	2%

	LCC relevant costs	cost ratios	
		core / no GPP	compr / no GPP
6. Office IT equipment - *computers (desktops & laptops) and monitors*	Purchase price	1,02	1,02
	Electricity use	0,85	0,85
	Maintenance costs	1,00	1,00
	weighted average impact	1%	1%
7. Paper - *copying & graphic paper*	Purchase price	1,15	1,19
8. Textiles - *clothing*	Purchase price	1,08	1,08
9. Transport - *passenger cars & light duty vehicles*	Purchase price	1,00	-
	Road tax	0,88	-
	Fuel costs	0,88	-
	Maintenance costs	1,00	-
	weighted average impact	-3%	-
10. Furniture - *office furniture*	Purchase price	-	-

Sources: See Appendix E

As mentioned before, the cost ratio is defined as the ratio of costs of a green product as compared to the costs of a non-green product. **A cost ratio of 0,38 for the cost of heating for construction can be interpreted as follows: it means that a green building has 1 - 0,38 = 62% lower costs for heating than a non-green building.** Thus its financial impact is -62% per building. On the other hand, a cost ratio of 1,15 for comprehensive green cleaning products/services (i.e. implying the use of microfiber cloths) means that these products/services are 15% more expensive than non-green cleaning products. Thus the financial impact is +15%.

3.2.3 Calculation of cost structures

In order to calculate the total financial impact of GPP, the cost ratios of all relevant elements as determined in the previous section need to be weighted on the basis of the overall cost structure of the relevant product group, meaning that one needs to take into account the weighting of each cost element in the total costs for the user of a product. For this reason, we calculate the cost structure of a non-green product. Also, those cost elements for which the cost ratio has been determined to be equal to one (meaning no difference in costs between green and non-green), are included in the weighting.

The reason that we calculate the cost structure for a non-green product is because we calculate the financial impact of GPP compared to a baseline. In our case, this baseline is a non-green product. Hence the cost structure also needs to be calculated for a non-green product. However, with the use of the cost ratios, we can also calculate the cost structures of core and comprehensive green products, as will be shown in the next section.

As a result of country-specific correction factors such as wages and fuel prices, the cost structure differs from country to country. For the calculation of a country-specific cost structure, we make use of a baseline country, for which a cost structure has been determined. Then, applying the correction factors for the various cost elements on the cost structure of the baseline country, we can determine the cost structure of a second country. In table 3.5, we show which correction factor is applied to which element of the cost structure. This table also lists the cost structures for all product groups, averaged for the seven countries under scope. Details on the calculation of all cost structures can be found in Appendix E. The actual country-specific correction factors can be found in the final section of this Appendix.

We have performed a reliability check of this approach on the cost structures of computers and laptops in Sweden. For details we refer to section E.6.1, where we calculate the Swedish costs structure using the above mentioned approach and compare these with the Swedish costs structure as determined by a market analysis. The consistency of the data gives us confidence that our approach provides us with reliable data.

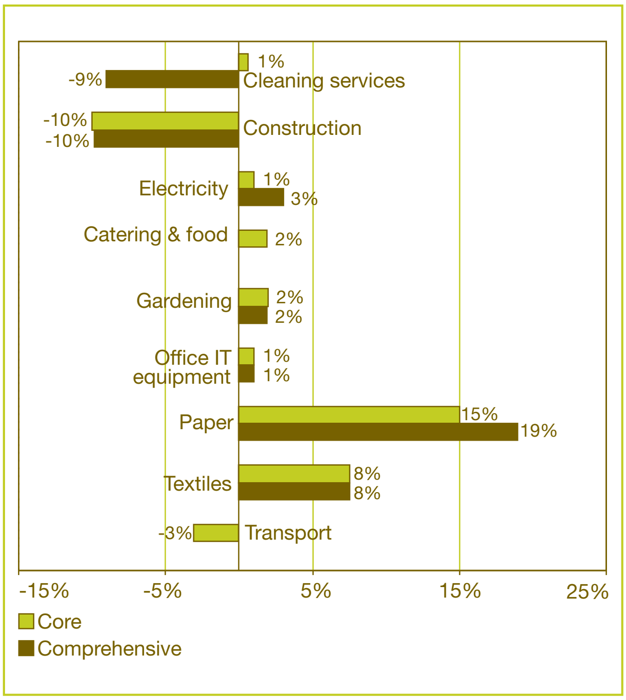
Table 3.5: LCC cost structures for the product groups

	LCC relevant costs	Correction factor	average
1. Cleaning products and services - *cleaning services*	Labour costs	labour cost index	92%
	Cleaning products	price levels (other)	2%
	Other costs	price levels (other)	6%
2. Construction - *new buildings & offices*	Investment cost	price levels (construction)	60,9%
	Costs for heating	euro/m^3 gas	5,4%
	Costs for electricity use	euro/kWh	8,6%
	Costs for water use	price levels (other)	0,8%
	Maintenance costs	0,5 labour cost index; 0,5 price levels (other)	19,9%
	Disposal costs	0,5 labour cost index; 0,5 price levels (other)	4,4%
3. Electricity - *electricity*	Purchase price	country specific	n/a
4. Catering and food - *catering services*	Labour costs	labour cost index	44,1%
	Procurement of food	price levels (food)	46,1%
	Other costs (e.g. kitchen equipment)	price levels (other)	5,9%
	Management fee	price levels (other)	3,9%
5. Gardening - *gardening services and machinery*	Labour costs	labour cost index	69,4%
	Transport costs	0,5 euro/litre diesel, 0,5 price levels (transport)	4,8%
	Machinery costs	price levels (machinery)	5,0%
	Other materials costs	price levels (other)	9,8%
	Procured matter (mainly soil improvers)	price levels (other)	1,5%
	Other procured matter	price levels (other)	9,4%
6. Office IT equipment - *computers (desktops & laptops) and monitors*	Purchase price	price levels (other)	85,2%
	Electricity use	euro/kWh	4,5%
	Maintenance costs	labour cost index	10,3%
7. Paper - *copying & graphic paper*	Purchase price	n/a	100,0%
8. Textiles - *clothing*	Purchase price	n/a	100,0%
9. Transport - *passenger cars & light duty vehicles*	Purchase price	price levels (transport)	65,3%
	Road tax	road tax	6,8%
	Fuel costs	euro/litre diesel	18,8%
	Maintenance costs	0,3 labour cost index; 0,7 price levels (other)	9,1%
10. Furniture - *office furniture*	Purchase price	n/a	100,0%

3.2.4 Financial impact of GPP per functional unit

In table 3.4, the various cost ratios have been weighted with the use of the cost structure, leading to the financial impact per functional unit (e.g. per vehicle or per m^2 cleaned office space). **The figures imply that, for example in the case of vehicles, the application of core green criteria in procurement leads to a decrease of 3% per vehicle in the total user's cost.** In the graph below, we show all average financial impacts per functional unit, both for core levels of GPP and for comprehensive levels. **No results are shown for furniture, since no reliable financial data was found concerning the criteria that were included in the questionnaire (i.e. criteria concerning the use of wood).**

Figure 3.3: Average financial impact of GPP per functional unit. Negative numbers imply cost reductions and positive numbers imply costs increases.



3.2.5 Financial impact of GPP in 2006/2007

The financial impact of GPP per functional unit gives insight into how the use of green criteria leads to lower or higher costs for purchasers. However, for the purposes of this study, we are also interested in how the actual application of green criteria in tenders and contracts has a certain financial impact, based on the levels of GPP.

For this calculation, we need the figures of indicator 1, which indicates per product group the distribution of public expenditure on core green purchases, comprehensive green purchases and non-green purchases (see also Chapter 2). The calculation is illustrated by means of an example.

3.2.6 Example: financial impact of GPP for computers

For the product group office IT equipment (product computers and monitors), a schematic representation of the calculation is shown for Germany in figure 3.4. As can be seen from table 3.5, there are three relevant cost elements in the user life cycle of a computer or monitor, i.e. purchase prices, electricity costs and maintenance costs.

The input parameters into the calculation are (indicated as light blue):

A. **The cost structure of a non-green product.** This cost structure corresponds to the relevant LCC cost elements of table 3.5. In our example the cost structure is built up from purchase prices, energy use costs and maintenance costs. The numbers are used to relate the different cost elements to each other. In our example, the percentages of purchase costs, cost for energy use and maintenance costs to the total cost for the user of a computer are 85%, 6% and 10% respectively.

B. **Cost ratios.** For all elements of the life cycle and for the core and comprehensive levels of GPP, cost ratios are calculated as described in section and Appendix E. In short, the cost ratio of a certain level for a certain element relates to price ratios between green and non-green products. Logically, the cost ratios of "no GPP" are equal to one. In our example, cost ratios for maintenance are equal to one. Both a core and a comprehensive green computer are 2% more expensive than a non-green computer and use 15% less energy.

C. **The results of indicator 1.** This indicator includes the percentage of core levels of GPP, the percentage of comprehensive levels of GPP and % of non-GPP. The distinction between these levels of GPP is based on the selected criteria from the GPP training toolkit (see Chapter 1). In our example, the levels of no-GPP, core GPP and comprehensive GPP are 5%, 77% and 18% respectively.

Having described the input parameters for the calculation, we now describe the various steps of the calculation itself. Following the diagram from (1) to (4), the calculation steps are:

1) **Determining the cost structures of green products.** We calculate these cost structures both for products complying with core green and comprehensive green criteria. These cost structures are based on the cost structure of a green product (input A) and on the cost ratios (input B). In our example, more expensive green computers lead to higher percentages for purchase prices compared to total costs (85% for a non-green computer compared to 86% for a green computer). On the other hand, less energy consumption leads to lower percentages for costs for energy use (6% for a non-green computer compared to 5% for a green computer).

2) **Determining all life cycle costs.** The results of indicator 1 (input C) relate to purchasing costs only, distributed between non-green, core green and comprehensive green. However, since we have calculated the cost structures (see step 1) of all three levels of GPP, we can calculate all costs for all levels of GPP for all its stages in the life cycle. Totals per cost element and per level of GPP are shown on the bottom and to the right of the calculated numbers respectively. The figures may be interpreted as follows: say a public purchaser spends € 100 annually on the procurement of computers, of which for € 5 non-green computers are purchased, for € 77 core green computers are purchased and for € 18 comprehensive green computers are purchased. Then, based on the various cost structures, we know that for example the purchase of the core green computers lead to € 4,43 costs for energy use and to € 8,51 cost for maintenance.

3) **Determining all life cycle cost,** if the purchases would not have been green. Having determined all costs for all purchases (non-green, core green and comprehensive green, see step 2), we can now calculate the same numbers if the purchases would not have been green. For this, we make use of the cost ratios of energy use costs (input C). Totals figures per cost element and per level of GPP are shown on the bottom and to the right of the calculated numbers respectively. The result can be interpreted as follows: if the purchased core green computers would not have been green, then the total purchase price would only be € 75,43 instead of € 77. On the other hand, the costs for energy use would have been € 5,21 instead of € 4,43.

4) **Determining the total financial impact of GPP for this product.** The final step in our calculation is to determine the financial impact of GPP. We use the numbers for all life cycle costs of green purchases (step 2) and compare the numbers as calculated if these purchases would not have been green. The total financial impact of this product group is (116,89/116,00) – 1 = 0,77% which means that the use of green criteria in this product group has led to an increase of 0,77% in costs for a public organisation. The division is performed in order to calculate the factor how much less costs there are in the user life cycle of a product because of GPP. A value of one is subtracted in order to arrive at the actual financial impact of GPP in percentages.

We can also calculate the separate impact of energy use and purchase price. We see that in our case, the use of green criteria in purchasing has led to an increase in purchasing costs of 1,90%, while the costs for energy use have been decreased by 14,23%. What is more, also the financial impact per level of GPP can be calculated. These are listed below the financial impact.

Figure 3.4: Calculation of financial impact of GPP. A description of the various steps in the calculation can be found in section 3.2.6. Please note that these numbers are fictitious.

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Product group: Office IT equipment
Product: Computers & monitors
Country: Germany

Financial impact of GPP for IT equipment (%):	0,77%
Financial impact of GPP on purchase prices (%):	1,90%
Financial impact of GPP on electricity use (%):	-14,23%
Financial impact of GPP from core criteria (%):	0,63%
Financial impact of GPP from comprehensive criteria (%):	0,15%

(A) cost structure of no GPP	
purchase price	85%
electricity use	6%
maintenance costs	10%

(C) results ind. 1	
No GPP	5%
Core	77%
Comprehensive	18%

(1)

cost structures	purchase price	electricity use	maintenance costs
No GPP	**85%**	**6%**	**10%**
Core	86%	5%	9%
Comprehensive	86%	5%	9%

(1)

(B) cost ratios	purchase price	electricity use	maintenance costs
no GPP / no GPP:	**1,00**	**1,00**	**1,00**
core / no GPP:	**1,02**	**0,85**	**1,00**
compr / no GPP:	**1,02**	**0,85**	**1,00**

(2)

Live Cycle costs	purchase price	electricity use	maintenance costs	*total*
No GPP	**5,04**	0,36	0,57	*5,96*
Core	**76,94**	4,43	8,51	*89,89*
Comprehensive	**18,02**	1,04	1,99	*21,05*
total	*100,00*	*5,82*	*11,07*	**116,89**

(3)

Live Cycle costs if no GPP	purchase price	electricity use	maintenance costs	*total*
No GPP	5,04	0,36	0,57	*5,96*
Core	75,43	5,21	8,51	*89,16*
Comprehensive	17,66	1,22	1,99	*20,88*
total	*98,14*	*6,78*	*11,07*	**116,00**

(4)

4 Population and sampling methods

This section describes the population definition and the methodology used for sample selection, needed to identify the desired sample size and number of respondents in order to be able to make statistically valid statements.

4.1 Population definition

The population is defined for each of the seven participating Member States. A distinction is made between central government entities and non-central government entities. Within the latter category, a further distinction is made between regional and local government entities, nationwide local and regional bodies and semi-public entities. Table 4.1 shows in more detail the types of public institutions identified under the categories central and non-central government in the seven Member States.

Table 4.1a: Type of public institutions – central government

Types of public institutions
Central government
note: these entities have responsibilities concerning the whole country
Government including ministries
Government
Presidential office
Chancellery
Chambers
Ministries
Governmental agencies & other central bodies
Governmental agencies
Higher state bodies

Table 4.1b: Type of public institutions – non-central government

Types of public institutions
Non-central government
Regional and local government
note: these entities have governing responsibilities for a specific region/municipality
Regional government
Provinces
Federal states
Counties
Local government
Municipalities
Nationwide local and regional bodies
note: these entities have no governing responsibilities
Regional institutions
State local districts
Regional co-operation councils
Water boards
Police districts
Courts of law
Public administration bodies
Social insurance carriers
Employment offices
Employment and economical centres
Public funds (e.g. retirement funds)
Public bodies for administration and private sector
Regional road administration offices
Tax offices
Public companies and institutions
Public owned companies
Advisory boards
Other (semi-public)
Higher Education Institutions/ Colleges
Universities
Hospitals
Museums

In order to make valid statistical statements about the complete population of public institutions, the collected data must be representative for the total public procurement population. More specific, the indicators we are deriving based on our sample dataset must reflect the situation of the complete population. In order to define the sample size for this survey we first need to identify the actual number of public institutions in the countries within scope. Table 4.2 provides an overview of the total number of public institutions in the countries on an aggregated level.

Table 4.2: Number of public institutions per country*

Number of public institutions per country	Overview Public Sector Institutions						
Type of public institutions	Austria	Denmark	Finland	Germany	Nether-lands	Sweden	United Kingdom
Central government	**62**	**66**	**115**	**538**	**117**	**300**	**92**
Government including ministries	19	18	14	18	16	14	21
Governmental agencies & other central bodies	43	48	101	520	101	286	71
Regional and local government	**2366**	**103**	**441**	**12829**	**455**	**332**	**454**
Regional government	9	5	25	329	12	42	4
Local government	2357	98	416	12500	443	290	450
Nationwide local and regional bodies	**736**	**457**	**2448**	**9008**	**322**	**1691**	**875**
Regional institutions	438	85	260	8	133	109	63
Public administration bodies	198	251	577	0	19	9	0
Public companies and institutions	100	121	1611	9000	170	1573	812
Other (semi-public)	**183**	**82**	**59**	**1009**	**22**	**90**	**206**
Other (universities and hospitals)	183	82	59	1009	22	90	206
Total	**3347**	**708**	**3063**	**23384**	**916**	**2413**	**1627**

* Sources of these figures, which are mainly governmental information websites, are given in Appendix C

4.2 Sample selection

In this section, we determine the number of potential respondents that will be selected for participation in the survey. Our aim is to make statistical statements with an acceptable precision level. This precision level is defined as the width of the confidence interval of the estimated percentage of the core/comprehensive level of GPP as an outcome of this study. The precision level depends on the following variables:

- the number of institutions within the Member State (population size);
- the net sample size
- the expected percentage of the core/comprehensive level of GPP.

For more details about the exact influence of each variable, the reader is referred to Appendix C.

The net sample size (the number of questionnaires that are completed and returned) depends on the gross sample size (the number of questionnaires sent out) and the response rate (the expected % of questionnaires that are completed and returned). In order to determine the necessary gross sample size, we begin by fixing the desired level of precision to 20%. This means that if the estimated outcome of this study is 50% level of GPP, the real level of GPP is expected to be somewhere between 40% and 60% (based on a confidence level of 95%).

Being 95% confident about the 20% confidence interval means that there is only a 5% probability that the interval does not contain the real level of GPP. Based on a fixed net sample size, we could make statements with a confidence level higher than 95%, but doing so would lead to much wider confidence interval. For example, assume we want to be more confident about the interval of the level of GPP that we calculate, e.g. a confidence level of 99%. In that case, the confidence interval may be widened ranging from 35% to 65% (again, assuming the outcome of the study is that the level of GPP is 50%). Conversely, if we allow ourselves to be less confident about our interval, perhaps 90% confident, then the interval may range from 43% to 57%. Simply put, given a fixed sample outcome: the higher the desired confidence level, the wider the confidence interval and vice versa. In our analyses, we choose to work with a confidence level of 95%, which is considered a standard amongst researchers[20]. Please note that the numbers used in the example above serve to illustrate only.

A certain precision level implies a necessary net sample size. In combination with the assessment of the response rates, the gross sample size is derived. In order to illustrate this calculation we use Denmark as an example. The population size of non-central public institutions in Denmark is 642. With a fixed precision level of 20%, we need a minimum of 66 returned questionnaires from non-central institutions in order to make statistical valid statements. If 24% of the questionnaires sent out to non-central institutions is expected to be returned, a minimum of 275 questionnaires need to be sent out to the non-central public sector in Denmark.

The response rate assessments are based on our own experiences with former surveys and on the consultation of key persons and local GPP experts. Our experience is that response rates vary enormously. For instance, the overall response rate for the Dutch 'Monitor on Sustainable Procurement Public Sector 2006' was 64%, whereas the response rate for the study by the Take 5 consortium was 11%[21]. The response rate of a survey highly depends on the quality of contact databases and the way in which respondents are approached and questioned. More details about this can be found in chapter 5.

4.2.1 Base scenario for response rates

The following table gives the necessary net and gross sample sizes, based on the above mentioned response rate assessment. We consider this table to be our base scenario.

20 For more a detailed description of statistics sampling, see e.g.: William G Cochran, Sampling Techniques, John Wiley & Sons, 1977

21 Bouwer M, Jonk M, Berman T, Bersani R, Lusser H, Nappa V, Nissinen A, Parikka K, Szuppinger P and Viganò C, 2006. Green Public Procurement in Europe 2006 – Conclusions and recommendations, Virage Milieu & Management, Haarlem, the Netherlands.

Table 4.2: Base scenario for response rates

Base scenario	Austria	Denmark	Finland	Germany	Netherlands	Sweden	United Kingdom
Population size - Central government	62	66	115	538	117	300	92
Population size - Non-central government	3285	642	2948	22846	799	2113	1535
Total population size	**3347**	**708**	**3063**	**23384**	**916**	**2413**	**1627**
Gross sample size - Central government	62	66	74	138	98	148	92
Gross sample size - Non-central government	322	275	313	352	316	282	369
Total gross sample size	**384**	**341**	**387**	**490**	**414**	**430**	**461**
Response rate - Central government	25,0%	27,7%	25,0%	10,0%	27,3%	20,0%	19,1%
Response rate - Non-central government	24,2%	24,0%	23,9%	23,1%	19,0%	22,2%	19,8%
Net sample size - Central government	16	18	19	14	27	30	18
Net sample size – Non-central government	78	66	75	81	60	63	73
Total net sample size	**93**	**84**	**93**	**95**	**87**	**92**	**91**
Expected fraction	50%	50%	50%	50%	50%	50%	50%
Lower bound 95% confidence interval	40,0%	40,0%	40,0%	40,0%	40,0%	40,0%	40,0%
Upper bound 95% confidence interval	60,0%	60,0%	60,0%	60,0%	60,0%	60,0%	60,0%
Precision level	20,0%	20,0%	20,0%	20,0%	20,0%	20,0%	20,0%

The expected percentage of core/comprehensive level GPP (expected fraction) is set to 50%. The reasoning is that 50% is the most conservative choice, in terms of the precision level, which results in the widest confidence interval. If it turns out that the expected fraction differs significantly from 50%, this will result in smaller confidence intervals. See Appendix C for more details.

The finite population correction is seen to have a very small influence. The necessary net sample size for Germany is equal to 95, given a population size of 23.384. If this population size had been a lot smaller, like 931 for the Netherlands, this would imply a necessary net sample size of 87. In other words, a decrease in population size from 23.384 to 931 gives a net sample size reduction of only 8 organisations. This illustrates that although there is an interrelation between the size of the population and the required net sample size, the influence is not very high. For more detail regarding the effect of population size, see Appendix C.

4.2.2 Pessimistic and optimistic scenarios for response rates

Despite the fact that everything will be done to obtain optimal response rates, the actual response rates may deviate from previous assessments. In order to show what the implications are in terms of precision level, we consider two additional scenarios. The following table contains a pessimistic scenario, which assumes response rates to be 25% lower than the base scenario assessments. In this scenario, the precision interval in which the 95% confidence interval is valid will increase.

Finally, table 4.5 contains an optimistic scenario, which assumes response rates to be 25% higher than the base scenario assessments. In this scenario, the precision level in which the 95% confidence interval is valid will decrease.

Table 4.4: Pessimistic scenario for response rates

Pessimistic scenario	Austria	Denmark	Finland	Germany	Netherlands	Sweden	United Kingdom
Population size - Central government	62	66	115	538	117	300	92
Population size – Non-central government	3285	642	2948	22846	799	2113	1535
Total population size	**3347**	**708**	**3063**	**23384**	**916**	**2413**	**1627**
Gross sample size - Central government	62	66	74	138	98	148	92
Gross sample size – Non-central government	322	275	313	352	316	282	369
Total gross sample size	**384**	**341**	**387**	**490**	**414**	**430**	**461**
Response rate - Central government	18,8%	20,8%	18,8%	7,5%	20,5%	15,0%	14,3%
Response rate – Non-central government	18,2%	18,0%	17,9%	17,4%	14,2%	16,7%	14,8%
Net sample size - Central government	12	14	14	10	20	22	13
Net sample size – Non-central government	58	50	56	61	45	47	55
Total net sample size	**70**	**63**	**70**	**71**	**65**	**69**	**68**
Expected fraction	50%	50%	50%	50%	50%	50%	50%
Lower bound 95% confidence interval	38,4%	38,2%	38,4%	38,4%	38,3%	38,4%	38,4%
Upper bound 95% confidence interval	61,6%	61,8%	61,6%	61,6%	61,7%	61,6%	61,6%
Precision level	23,2%	23,5%	23,2%	23,2%	23,4%	23,2%	23,3%

Table 4.5: Optimistic scenario for response rates

Optimistic scenario	Austria	Denmark	Finland	Germany	Netherlands	Sweden	United Kingdom
Population size - Central government	62	66	115	538	117	300	92
Population size – Non-central government	3285	642	2948	22846	799	2113	1535
Total population size	**3347**	**708**	**3063**	**23384**	**916**	**2413**	**1627**
Gross sample size - Central government	62	66	74	138	98	148	92
Gross sample size – Non-central government	322	275	313	352	316	282	369
Total gross sample size	**384**	**341**	**387**	**490**	**414**	**430**	**461**
Response rate - Central government	31,3%	34,7%	31,3%	12,5%	34,1%	25,0%	23,9%
Response rate – Non-central government	30,3%	30,0%	29,9%	28,9%	23,7%	27,8%	24,7%
Net sample size - Central government	19	23	23	17	33	37	22
Net sample size – Non-central government	97	83	94	102	75	78	91
Total net sample size	**117**	**105**	**117**	**119**	**108**	**115**	**113**
Expected fraction	50%	50%	50%	50%	50%	50%	50%
Lower bound 95% confidence interval	41,1%	41,2%	41,1%	41,0%	41,2%	41,1%	41,1%
Upper bound 95% confidence interval	58,9%	58,8%	58,9%	59,0%	58,8%	58,9%	58,9%
Precision level	17,8%	17,6%	17,8%	17,9%	17,7%	17,8%	17,8%

It should be noted, that the above percentages are overall response rates. That is, respondents who filled in at least part of the questionnaire. Our experience is that the response rates per product group are lower. Some respondents skip certain product groups, for instance because they did not conclude procurement contracts regarding this product group during the last two years.


1
2

5 Data collection

The survey is the main method of data collection. Within this chapter, we state some general considerations concerning the questionnaire, and describe methods for identifying contact persons and to increase response.

5.1 Questionnaire

5.1.1 Why use questionnaires?

Several quantitative methods are available for measuring indicators on GPP. In finding the right and most suitable method, we considered the following alternatives:

1. Tender database analysis: quantitative analysis of electronic tender documents, based on information from the Official Journal of the European Union and additional tender documents from contracting authorities;
2. Digital questionnaires: quantitative analysis of questionnaires to be filled out by public procurement officers;
3. Analysis of procurement contracts; contracts can be analysed quantitatively (number and value of 'green' contracts) as well as qualitatively (how have environmental aspects been evaluated in the procurement process?).

The most suitable method of data collection should return the right information, with the right level of detail on the right investment of time and energy.

We foresee complications using the method of tender analysis. Generally, there is too little organisation specific and detailed information available for this type of analysis. Contract analysis delivers more detailed information, but demands more effort as well. Although this method would be most informative, this method it is too time consuming to be considered a realistic method for measuring indicators on GPP. More informative than the tender analysis and less time consuming than procurement document analysis is the digital questionnaire. This method has proven to be very useful in previous studies on green public procurement, for example in the Dutch 'Monitor on Sustainable Procurement Public Sector 2006'[22].

5.1.2 Content of the questionnaire

The questionnaire consists of three different types of questions. First, there are a couple of general questions about the respondent and his organisation. These questions are put in section A of the questionnaire (see appendix A of this report). For data protection reasons, a privacy statement is attached to the questionnaire (full text, see appendix A).

Second, there is a list of questions concerning the environmental policy within the participating organisation (section B1), the procurement policy (section B2) and the implementation of green procurement (B3). The answers to these qualitative questions are not necessarily part of the analysis needed for indicators 1, 2 and 3. However, they will give a lot of valuable insights, and may contribute to giving an explanation for the behaviour and results of respondents.

Third, section C of the questionnaire contains questions about the use of green criteria within specific contracts. For the most recent procurement contract within every product group, participating organisations are asked which green criteria have been used and which have not been used. **These criteria are based on the GPP training toolkit of the European Commission. Since the exact toolkit criteria were not yet available at the time of conclusion of the contracts which have been subject to the current survey, the criteria used in the survey to distinguish between green and non green contracts are broadly based on the toolkit criteria, without copying/pasting them, as this would presumably not lead to any 'green' results. In future monitoring exercises however, it would be necessary to replace the criteria in the questionnaire with the exact 'core' and 'comprehensive' criteria of the training toolkit, to measure whether Member States and purchasing authorities actually use these criteria for greening their purchases, as recommended by the Commission in its Communication on 'Public procurement for a better environment'.** In addition, section C contains questions to measure the total amount of money the organisation has spent on the product group during the last fiscal year. This volume is necessary to measure the extent to which a 'green' contract contributes to the total amount of annual expenditure (indicator 1).

22 Blom, M., Jongebreur-Telgen H.L. and Karssen B., 2007. Monitor Duurzame Bedrijfsvoering Overheden 2006. Onderzoek naar de mate waarin overheden beschikken over een duurzame bedrijfsvoering. Significant, Barneveld, the Netherlands, 2007.

5.2 Methods for identifying contact persons

A sufficiently high response is essential for measuring the level of GPP within the seven selected countries. For that purpose, we introduce a set of response increasing methods (see section 5.3). In addition, the response rates are higher when contacts are identified from reliable and up-to-date sources[23]. For the GPP survey, we use the following sources for identifying contacts in the selected countries (in order of decreasing expected response rate):

(a) (Personal network of the research team within each of the seven Member States;
(b) (National purchasing associations;
(c) (GPP contact databases;
(d) (The Tender Electronic Daily (TED) database, containing electronic tender documents, based on information from the Official Journal of the European Union.

5.2.1 Personal network

Both PwC and Significant have a high quality international network with local knowledge and experience in the public sector and on GPP. Through their local offices, PwC is present in all seven Member States. From this network, contacts are selected to include in the sample of this GPP study. Because of the personal relationship with these contacts, we expect a relatively high response rate for this group. This is particularly true for those contacts that participated in previous studies on green public procurement[24], public procurement in general, sustainability and comparable subjects.

5.2.2 National purchasing associations

Within most European countries, national purchasing associations are active. Wherever possible, we involve these national associations closely, as that might add to the response on the survey. This involvement might enable the research team to be introduced to members of each association, or provide us with a letter of endorsement (or a co-signed introduction letter) to be sent to the contacts in the sample. Our experience is that the involvement of the associations at an early stage of the study, adds to their willingness to cooperate. The relevant national purchasing associations for this study are[25]:

(a) (UK: CIPS (www.cips.org);
(b) (The Netherlands: NEVI Publiek (www.nevi.nl):
(c) (Austria: AFPMML (www. opwz.com/einkauf) and/or BMO (www.bmoe.at);
(d) (Germany: BME (www.bme.de);
(e) (Denmark: DILF (www.dilf.dk) and/or GPU (Governmental Procurement Unit);
(f) (Sweden: SILF (www.iolservice.se);
(g) (Finland: LOGY (www.logy.fi).

5.2.3 GPP contact databases

GPP contact databases[26] were made available to us by the Commission. The contacts in these databases were derived from participation lists of GPP (related) events, and from contacts lists for a previous study on GPP. All relevant contacts from these sources are updated and invited to participate.

5.2.4 Tenders Electronic Daily (TED) database

The fourth source for identifying contacts is the TED database, the electronic Supplement to the Official Journal of the European Union[27]. The TED database contains all announcements and award notices for tenders according to the European directives for public procurement. Most announcements contain information on the contracting authority and the person to be contacted for additional information. In this way, we identify contact details for contracting authorities to be included in the sample.

When using the TED, we select tenders based on the following criteria:

a) Year of reference: 2007 and later;
b) Country: all seven Member States;

23 Postal address, e-mail address and phone number must be obtained for each contact.

24 For example the Dutch 'Monitor on Sustainable Procurement Public Sector 2006' by Significant. Obviously, we will not include contacts from previous studies on GPP only, because that might result in a bias in the responses to the survey.

25 Only parts of the members of these associations work for a public authority, as some associations mainly focus on private organisations. On the other hand, the Dutch NEVI for example has a specific branch for public purchasers (NEVI Publiek). More than one purchaser from the same organisation might be member of their national association. When using the contact databases of national associations, one contact from the same organisation must be selected only.

26 These contact databases will be used solely for the purpose of this study.

27 http://ted.europa.eu

c) Type of document: contract notice, request for proposal or contract award;
d) Type of authority: Body governed by public law, Ministry or any other national or federal authority, Regional or local authority, National or federal Agency/Office, or Regional or local Agency/Office;
e) Procedure: all procedures according to the European directives.

From the list of tenders that match the criteria, we select tenders randomly, and investigate whether the corresponding document contains relevant contact details on the contracting authority[28]. If so, this contracting authority will be included in the survey sample. The tenders are selected from the list in such a way that the required number of tenders per country and per type of authority is obtained.

5.3 Communication and response increasing methods

Previous use of questionnaires by PwC and Significant has shown that the response will be higher and the quality better when a certain number of conditions are met. Within this paragraph, the following topics are covered:
a) Clear communication to respondents;
b) Easy-to-use questionnaires;
c) Professional help desk;
d) Reminders by email & phone.

5.3.1 Clear communication to respondents

We are confident that a 'national approach' to the respondents will result in a higher involvement with the survey and, therefore, in a higher response rate. This includes:
a) Communication with respondents is in their national language as much as possible;
b) The national 'policy makers' (Ministries of Environment etc.) in each country are asked to co-sign an introduction letter to all respondents;
c) The local PwC office in each country is highly involved in the survey. A local PwC expert can be consulted by the respondents during the response period.

In addition, we use a personal approach to the contacts within the selected public authorities. This means that all intended contacts receive a personal introduction letter (by regular mail) about the aims of the project and their expected effort, before they receive the questionnaire. All correspondence is addressed to a known contact, not just to the "head of procurement".

To increase awareness and involvement, other channels are used to inform the contacts and other interested parties about the project in advance:
a) National and European newsletters and expert bodies on (Sustainable) Public Procurement, amongst others:
    a. Ecolabel News Alert[29];
    b. Ecolabel Magazine;
    c. Newsletter supporting the Eco-Management and Audit Scheme[30];
b) The website of DG Environment[31]: public authorities are enabled to participate in the survey through a link on the website;
c) A project website that contains news and information on the survey (www.thevalueofgreen.com). This website will be updated regularly during the survey, for example by adding answers to frequently asked questions, and can be consulted afterwards for the survey results;
d) National thought leaders on (Sustainable) Public Procurement, for instance from academic and governmental circles, and representatives of national purchasing associations are invited to become a member of a recommendation committee.

To increase the willingness to participate, the participating organisations will receive feedback on their completed questionnaire afterwards and, in addition, the aggregated results of all other respondents within the same sample group in their country.

28 Some tenders are being executed by intermediate organisations, on behalf of the contracting authority. In such cases, the tender will be removed from the list of selected tenders. Preferably, contact details refer to procurement officers who hold a central position within the contracting authority, overlooking a large range of product groups.

29 See http://ec.europa.eu/environment/ecolabel/news/index_en.htm

30 See http://ec.europa.eu/environment/emas/index_en.htm

31 http://ec.europa.eu/environment/gpp/index_en.htm and http://ec.europa.eu/environment/ecolabel/news/index_en.htm

5.3.2 Easy-to-use questionnaires

Data collection by sending out digital questionnaires has several advantages in comparison with paper questionnaires:

a) The survey can include a large population with little extra effort;
b) Standardised questions will lead to reliable answers suitable for analysis[32];
c) A digital questionnaire comes across professionally, which will increase the response;
d) Corresponding the questionnaire digitally is sustainable (paper saving);
e) Collecting, processing and analysing data can be done very time efficiently.

In order to achieve a high response rate, the questionnaire must be easily accessible and easy-to-use. Therefore, the following conditions are met:

a) All the questionnaires are in the national language (Danish, Dutch, English, Finnish, German or Swedish);
b) Easy-to-use and clear functionality;
c) Acceptable time needed for completion of the questionnaire by the respondent
d) The participating procurement officer should be able to fill out most of the general questions without too much desk research. To answer the questions concerning specific tenders or product groups, he or she may have to consult colleague procurement officers;
e) Adequate response period (1st half of June – 1st half of September);
f) Easy to understand for purchasing officers of all public authorities and without much environmental expertise;
g) Only relevant questions to be answered, depending on the characteristics of the target organisation;
h) Respondents are enabled to store their given answers on their own computer, after having completed the questionnaire (for future use and reference).

The questionnaire is sent to the contacts of the selected public authorities by email message. The personal internet link (including login and password) gives them access to the questionnaire on a unique and secured webpage. The data is saved directly during the filling-out process. It is possible to temporarily exit the questionnaire and return later to complete the remaining questions. It is also possible, for respondents to temporarily skip questions, giving them the opportunity to look up the answers and return to finish at a later date. The digital version of the questionnaire must be created by a specialised IT company or department, to ensure ease of use for the respondents.

One possible disadvantage of using a digital questionnaire might be that some respondents can be biased and provide socially correct answers. In anticipation to this, a small sample of the respondents (2 per country) is asked to allow access to purchasing contracts to check the answers given in the questionnaire with the actual content of the contract. We assume that participating organisations will tend not to submit socially correct answers when they know they can be part of a random sample of organisations that will be asked to 'prove' their answers[33].

Another issue is that some organisations might face difficulties receiving the questionnaire through the internet, because they do not have external internet access or make use of a highly secured internet connection that blocks the questionnaire. These organisations will – upon request - be able to receive a paper version of the questionnaire by regular mail as well.

The respondents are enabled to share the questionnaire with their colleagues easily, as some respondents may need input from colleagues to be able to fill in the correct answers. Therefore, every respondent is enabled to forward the email message (containing the personal internet link) to their colleagues, so they can fill in parts of the questionnaire. In addition, the questionnaire is easy to print by respondents.

Before sending out the questionnaires to the whole population, the questionnaire is tested extensively among a pilot group. The aim of this pilot is to check understanding and functionality of the questionnaire. The indented pilot target group consists of 14 different public authorities, two from every participating country. The pilot group of 14 public authorities is contacted personally to

32 To make sure that participants do not feel restricted by the limited number of answering options, wherever possible participants will be allowed to fill out comments in free text format.

33 In the Dutch 'Monitor on Sustainable Procurement Public Sector 2006' by Significant the same method was used. The results of the visits to several public authorities showed that most of the answers to the questionnaires were consistent with the actual specifications in the contract.

ask for feedback on the questionnaire. This step is very valuable as it gains a lot of insight into respondents' answers. Based on this feedback, the project team is able to further improve the questionnaire.

5.3.3 Professional help desk

PwC installs a central helpdesk in The Netherlands, which is reachable by phone and email on working days (9 AM – 5 PM CET). Besides this central helpdesk, every participant receives a name, telephone number and email address of a local PwC expert who can be consulted with questions. For this reason, PwC Netherlands drafts a Frequently Asked Questions guide for the national PwC contact persons.

5.3.4 Reminders by email & phone

The questionnaire database records each and every response, so we are able to identify and remind the non-responding or partially responding participants. Response is monitored centrally from the central PwC office in the Netherlands. Reminders are delivered to non-respondents twice by email - in national languages, from the central PwC office - during the response period (June – August). Reminding by phone - in national languages, from local PwC offices - starts right after the initial response period has passed (1st half of September).

Responses are monitored continuously during the response period, and extra countermeasures are taken when necessary. These countermeasures could be: reminding to more public authorities by phone, intensify communication by newsletters, involve the national 'policy makers', etcetera. The table below contains the overall target response at specified moments during the response period. If, for instance, the expected response at the end of the response period is 1000, then the target response at the end of July will be 550. Countermeasures will take effect if the actual response will fall behind this number at the end of July.

Table 5.1: Target response over time

Target response by (% of total expected response		
End of June	End of July	End of August
40%	70%	100%

Appendix

A Questionnaire

		Green Public Procurement Questionnaire 2008		
A		**Questions about your organisation**	**Answer (open, single or multiple choice)**	**Answering categories**
	A.1	In which country is your organisation situated?	SC	Austria
				Denmark
				Finland
				Germany
				Netherlands
				Sweden
				United Kingdom
	A.2	Last name	Open	
	A.3	First name	Open	
	A.4	Job title	Open	
	A.5	Telephone number	Open	
	A.6	Email address	Open	
	A.7	Name of your organisation	Open	
	A.8	Name of your department	Open	
	A.9	Type of organisation	SC	Central government: ministries
				Central government: agencies
				Regional government
				Local government
				Regional institutions
				Regional public administration bodies
				Regional public companies and institutions
				Other: universities and hospitals
				Other: i.e.:………….
	A.10	How many employees does your organisation have?	SC	0 – 50
				50 – 100
				100 – 500
				500 – 1.000
				> 1.000

		Green Public Procurement Questionnaire 2008		
	A.11	How large is the municipality for which your organisation is responsible (number of inhabitants)?	SC	0 - 50.000
				50.000 - 100.000
				100.000 - 500.000
				> 500.000
				Not applicable
	A.12	Please list the names of the organisations that you purchase on behalf of. This questionnaire has to be filled out having in mind all the organisations you have listed.	Open	
B		**General questions about (green) public procurement**		
B1		**Questions about the environmental policy within your organisation**		
	B.1.1	Does your organisation have an environmental management system (EMS)?	SC	Yes
				No
B2		**Questions about the procurement policy within your organisation**		
	B.2.1	To what extent does your organisation have a centrally organised procurement function?	SC	Completely centralised
				Mostly centralised, some non-central
				Just as much centralised as non-central
				Mostly non-central, some centralised
				Completely non-central
	B.2.2	What is your procurement spend annually (in EUR)?	Open	€
	B.2.3	Is there an environmental component to your organisation's procurement policy?	SC	Yes
				No
B3		**Questions about the implementation of green procurement**		
	B.3.1	Does your organisation have an action plan for meeting goals on green procurement?	SC	Yes
				No
	B.3.2	On which organisational level have the environmental goals been established?	MC	Representative body (e.g. Parliament, Municipal Council)
				Board level of the organisation (e.g. Minister, Municipal Executive, etc.)

		Green Public Procurement Questionnaire 2008		
				Directorate or management level
				Else,…
	B.3.3	Is green procurement part of the regular Planning & Control cycle?	SC	Yes
				No
	B.3.4	Who [job title] is/are responsible for meeting goals set for greening procurement?	Open	
	B.3.5	What has been done to empower the responsible people to meet the environmental goals?	MC	Training and education of procurement officers in the field of green procurement
				Active communication towards the organisation about set goals in greening procurement
				Formally appointed powers to the responsible officers
				Political support
				Else,…
	B.3.6	Which external sources are being used to find information about green procurement (for example on green criteria)?	MC	European Commission GPP website
				Procura+ website
				Ecolabel
				Mimicker
				SenterNovem
				Else, …
	B.3.7	Does your organisation cooperate with other (governmental) organisations ion the field of green procurement?	SC	Yes, our organisation cooperates with ...
				No
	B.3.8	How does your organisation keep the level of knowledge and information on green procurement up to date?	MC	Training and education
				Seminars
				By cooperating with other (governmental) organisations
				Internet, through the following websites ...
				Else, …
	B.3.9	During the procurement process, are environmental aspects always compared with price and other criteria?	SC	Yes, always
				Yes, most of the time

		Green Public Procurement Questionnaire 2008		
				Yes, only when…
				Seldom
				Never
	B.3.10	Are proposals being evaluated on Life Cycle Costing (LCC) or on the procurement costs of the product/service only?	SC	Mostly evaluation on LCC
				Sometimes evaluation on LCC, sometimes on purchasing costs
				Mostly evaluation on purchasing costs
	B.3.11	Which criteria are decisive for asking for “green” goods instead of non-green (by including green criteria as minimum technical specifications or as award criteria)?	MC	Volume of the tender, only the larger tenders
				Volume of the tender, only the smaller tenders
				Environmental impact of the purchase
				Availability of green alternatives
				Familiarity with green alternatives
				Familiarity with suppliers that offer green goods/services
				The impact of the green alternative on the processes of the organisation - only choosing for the green alternative when impact is minimal
				Else, …
C		**Questions about green procurement within specific product groups**		
C1		**Cleaning services**		
	C.1.1	What is the total amount of money your organisation has spent on cleaning services during the last fiscal year (in EUR, excluding VAT)?	Open	€
	C.1.1a	Were procurement contracts regarding cleaning services concluded by your organisation in 2006 or 2007?		Yes
				No
		Please answer the following questions for your most recent procurement contract (after January 2006) regarding cleaning services, with a value of EUR 25.000 or above:		
	C.1.2	Is the acquired product or service being certified by an ecolabel?	SC	Yes
				No

		Green Public Procurement Questionnaire 2008		
	C.1.3	If yes, which?		Open
	C.1.4	Does the contractor avoid the use of hazardous substances?	SC	Yes
				No
				Information not available
	C.1.5	Is all cleaning staff employed in carrying out the service regularly trained for their various tasks?	SC	Yes
				No
				Information not available
		This training should cover cleaning agents, methods, equipment and machines used; waste management; aspects of health, safety and the environment.		
	C.1.6	Does the contractor use reusable microfiber cloths and/or apply dry-cleaning techniques for linoleum flooring where appropriate?	SC	Yes
				No
				n/a
	C.1.7	Does the acquired product or service comply with other green criteria?	SC	Yes
				No
	C.1.8	If yes, which?	Open	
C2		**New buildings & offices**		
	C.2.1	What is the total amount of money your organisation has spent on the construction of new buildings & offices during the last fiscal year (in EUR, excluding VAT)?	Open	€
	C.2.1a	Were procurement contracts regarding new buildings & offices concluded by your organisation in 2006 or 2007?	SC	Yes
				No
		Please answer the following questions for your most recent procurement contract (after January 2006) regarding the construction of new buildings & offices, with a value of EUR 250.000 or above:		
	C.2.2	Has the building been designed and built to reduce the amount of energy consumed in use?	SC	Yes
		If so, what are these energy-saving measures	MC	natural ventilation
				double glazing
				insulation
				design to make best use of natural light

		Green Public Procurement Questionnaire 2008		
				Other…
	C.2.3	Are all sanitary and kitchen water facilities being equipped with the latest water-saving technologies available on the market?	SC	Yes
				No
	C.2.4	Has the contracted party declared that the following materials/substances have not been used in the construction: Recycled wood-based products (e.g. timber), plastics, steel or other used materials not accompanied by test documents that they contain no hazardous substances (as defined by national regulations). Products which contain hydro fluorocarbons (HFCs) Products which contain sulphur hexafluoride (SF6) Indoor paints and varnishes with a content of solvents	SC	Yes
				No
	C.2.5	Does all timber used in the building come from legal sources?	SC	Yes
				No
	C.2.6	C.2.8 Has a minimum of the energy demand been defined that has to be provided by localised renewable energy sources (L-RES)?	SC	Yes
				No
	C.2.7	If yes, what percentage?	Open	%
	C.2.8	Does the acquired product or service comply with other green criteria?	SC	Yes
				No
	C.2.9	If yes, which?	Open	
C3		**Electricity**		
	C.3.1	What is the total amount of money your organisation has spent on electricity during the last fiscal year (in EUR, excluding VAT)?	Open	€
	C.3.1a	Were procurement contracts regarding electricity concluded by your organisation in 2006 or 2007?		Yes
				No
		Please answer the following questions for your most recent procurement contract (after January 2006) regarding electricity, with a value of EUR 50.000 or above:		
	C.3.2	Does (part of) the supplied electricity come from renewable energy sources (RES-E)?	SC	Yes
				No
				Information not available

		Green Public Procurement Questionnaire 2008		
	C.3.3	If yes, what percentage?	Open	%
	C3.4	Is the acquired product or service being certified by an ecolabel or does the product or service meet its underlying criteria?	SC	Yes
				No
				Not applicable
	C.3.5	If yes, which?	Open	
	C.3.6	Does the acquired product or service comply with other green criteria?	SC	Yes
				No
	C.3.7	If yes, which?	Open	
C4		**Catering services**		
	C.4.1	What is the total amount of money your organisation has spent on catering services during the last fiscal year (in EUR, excluding VAT)?	Open	€
	C.4.1a	Were procurement contracts regarding catering services concluded by your organisation in 2006 or 2007?		Yes
				No
		Please answer the following questions for your most recent procurement contract (after January 2006) regarding catering services, with a value of EUR 25.000 or above:		
	C.4.2	Has part of the range of products been produced organically?	SC	Yes
				No
				Information not available
	C.4.3	If yes, what percentage of the products?	Open	%
	C.4.4	Are the main fruit, vegetables and fish that are used whenever possible, being selected according to the season based on the geographical location in which the assignment is performed?	SC	Yes
				No
				Information not available
	C.4.5	Is the acquired product or service being certified by an ecolabel or does the product or service meet its underlying criteria?	SC	Yes
				No
	C.4.6	If yes, which?	Open	
	C.4.7	Does the acquired product or service comply with other green criteria?	SC	Yes

		Green Public Procurement Questionnaire 2008		
				No
	C.4.8	If yes, which?	Open	
C5		**Gardening**		
	C.5.1	What is the total amount of money your organisation has spent on gardening during the last fiscal year (in EUR, excluding VAT)?	Open	€
	C.5.1a	Were procurement contracts regarding gardening concluded by your organisation in 2006 or 2007?		Yes
				No
		Please answer the following questions for your most recent procurement contract (after January 2006) regarding gardening, with a value of EUR 25.000 or above:		
	C.5.2	Did you purchase gardening machines that can run on unleaded petrol with a benzene content of <1.0 % by volume, alkylate petrol, class A diesel oil, or biofuel-based engine fuel?	SC	Yes
				No
				Information not available
	C.5.3	If yes, what percentage of the purchased machines?	Open	%
	C.5.4	If yes, what is the average biofuel use per year in litres?	Open	[litres]
	C.5.5	Are the acquired soil improvers being certified by an ecolabel or do they meet the underlying criteria of an ecolabel?	SC	Yes
				No
	C.5.6	If yes, which?	Open	
	C.5.7	Are the following substances being excluded from the purchased products? Peat Sewage sludge	SC	Yes
	C.5.8	Does the acquired product or service comply with other green criteria?	SC	Yes
				No
	C.5.9	If yes, which?	Open	
C6		**Computers (desktops & laptops) and monitors**		
	C.6.1	What is the total amount of money your organisation has spent on computers and monitors during the last fiscal year (in EUR, excluding VAT)?	Open	€
	C.6.1a	Were procurement contracts regarding computer and monitors concluded by your organisation in 2006 or 2007?		Yes
				No

		Green Public Procurement Questionnaire 2008		
		Please answer the following questions for your most recent procurement contract (after January 2006) regarding computers and monitors, with a value of EUR 15.000 or above:		
	C.6.2	Do (part of the) products meet the latest ENERGY STAR standards for energy performance?	SC	Yes
				No
				Information not available
	C.6.3	If yes, what percentage of the purchased products?	Open	%
	C.6.4	Have PCs and notebooks been designed so that: The memory is readily accessible and can be changed? The hard disk and, if available, the CD drive and/or DVD drive, can be changed?	SC	Yes
				No
				Not applicable
	C.6.5	Is the acquired product or service being certified by an ecolabel or does the product or service meet its underlying criteria?	SC	Yes
				No
	C.6.6	If yes, which?	Open	
	C.6.7	Does the acquired product or service comply with other green criteria?	SC	Yes
				No
	C.6.8	If yes, which?	Open	
C7		**Paper**		
	C.7.1	What is the total amount of money your organisation has spent on paper during the last fiscal year (in EUR, excluding VAT)?	Open	€
	C.7.1a	Were procurement contracts regarding paper concluded by your organisation in 2006 or 2007?		Yes
				No
		Please answer the following questions for your most recent procurement contract (after January 2006) regarding paper, with a value of EUR 15.000 or above:		
	C.7.2	Is the acquired product or service being certified by an ecolabel or does the product or service meet its underlying criteria?	SC	Yes
				No
	C.7.3	Has all (recycled) office paper been made from 100% recovered paper fibres?	SC	Yes

		Green Public Procurement Questionnaire 2008		
				No
				Information not available
	C.7.4	If not, what is the %?	Open	%
	C.7.5	Is all paper at least Elementary Chlorine Free (ECF) or Totally Chlorine Free (TCF)?	SC	Yes
				No
				Information not available
	C.7.6	In case of paper based on virgin fibres: do the virgin wood fibres for pulp production come from sustainable management forests?	SC	Yes
				No
				Not applicable
	C.7.7	Does the acquired product or service comply with other green criteria?	SC	Yes
				No
				Information not available
	C.7.8	If yes, which?	Open	
C8		**(Textile) clothing**		
	C.8.1	What is the total amount of money your organisation has spent on clothing during the last fiscal year (in EUR, excluding VAT)?	Open	€
	C.8.1a	Were procurement contracts regarding clothing concluded by your organisation in 2006 or 2007?		Yes
				No
		Please answer the following questions for your most recent procurement contract (after January 2006) regarding clothing with a value of EUR 15.000 or above:		
	C.8.2	Is the acquired product or service being certified by an ecolabel or does the product or service meet its underlying criteria?	SC	Yes
				No
	C.8.3	If yes, which?	Open	
	C.8.4	Do the products meet the ecological criteria relating to the product itself and production processes of the Öko-Tex Standard 100 or EU Ecolabel?	SC	Yes
				No
				Information not available
	C.8.5	Does the acquired product or service comply with other green criteria?	SC	Yes

		Green Public Procurement Questionnaire 2008		
				No
				Information not available
	C.8.6	If yes, which?	Open	
C9		**Passenger cars and light duty vehicles**		
	C.9.1	What is the total amount of money your organisation has spent on passenger cars and light duty vehicles during the last fiscal year (in EUR, excluding VAT)?	Open	€
	C.9.1a	Were procurement contracts regarding passenger cars and light duty vehicles concluded by your organisation in 2006 or 2007?		Yes
				No
		Please answer the following questions for your most recent procurement contract (after January 2006) regarding passenger cars and light duty vehicles, with a value of EUR 50.000 or above:		
	C.9.2	Do (part of) the vehicles comply with the following maximum average CO_2 emissions per vehicle segment: Vehicle segment CO_2 g/km Small car = 120 Compact car = 140 Middle class = 160 Upper middle class = 200 Upper class = 270 Cross-country vehicle = 210 Van = 150 Transporter up to 3.5 Tn maximum permissible mass = 250	SC	Yes
				No
				Information not available
	C.9.3	If yes, what percentage of the purchased vehicles?	Open	%
	C.9.4	Do the purchased vehicles comply with the EURO 5 standard?	SC	Yes
				No
				Information not available
	C.9.5	Does the acquired product or service comply with other green criteria?	SC	Yes
				No
	C.9.6	If yes, which?	Open	
C10		**Office furniture**		
	C.10.1	What is the total amount of money your organisation has spent on office furniture during the last fiscal year (in EUR, excluding VAT)?	Open	€

		Green Public Procurement Questionnaire 2008		
	C.10.1 a	Were procurement contracts regarding office furniture concluded by your organisation in 2006 or 2007?		Yes
				No
		Please answer the following questions for your most recent procurement contract (after January 2006) regarding office furniture, with a value of EUR 15.000 or above:		
	C.10.2	Do all wood and wood-based materials come from legally sourced timber?	SC	Yes
				No
				Not applicable
	C.10.3	Do you purchase plastic furniture?	SC	Yes
				No
				Not applicable
	C.10.4	If yes, what percentage of the purchased products?	Open	%
	C.10.5	Does the solid wood or wood-based materials used come from forests that are verified as being managed so as to implement the principles and measures aimed at ensuring sustainable forest management?	SC	Yes
				No
				Not applicable
	C.10.6	Is the acquired product or service being certified by an ecolabel or does the product or service meet its underlying criteria?	SC	Yes
				No
	C.10.7	If yes, which?	Open	
	C.10.8	Does the acquired product or service comply with other green criteria?	SC	Yes
				No
	C.10.9	If yes, which?	Open	
D		**Round-off**		
		We thank you for filling out this questionnaire. Would you be so kind to provide us with the following feedback information?		
	D.1	How much time did you need to fill out the questionnaire?	Open	[minutes]
	D.2	How difficult was it for you to obtain the information needed to fill out this questionnaire?	SC	It was easy to obtain information needed

Green Public Procurement Questionnaire 2008				
				It was not easy and not difficult to obtain information needed
				It was difficult to obtain information needed
	D.3	Are there any additional remarks you would like to share after filling out this questionnaire?	Open	

Privacy statement

For the questionnaire, the following privacy statement of the European Commission is applicable.

1. Objective of this Questionnaire

The objective of this questionnaire is to measure the level of green procurement by public institutions in the seven best-performing Member States of the EU. Furthermore, it is aimed to calculate the environmental benefits of GPP.

2. What personal information do we collect, for what purpose and through which technical means?

Identification Data
The following data are collected:
Individuals: Name, address, email address, country of residence
Organisation / Institution: Name of the organisation/institution, type of organisation / institution, country where organisation is based

Contact data will serve to identify the respondent for the purpose of the questionnaire and for potential subsequent contacts/mailing lists in relation to the European Commission 'DG Env' GPP Initiative. Other data will facilitate the synthesis and analysis of the responses as it will allow us to categorise the information according to geographical origin or according to the type of organisation. The result of this type of analysis will be rendered anonymous in any published report of the findings of the consultation.

Technical information
The system uses session "cookies" in order to ensure communication between the client and the server. Therefore, your browser must be configured to accept "cookies". However, it does not collect any personal or confidential information of any kind, nor any IP address from your PC. The cookies disappear once the session has been terminated.

3. Who has access to your information and to whom is it disclosed?

The answers will be analysed by DG Environment, Unit G.2: 'Environment and Industry'.
The results of the consultation will be used to inform the preparation of a formal proposal in 2008. Once finalised, the report will be published on the Green Public Procurement web-site of DG Environment. No personal data will be published together with the report.
The European Commission will not share data with third parties for direct marketing.

B Information on public entities per country

This appendix provides, for all 7 countries, more detailed information of the population and the number of public institutions that were selected in the sample, per category of public organisations. These numbers are provided in the tables below.

In the first table we compare the population with the sample and the expected response for all countries together. Out of the total population, 8% are selected to be in the sample. For this sample, we expect an overall response rate of around 20%, resulting in a total of 639 respondents that are expected to fill out the questionnaire.

Regarding the sample size compared to the population size (last column), it is evident that the population size has a very limited influence on the uncertainty. This logically implies that the number of entities in the sample compared to the population is high for the central government and semi-public entities.

If needed, when calculation the levels of GPP, we may apply a correction to the sample proportions to correct for any dominant effects of individual (groups of) respondents. For example, if the proportion of central governmental organisations in the sample population is much higher or lower than in the actual population, the overall figure will need to be corrected for a certain country.

A more detailed overview of the number of organisations in the population and in the sample is provided in table B2.

Table B3 lists the sources that were used to retrieve the number of public institutions in the seven countries.

Table B1 Population compared with sample and expected responses for all 7 countries combined

Type of public institutions	Nr in population	Nr in sample	Conservative response rate assessment	Expected response	sample % of total
Central government	1.290	678	21%	140	53%
Government including ministries	120	116			97%
Governmental agencies & other central bodies	1.170	562			48%
Regional and local government	16.980	1.509	24%	359	9%
Regional government	426	87			20%
Local government	16.554	1.422			9%
Nationwide local and regional bodies	15.537	326	17%	57	2%
Regional institutions	1.096	129			12%
Public administration bodies	1.054	74			7%
Public companies and institutions	13.387	123			1%
Other (semi-public)	1.651	394	21%	83	24%
Other (semi-public)	1.651	380			23%
Total	**35.458**	**2.907**	**22%**	**639**	**8%**

Table B2: Overview of number of organisations in population and in sample, for all seven Member States.

All 7 Member States	Austria		Denmark		Finland		Germany		Netherlands		Sweden		United Kingdom	
Type of public institutions	Nr in population	Nr in sample	Nr in population	Nr in sample	Nr in population	Nr in sample	Nr in population	Nr in sample	Nr in population	Nr in sample	Nr in population	Nr in sample	Nr in population	Nr in sample
Central government	**62**	**62**	**66**	**66**	**115**	**74**	**538**	**138**	**117**	**98**	**300**	**148**	**92**	**92**
Government including ministries	19	19	18	18	14	14	18	18	16	13	14	13	21	21
Governmental agencies & other central bodies	43	43	48	48	101	60	520	120	101	85	286	135	71	71
Regional and local government	**2.366**	**237**	**103**	**103**	**441**	**203**	**12.829**	**232**	**455**	**242**	**332**	**193**	**454**	**299**
Regional government	9	9	5	5	25	25	329	12	12	12	42	20	4	4
Local government	2.357	228	98	98	416	178	12.500	220	443	230	290	173	450	295
Nationwide local and regional bodies	**736**	**45**	**457**	**90**	**2.448**	**60**	**9.008**	**20**	**322**	**52**	**1.691**	**39**	**875**	**20**
Regional institutions	438	15	85	30	260	20	8	8	133	36	109	10	63	10
Public administration bodies	198	15	251	30	577	20	0	0	19	0	9	9	0	0
Public companies and institutions	100	15	121	30	1.611	20	9.000	12	170	16	1.573	20	812	10
Other (semi-public)	**183**	**40**	**82**	**82**	**59**	**50**	**1.009**	**100**	**22**	**22**	**90**	**50**	**206**	**50**
Other (semi-public)	183	40	82	82	59	50	1.009	100	22	8	90	50	206	50
Total	**3.347**	**384**	**708**	**341**	**3.063**	**387**	**23.384**	**490**	**916**	**414**	**2.413**	**430**	**1.627**	**461**

Table B3: Sources of public institutions per country

Country	Source
Austria	www.oesterreich.com/deutsch/staat/index.htm
	www.help.gv.at
	www.austria.gv.at
	Gerhart Holzinger (Die Organisation der Verwaltung)
	www.svb.at
Denmark	www.borger.dk
Finland	www.vn.fi/etusivu/en.jsp
	www.suomi.fi
	www.laaninhallitus.fi/lh
	www.reg.fi
	www.kunnat.net
	www.etusivu.info/Kunnat/
	www.ymparisto.fi
	www.kela.fi
	www.minedu.fi
Germany	www.bund.de
	website of DStGB
	website of German landkreistages
	www.goew.de
	www.museumsbund.de
Netherlands	www.europeseaanbesteding.eu
	www.overheid.nl
	guide gemeentebesturen 2005
Sweden	www.skl.se
	www.statskontoret.se
United Kingdom	www.number-10.gov.uk
	www.civilservice.gov.uk
	www.direct.gov.uk/en/Gtgl1/GuideToGovernment
	www.police.uk/forces.htm
	www.hmcourts-service.gov.uk
	www.universitiesuk.ac.uk

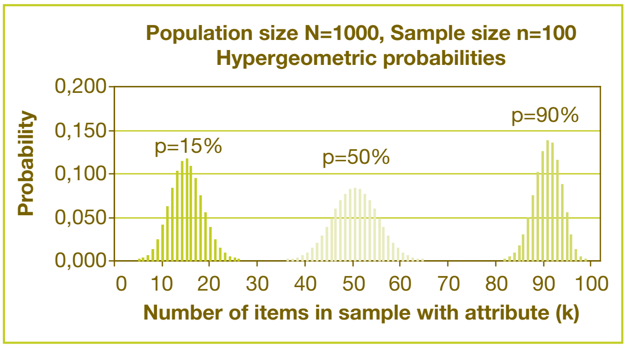
C Statistical details

This appendix gives some background with respect to the relationship between population size, sample size, confidence level and precision level of estimates.

C.1 Sampling distribution

Consider a population consisting of *N* items, e.g. "all government institutions in a country". From this population a random sample is selected, with sample size n. The items in the sample are examined for a specific attribute, e.g. "the last tender for this institution can be categorised as advanced level GPP". Goal of the sample is to make a statement about the number of items in the population that have the same attribute. This latter number of items in the population having the specific attribute is denoted K. Let p denote the percentage of items in the population that has the attribute. This percentage can be calculated as $p = K / N$.

If we assume a fixed level for p or *K*, we are able to calculate the probabilities of the number of items in the sample, containing the attribute. This latter number of items is denoted *k*.
The probabilities are based on the hyper geometric probability distribution.
The following figure shows three examples, assuming a population size of 1.000 and a sample size of 100.

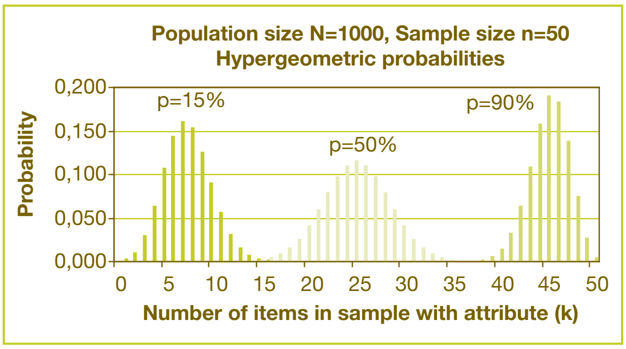


The figure shows the probability distributions for respectively *p*=15% (*K*=150), p=50% (*K*=500) and *p*=90% (*K*=900).

From the figure, it is clear that the variation in the sample outcome is smaller if the percentage of items containing the attribute is close to 0% or 100%. In fact, the variation reaches its maximum for *p*=50%.

C.2 Influence of the sample size

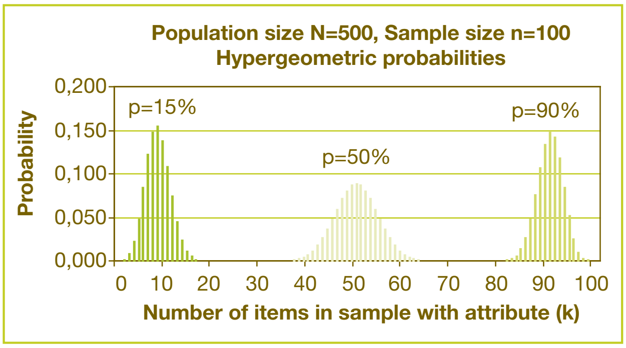
The variation in sample outcome depends on the size of the sample. To give some insight in this relation, the following figure shows the probability distributions for a sample size of 50.
The percentage of items containing the attribute are the same as above, respectively *p*=15% (*K*=150), *p*=50% (*K*=500) and *p*=90% (*K*=900).

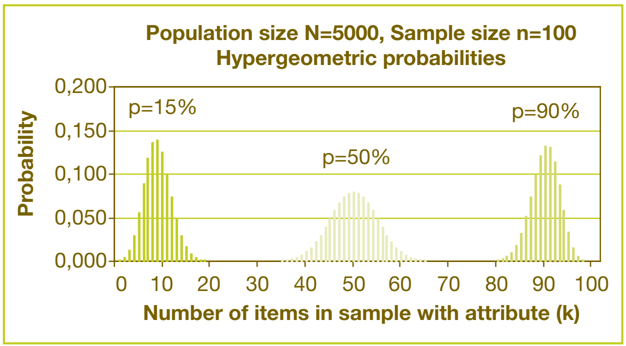


From the figure it can clearly be seen that the variation has been increased as a result of decreasing the sample size. The opposite effect will also hold, as sample size increases, variation decreases and the probability distributions become narrower.

C.3 Influence of the population size

The following figures show the three above mentioned probability distributions, for different population sizes of respectively *N*=500 and *N*=5.000.

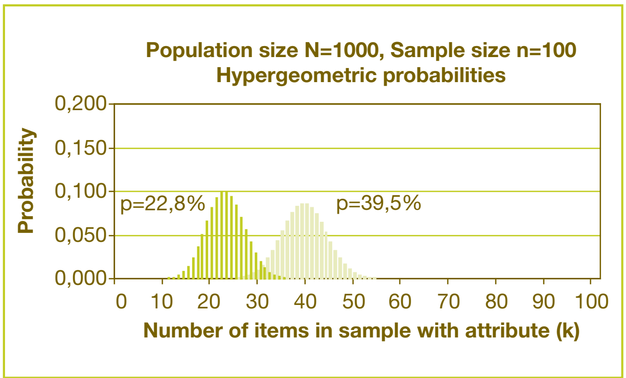




From the figures it is clear that there is no large influence from the population size on the sampling distributions. In general, the smaller the population, the smaller the variation in sample outcome, however, the effect is limited.

C.4 Precision level of estimates

After the sample has been performed and the number of items in the sample containing the attribute has been established, the sampling distribution can be used to calculate precision levels. To demonstrate how this works, we assume an example.
Let the number of items having the attribute (k) in the sample of size 100 be equal to 30.
The best estimate of the number of items in the population containing the attribute (*K*) is equal to $N \cdot k/n$ = 300. The 95% confident upper and lower bound for this estimate can be found by manipulating the sampling distribution. This is demonstrated in the following figure.



The figure above shows two probability distributions. The left hand side distribution assumes that *p*=22,8% or *K*=228. This value of *K* is the largest value for which holds that the probability of *k* being 30 or less is smaller that 2,5%. In other words, for this value of *K*=228, the sample outcome *k*=30 is very unlikely. Reasoning in the opposite direction, for sample outcome *k*=30, the assumption of *i*=228 seems very unlikely. There is only a 2,5% probability that the sampling result *k*=30 occurs when i=228 is true. For this reason, *K*=228 may serve as a lower bound for our estimate.
The upper bound can be derived in the same way, and is represented by the right hand side probability distribution for *K*=395.
The 95% confidence interval for p ranges from 228/1.000 to 395/1.000 or 22,8% to 39,5%. This implies a precision of 39,5% - 22,8% = 16,7%.
A confidence level of 95% is considered a statistical standard, implying a 2,5% tail probability for both the upper and lower bound probability distributions. Hence, if the confidence level increases, this will imply smaller tail probabilities and a wider interval.

C.5 Summary of influences

The following table summarises the main effects from variables on the confidence interval.

Variable	Change	Effect on confidence interval
Population size (*N*)	Increase	Interval becomes slightly wider
	Decrease	Interval becomes slightly smaller
Sample size (*n*)	Increase	Interval becomes smaller
	Decrease	Interval becomes wider
Confidence level	Increase	Interval becomes wider
	Decrease	Interval becomes smaller
Attribute percentage (p)		Largest variation / interval at level *p* = 50%

D Indicator 3 product group tables

In this Appendix for each of the ten products / product groups, we give an overview of:

a) The most relevant parameter of the product and its production process or life cycle for measuring the CO_2 impact,
b) The selected green and non-green products used for calculating the CO_2 ratio,
c) The life cycle phase of these products to which the relevant parameter relates,
d) Remarks on why only certain criteria from the GPP training toolkit have been selected for calculating this indicator. This includes an analysis on why the criterion/criteria are considered relevant for CO_2 impact calculations, and which other criteria are considered to be equally or more relevant when taking into account the overall environmental impact of the product.

D.1 Cleaning products and services

As described in Chapter 1, we take cleaning services (including cleaning products) as a representative product for this product group. Therefore, the calculation of the CO_2 emissions impact and the CO_2 ratios will be based on cleaning services only.

D.1.1 CO_2 emission impact

The non-green product has been identified as a cleaning method using hot water and traditional cleaning products. The core green cleaning product is not to contain any hazardous substances and the comprehensive green cleaning product is identified as a dry-cleaning method using microfiber cloth.

There is no indication that CO_2 emissions are directly related to the use of hazardous substances. In order to determine the relation between hazardous substances and CO_2 emissions one has to perform a complete Life Cycle Analysis, which is out of the scope of this study (see also 3.1.2). At the moment there is no sufficient data available for measuring the CO_2 impact of hazardous substances.

Warm water in the usage phase is identified as the only element of the product group that can be related to CO_2 emissions. The use of warm water during the cleaning process results in the use of energy for water heating. The use of microfiber cloth is a dry-cleaning method; therefore the use of energy and the related emission of CO_2 are lower than those of a wet-cleaning technique.

For the non-green product we assume 10 litres of warm water is needed. In order to know how much energy is needed to raise the temperature of 10 litres of water from 20 °C to 50 °C, we need to know the heat capacity of water. The heat capacity is the amount of Joule that is required to heat one gram of water with one degree. For water the heat capacity is 4,1813 J/(g*K)[34]. To calculate the total amount of energy needed to raise the water temperature with 30 degrees, we multiply the volume of the water (expressed in grams) by the heat capacity of water and by the rise in temperature we want to establish:

$$Q = m*c*\Delta T = 10,0 \times 10^3 g * 4,1813 J/(g*K) * (50-20) = 1,25 MJ.$$

We assume that we make use of natural gas and 90% of the energy in gas is converted to heat. The CO_2 emission of natural gas is 56 kg CO_2/GJ.[35] So the consumption of 1,25 MJ (equals 0,00125 GJ) leads to 1,1 * (0,00125 GJ * 56 kg CO_2/GJ) = 0,077 kg CO_2 emission, which results in a CO_2 emission of 77 gram per 10 litre water. We assume that per square meter (m^2) we need 1 litre of water[36]. This results in a total CO_2 emission of 7,7 g/m^2.

D.1.1.1 CO_2 emission ratio of core green vs. non-green

As the core green cleaning services do not refer to the use of microfiber cloth and therefore, use the same cleaning technique as the non-green cleaning services, and only differ from the non-green product in terms of the cleaning products used (no hazardous substances), the amount of warm water is assumed to be the same as for the non-green cleaning services. This means that the CO_2 emission of the core green cleaning services is also 7,7 grams per m^2, which leads to a CO_2 emission ratio between core green and non-green cleaning services of 1.

D.1.1.2 CO_2 emission ratio of comprehensive green vs. non-green

For the use of dry microfiber cloth, no warm water is needed. In case the microfiber cloths are used with water, cold water is used. We therefore assume that the CO_2 emission for the use of the comprehensive green cleaning services is 0 grams CO_2 per m^2, which means that the CO_2 emissions ratio between the comprehensive green and non-green cleaning services is 0.

D.1.1.3 CO_2 emission impact of GPP per m^2 cleaned office space

Based on the above calculations, the ratios in the table below were used for our analysis. The ratio between non-green and core green equals 1, which means that the CO_2 emission related to the core green product are the same as the CO_2 emissions of the non-green product. The ratio between non-green and comprehensive green equals 0, which means that the CO_2 emission related to the comprehensive green product is 0% of the CO_2 emission of the non-green product.

34 Zakboek basiskennis voor technici, PBNA (1999)

35 International Energy Agency, CO_2 emissions from fuel combustion 1972-1995, OECD/IEA (1997)

36 Established in a workshop with Ecofys, Significant, PwC, 2008

Table D1: CO_2 ratios per functional unit of GPP for cleaning services

Cleaning products and services		
Cleaning services (incl. cleaning products)		
CO_2 impact	CO_2 ratios	
Relevant indicator	core / non-green	compr. / non-green
heating water	1,00	0,00

D.1.2 Suggestions for further research

The key environmental impacts of the product group Cleaning products and services, as described in the EC GPP Training Toolkit[37], are:

- Air pollution, ozone formation (smog), bioaccumulation or food chain exposure and hazardous effects on aquatic organisms or the increased growth of undesirable aquatic organisms, which can degrade water quality due to the use of certain substances within cleaning agents;
- Negative impact on the occupational health of employees due to the use of certain cleaning agents that contain solvents classified as harmful to health;
- Generation of waste through packaging.

As can be concluded from the fact that CO_2 emissions are not mentioned in the Toolkit related to cleaning services, CO_2 emissions are not the most relevant environmental impact of cleaning services. We therefore recommend for further research to also take into account the use of hazardous substances as a relevant environmental impact from cleaning services, as well as a review of the impact on the health of employees and of the use of non-reusable packaging.

37 http://ec.europa.eu/environment/gpp/toolkit_en.htm

D.2 Construction

As described in Chapter 1, we take new buildings and offices as a representative product for this product group. Therefore, the calculation of the CO_2 impact and the CO_2 ratios will be based on new buildings and offices only.

D.2.1 CO_2 emission impact

A large number of CO_2 -related indicators were identified for this product group. Some of them require too much additional research given the scope of this study, nevertheless an overview is given:

1. Energy demand. The energy demand of a building can be related to CO_2 emissions. However since this criterion specifically relates to the overall energy demand, exact measures of all energy demanding activities of a building are needed to calculate the overall CO_2 impact. To estimate figures of energy use of new buildings one needs the following figures:
    a. Geometry of a reference building (preferably country specific)
    b. Insulation standard per country for office buildings (depending on building regulations)
    c. Kind of energy supply per country (e.g. most often used concept)
    d. Standard usage pattern (times of use, internal gains etc.)
    e. Average climate conditions per country. Considering the level of detail of the data required from the respondent, only some of these figures are used in our calculation for the CO_2 impact of buildings. Details of the calculation method follow below.
2. Hazardous substances. Of all hazardous substances mentioned, HFC is the most relevant for the calculation of CO_2 emissions of buildings. To calculate the CO_2 emissions related to HFC we need to know how much insulation foam is used in buildings and which part has been manufactured using HFC. The measurement of a reference per m^2 is very complex. At the moment we do not have sufficient data available to estimate the average use of HFC in/for constructing a building is. Considering the scope of this study we therefore do not relate the CO_2 impact of GPP on construction to the use of hazardous substances, in particular HFC.
3. Timber. When translated into CO_2 emissions, no direct distinction can be made between legal/illegal timber. Legal timber, included as a green criterion in the survey (GPP Toolkit selection criterion), does not necessarily mean that the timber is sustainably managed. Timber from sustainably managed forests does imply an indirect CO_2 emissions reduction because of the recovered CO_2 storage by replanting trees. (see also section D.7 Paper) The criterion 'sustainably managed timber' (GPP Toolkit award criterion) however was not included in the questionnaire for construction and can therefore not be used in the CO_2 impact calculation.
4. Localised renewable sources. The presence of localised renewable energy sources (l-RES) is relevant for the calculation of CO_2 emissions. L-RES means renewable energy source generating capacity within the building site itself (e.g. solar panels, biomass boilers, wind turbines etc.). We use this criterion for the calculation of the comprehensive green CO_2 indicator by calculating the CO_2 emissions for buildings including a photovoltaic (PV) system. A photovoltaic system is a system which uses solar cells to convert light into electricity.
5. Transport. CO_2 emissions resulting from the transportation of construction materials and products are relevant. We do not use this criterion because the complex calculation for transportation is beyond the scope of this study.

Taking into account the above mentioned considerations, we have based the calculation of a green and non-green product in the product group construction on the yearly CO_2 emissions of an average office building related to the yearly CO_2 emissions of an energy efficient office building in the usage phase of offices. The calculation focuses on CO_2 emissions resulting from electricity and heating/cooling (energy demand and l-RES). The CO_2 emission is country specific as every country has a different standard fuel mix with a characteristic CO_2 emission. Distinction is made between core green and comprehensive green new buildings and offices.

The CO_2 emission of the non-green product is related to the energy consumption of a standard office building (260 $kWh_{primary}/m^2/year$[34, 35]). This is divided in 80 $kWh_{primary}$ for heating and warm water and 180 $kWh_{primary}$ for electricity.

34 Bine Informationsdienst Energieeffizientes Bürogebäude

35 For these calculations we use Germany as the baseline country. Sweden and Finland belong to different climatic region (cold) than Germany, Netherlands, UK, Denmark and Austria (moderate). Although Sweden and Finland have more degree days, the cooling demand is much lower. Therefore we assume the energy demand is almost equal for all the participating countries.

The total amount of energy finally consumed for electricity consumption (final energy demand) is lower than the energy that needs to be produced (primary energy demand) to deliver the desired amount of electricity. The primary efficiency factor for Germany[36] is used to convert the primary energy demand of electricity into the final energy demand. In Table D.2 below this is reflected in the following numbers: the primary energy demand per m^2 per year of a non-green office building is 180 kWh. The final energy demand will be only 38,6% of that amount, which equals 180 * 38,6% = 69,48 kWh/m^2/a.

The CO_2 emission related to this energy consumption is based on the country specific mix of energy sources.[37] As every country uses different combinations of energy sources for their standard production of electricity, different amounts of CO_2 are emitted per produced kWh. These numbers are also presented in the table below. For example for Germany the CO_2 emission caused by the consumption of 69,48 kWh of electricity, equals 69,48 kWh * 517 g/kWh = 35,921 g CO_2, which equals 35,9 kg CO_2/m^2/a for electricity use. This calculation is done for all countries, based on the CO_2 emissions per kWh of their standard fuel mix.[38]

Finally, the yearly CO_2 emissions for electricity are calculated by multiplying this amount by the average amount of m^2 per office building, so for Germany: 35,9 kg CO_2/m^2/a * 5.239 m^2 = 188.190 kg CO_2/a, which equals 188 tons of CO_2 per year.

As for the calculation of CO_2 emission due to gas consumption for heating purposes, the conversion factor for gas is used to convert the primary heat demand in kWh per square meter per year into CO_2 emission in ton CO_2 per year. The CO_2 emission of natural gas is 56 kg CO_2/GJ.[39] To calculate the CO_2 emission we take the energy demand (80 kWh/m^2/a) expressed in GigaJoule, 80 kWh / 278 kWh/GJ = 0,29 GJ/m^2/a[40] and multiply it by the amount of CO_2 emitted per GJ: 0,29 GJ/m^2/a * 56 kg CO_2/GJ = 16,11 kg CO_2/m^2/a. Finally we multiply this by the number of square meters of an average office building: 16,24 kg CO_2/m^2/a * 5239 m^2 = 85 ton CO_2/a.

The results per country of the calculation of the CO_2 emission of a non-green building are demonstrated in the table below:

Table D2: CO_2 emission of a non-green building

heating		total kWh primary/m^2/a		total GJ/m^2/a	kg CO_2/GJ	g CO_2/m^2/a	average office (m^2)	ton CO_2	total ton CO_2
		80		0,28777	56	16115	5239	84	84
electricity		total kWh primary/m^2/a	conversion form primary in final	kWh final/m^2/a	g CO_2/kWh	kg CO_2/m^2/a	average office (m^2)	ton CO_2	
	Austria	180	0,386	69,48	205	14	5239	75	159
	Denmark	180	38,60%	69,48	334	23	5239	122	206
	Finland	180	38,60%	69,48	253	18	5239	92	177
	Germany	180	38,60%	69,48	517	36	5239	188	273
	Netherlands	180	38,60%	69,48	440	31	5239	160	245
	Sweden	180	38,60%	69,48	44	3	5239	16	100
	UK	180	38,60%	69,48	455	32	5239	166	250
sum		**260**							

36 IEA, Energy Efficiency Indicators for Public Electricity Production from Fossil Fuels, table: Efficiency of Electricity Production from all Fossil Fuels in Public Electricity and CHP Plants, Average 2001-2005, 2008.

37 Changement climatique et électricité. Facteur Carbone européen. Comparaison des émissions de CO_2 des principaux électriciens européens", de PWC et ENERPRESSE, novembre 2005 (données pour année 2004)

38 See Glossary of terms

39 International Energy Agency, CO_2 emissions from fuel combustion 1972-1995, OECD/IEA (1997)

40 http://bioenergy.ornl.gov/papers/misc/energy_conv.html

D.2.1.1 CO_2 emission ratio of core green vs. non-green

The CO_2 emission of a green product is related to the energy consumption of an energy efficient office (75 $kWh_{primary}/m^2/year$[41],[42]). This is divided in 30 $kWh_{primary}$ for heating and warm water and 45 $kWh_{primary}$ for electricity. The same calculations as above are used to determine the CO_2 emissions per country of a core green new building / office, the results of which are demonstrated in the table below:

Table D3: CO_2 emission of a core green building

heating		total kWh primary/m²/a		total GJ/m²/a	kg CO_2/GJ	g CO_2/m²/a	average office (m²)	ton CO_2	total ton CO_2
		30		0,11	56	6160	5239	32	32
electricity		total kWh primary/m²/a	conversion form primary in final	kWh final/m²/a	g CO_2/kWh	kg CO_2/m²/a	average office (m²)	ton CO_2	
	Austria	45	0,386	17,37	205	4	5239	19	51
	Denmark	45	38,60%	17,37	334	6		30	63
	Finland	45	38,60%	17,37	253	4		23	55
	Germany	45	38,60%	17,37	517	9		47	79
	Netherlands	45	38,60%	17,37	440	8		40	72
	Sweden	45	38,60%	17,37	44	1		4	36
	UK	45	38,60%	17,37	455	8		41	74
sum		**75**							

41 Bine Informationsdienst Energieeffizientes Bürogebäude

42 Sweden and Finland belong to another climatic region (cold) unlike Germany, Netherlands, UK, Denmark and Austria (moderate). Although Sweden and Finland have more degree days, the cooling demand is much lower. Therefore we assume the energy demand is almost equal for all the participating countries.

D.2.1.2 CO_2 emission ratio of comprehensive green vs. non-green

Above we have calculated the core green version of an office building. To distinguish between core and comprehensive we add a photovoltaic system of 50 m^2 to the green comprehensive building whereas the core green building has no PV system. A PV system is a system which uses solar cells to convert light into electricity and is considered a localised renewable energy source (l-RES) as mentioned in the award criteria for comprehensive green construction of the GPP Toolkit. The maximum yield of a photovoltaic energy is 112 $kWh/m^2/a$[43]. The results of the calculation of the CO_2 emission per country of a comprehensive green building are demonstrated in the table below:

Table D4: CO_2 emission of a comprehensive green building

heating		total kWh primary/m^2/a		total GJ/m^2/a	kg CO_2/GJ	g CO_2/m^2/a	average office (m^2)	ton CO_2	total ton CO_2
		30		0,11	56	6043	5239	32	32
electricity		total kWh primary/m^2/a	conversion form primary in final	kWh final/m^2/a	MWh final (office of 5239 m^2)	net consumption (minus yield PV-system)	g CO_2/kWh	ton CO_2	ton CO_2
	Austria	45	0,386	17,37	91	85	205	17	49
	Denmark	45	38,60%	17,37	91	85	334	28	60
	Finland	45	38,60%	17,37	91	85	253	22	53
	Germany	45	38,60%	17,37	91	85	517	44	76
	Netherlands	45	38,60%	17,37	91	85	440	37	69
	Sweden	45	38,60%	17,37	91	85	44	4	35
	UK	45	38,60%	17,37	91	85	455	39	70
sum		**75**							

43 Ecofys, 2008.

D.2.1.3 CO_2 emission impact of GPP per office building

We can summarise the above in the following table:

Table D5: CO_2 emissions per functional unit of GPP for construction

Construction - *New offices and buildings*			
Country	CO_2 emissions in ton CO_2 per year		
	non-green	core green	compr. green
Austria	159	51	49
Denmark	206	63	60
Finland	177	55	53
Germany	273	79	76
Netherlands	245	72	69
Sweden	100	36	35
UK	250	74	70

The CO_2 emission ratios per country for the product group Construction are shown in Table D6 below. As we can see in Germany, for example, the ratio of CO_2 emissions between a non-green building and a comprehensive green building is 0,28.

Table D6: CO_2 ratios and environmental impact per functional unit of GPP for construction

Construction - *New offices and buildings*		
Country	CO_2 ratios	
	core / non-green	compr. / non-green
Austria	0,32	0,31
Denmark	0,30	0,29
Finland	0,31	0,30
Germany	0,29	0,28
Netherlands	0,30	0,28
Sweden	0,36	0,35
UK	0,29	0,28

D.2.2 Suggestions for further research

Although CO_2 emissions as a result of the use of electricity and heating/cooling in the usage phase account for a very important part of the environmental impact of new buildings and offices, there are other elements in this context that could be considered. Following the GPP Training Toolkit, the following are the most important elements would be:

- The consumption of natural resources;
- The consumption of fresh water (in the construction and the usage phase);
- Emission of substances harmful to human health and the environment during the production or disposal of building materials leading to air and water pollution;
- Negative health impacts on building users due to building materials containing hazardous substances;
- CO_2 emissions resulting from the transportation of construction materials and products.

D.3 Electricity

For the product group Electricity there is only one relevant product, which is the electricity itself. As a result of differences in the fuel mix per country, we have chosen to look at the CO_2 impact of GPP for electricity at a country specific level in the production phase of the life cycle.

D.3.1 CO_2 emission impact

The calculation of a green and non-green product in the product group 'electricity' is based on the CO_2 emission from power generation. **The CO_2 emission is country-specific.** Distinction is made between core and comprehensive levels of green electricity.

For the non-green product we look at the standard country-specific mix of energy sources used by a country to produce electricity. We use this for the calculation of the CO_2 emission of electricity. The numbers below represent the amount of CO_2 emitted per kWh of produced electricity, bearing in mind that for example Sweden uses a relatively large amount of hydropower to produce electricity. As the use of hydropower to produce electricity does not emit much CO_2 , the overall CO_2 emission for Sweden is low. The CO_2 emission per kWh of the standard fuel mix per country is mentioned in the table below.[34]

Table D7: CO_2 emissions of the conventional energy mix per country[36]

CO_2 emissions	
Country	Gram CO_2/kWh
Austria	205
Denmark	334
Finland	253
Germany	517
Netherlands	440
Sweden	44
UK	455

D.3.1.1 CO_2 emission ratio of core green vs. non-green

The core green product consists of at least 50% electricity produced from renewable energy sources. We define renewable energy as electricity that is generated in plants that only use renewable energy sources (wind, solar, geothermal, wave, tidal, hydropower, biomass, landfill gas, sewage treatment plant gas and biogases), as well as the proportion of electricity produced from renewable energy sources in hybrid plants also using conventional energy sources and including renewable electricity used for filling storage systems, and excluding electricity produced as a result of storage systems[35].

To calculate the CO_2 emission of a core green product we take the CO_2 emission of the non-green product, and subtract the CO_2 emission of the non-green product multiplied by the difference between the level of RES-E in the standard fuel mix of the country and 50% (the requirement for the core green product).

For the Netherlands for example this means: 440 – 440 * (50%-5,4%) = 243 g CO_2/kWh.
The emissions of the other countries are specified in Table D8 below:

Table D8: CO_2 emissions of core green product

CO_2 emission of core green product			
Countries	% RES-E in conventional mix	Non-green	Core green
		g/kWh	g/kWh
Austria	65,0%	205	205
Denmark	24,4%	334	248
Finland	29,3%	253	201
Germany	9,2%	517	306
Netherlands	5,4%	440	243
Sweden	45,8%	44	42
UK	3,4%	455	252

34 Although we look at the usage phase of electricity the numbers presented in Table D7 refer to the emissions per kWh of the production of electricity. It was not possible to find CO_2 emission numbers on the country specific mixes at the consumption end, but from the percentages RES-E in the mix at the production stage and the consumption stage we know that the numbers are comparable.

35 GPP product sheet for electricity.

36 Changement climatique et électricité. Facteur Carbone européen. Comparaison des émissions de CO_2 des principaux électriciens européens", de PWC et ENERPRESSE, novembre 2005 (données pour année 2004)

D.3.1.2 CO_2 emission ratio of comprehensive green vs. non-green

The comprehensive green product consists of 100% electricity supplied from renewable energy sources. As we look at the usage phase of electricity, we assume that the CO_2 emission of a comprehensive green product in the production phase is 0 g/kWh. This means that all countries have 0 g/kWh for their comprehensive products:

Table D9: CO_2 emissions of comprehensive green product

CO_2 emission of comprehensive product			
Countries	% RES-E in conventional mix	Non-green	Core green
		g/kWh	g/kWh
Austria	65,0%	205	0
Denmark	24,4%	334	0
Finland	29,3%	253	0
Germany	9,2%	517	0
Netherlands	5,4%	440	0
Sweden	45,8%	44	0
UK	3,4%	455	0

D.3.1.3 CO_2 emission impact of GPP per kWh

Having calculated the CO_2 emission per country for the core green product, and assuming that the emission is 0 for the comprehensive product, we can calculate the CO_2 emission ratio between the non-green and core and comprehensive products. For the core green product, the ratio is the outcome of the division of the emission of the core green product by the non-green product. For example for Denmark: 248 g/kWh (for the core green product) / 334 g/kWh (for the non-green product) = 0,74. This ratio means that the core green product in the case of Denmark emits 74% of the CO_2/kWh of the non-green product. As in Austria the standard country-specific mix consist for more than 50% of RES-E, the non-green product is actually a core green product. This means that the CO_2 emissions are equal for the 'non-green' and core-green product, which results into a ratio of 1.

As for the ratios between the non-green product and the comprehensive green product, as in all countries, 100% RES-E would mean no CO_2 emissions, in other words, the emission is always 0% of the non-green emission, the ratio is always 0.

The results of the above calculations for the other countries are summarised in the table below:

Table D10: CO_2 ratios per functional unit of GPP for electricity

Electricity - *Electricity*		
Country	CO_2 ratios	
	core / non-green	compr. / non-green
Austria	1,00	0,00
Denmark	0,74	0,00
Finland	0,79	0,00
Germany	0,59	0,00
Netherlands	0,55	0,00
Sweden	0,95	0,00
UK	0,55	0,00

D.3.2 Suggestions for further research

Although CO_2 emissions are the most influential in terms of environmental impact when looking at electricity, as the GPP Training Toolkit suggests there are other factors to consider when looking at electricity. The most important ones are:

- Impact on human health, bio-diversity and water resources due to the acquisition of materials, i.e. mining (coal) and drilling (oil), and waste treatment;
- Exploitation of finite fossil fuel resources;
- Risk of rising CO_2 emissions related to the use biomass;
- Impact on river eco-systems and local populations due to hydropower schemes;

Limited impact on CO_2 reduction of Combined Heat and Power based on non-renewable energy sources.

D.4 Catering & food

As described in Chapter 1, we take catering services (including food) as a representative product for this product group. Therefore, the calculation of the CO_2 and the CO_2 ratios will be based on catering services only.

D.4.1 CO_2 emission impact

The consumption of seasonal fruit and vegetables and fish (in particular in terms of treatment and transport) was identified as being relevant for the calculation of CO_2 emission for this product group. However, this calculation is very complex, for the non-organic production as well as for the organic production of food: the CO_2 emissions of seasonal products depend on the type of fertilisers, energy use and harvesting methods per product. Currently there is no data available to make these exact calculations, and it is therefore out of the scope of this study to make this analysis.

The calculation of the CO_2 impact in the product group catering and food is based on the CO_2 emissions of an average lunch in the of raw material acquisition phase of an organic compared to a non-organic lunch. Rather than looking at the direct CO_2 emissions related to the energy consumption in the raw material acquisition phase, we base our calculations for the non-green product on a study that considers the indirect CO_2 emissions in the raw material acquisition phase. With indirect CO_2 emissions we mean the CO_2 that could theoretically have been stored by trees on the number of hectares of land needed for the production of the food products, in other words lost CO_2 storage. This approach was proposed by the Institute for Applied Environmental Economics in their study “Global Footprint for Companies”[34]. The reason for not using direct CO_2 emissions is that the numbers needed for this calculation differ strongly per country, per product and even per supplier, depending on climate conditions, type of machinery used, type of fertilizers used etc. The huge amount of assumptions would make the numbers too unreliable to be used for this analysis.

We assume that an average non-green lunch consists of 1 glass of milk, 2 pieces of bread, 2 portions of butter, 2 slices of meat, 2 slices of cheese, 1 cup of salad and 1 cup of soup[35]. For the calculation of this non-green product we also used the figures in the study “Global Footprint for Companies”. In this study the global footprint of food is calculated as a result of the spatial occupation in m^2/kg (or litre) and the indirect energy usages in MJ/kg (or litre). This results in a global footprint of 5,42 m^2, see also Table D11 below:

Table D11: Global footprint of non-green lunch

Non-green lunch			
average composition	entity	m^2/kg	total (m^2)
1 glass of milk	200 ml/glass	1,94	0,39
2 slices of bread	33,33 g/slice	2,72	0,18
1 portion of butter	10 g/portion	25,64	0,26
2 slices of meat	16,67 g/slice	71,77	2,39
2 slices of cheese	20 g/slice	18,86	0,75
1 bowl of salad	50 g/bowl	10,11	0,51
1 cup of soup	200 ml/cup	4,72	0,94
total			**5,42**

To stipulate the global footprint, the CO_2-emissions are converted into hectares. The assumption is that CO_2 is fixed in biomass (e.g. a forest). This is to say that if the calculated hectares of land had not been used for the purpose of providing food, that land could have been covered in trees that store CO_2. Wackernagel et al. (2000) assume an average CO_2-fixation of 5,26 ton/ha[36]. This is equal to 0,19 ha/kg CO_2.

The spatial occupation and the indirect energy use of one average lunch (5,42 m^2) multiplied with the global footprint (0,19 ha/kg CO_2) results in 103 g CO_2 for a non-green lunch.

34 Instituut voor Toegepaste Milieu-economie (TME), Mondiale voetafdruk voor bedrijven, 2003. The source which is used in this study is “Groen Kookboek” van RUG/IVEM Gerbens-Leenes, P.W., 2000, appendix A1 indirect ruimte- en energiebeslag per levensmiddel.

35 Catering services at Ecofys office, 2008.

36 Instituut voor Toegepaste Milieu-economie (TME), Mondiale voetafdruk voor bedrijven, 2003. The source which is used in this study is Wackernagel, Mathis, Nocky Chambers and Craig Simmons, “Sharing Natures Interest, Ecologal Footprints as an Indicator of Sustainability”, Oxford/Oackland, August 2000 p.94.

D.4.1.1 CO_2 emission ratio of core green vs. non-green

Although a methodology was found to calculate the indirect CO_2 emissions of an average lunch in the raw material phase, according to the Institute for Applied Environmental Economics (TME) this methodology cannot be used for making a distinction between organic (core green) and non-organic (non-green) lunches. "Given the methodology of calculating the footprint (with global converting factors) it does not matter whether organic or non-organic products are bought"[37]. Therefore, by using this methodology, the CO_2 emissions calculation for a core green (organic) product is equal to that of the non-green (non-organic) product[38].

Table D12: CO_2 emission of core green lunch

CO_2 emission per lunch	
product	Emission
non-green lunch	103 g CO_2/lunch
core green lunch	103 g CO_2/lunch

Table D13: CO_2 emission of comprehensive green lunch

CO_2 emission per lunch	
product	emission
non-green lunch	103 g CO_2/lunch
comprehensive green lunch	103 g CO_2/lunch

D.4.1.2 CO_2 emission impact of GPP per lunch

From the above calculations we conclude that the CO_2 emissions are not affected by the consumption of a core or comprehensive green lunch. The ratios are therefore 1, as shown in Table D14 below:

Table D14: CO_2 ratios per functional unit of GPP for catering

Catering & food - *Catering services (including food)*		
CO_2 impact	CO_2 ratios	
	core / non-green	compr. / non-green
raw material acquisition	1,00	1,00

D.4.2 Suggestions for further research

As we have seen, in terms of CO_2 emissions the green and non-green versions of this product do not differ from one another when calculated in terms of lost CO_2 storage. When using a more extensive method for calculating CO_2 emissions related to catering and food, and using different criteria for distinguishing between non green, core green and comprehensive green (focusing for instance on the type of products consumed, such as vegetables compared to meat) comparing other types of lunches with each other, different conclusions could be drawn. For example replacing meat with vegetable products will reduce the climate footprint enormously[39], as will using locally produced products.

Many other aspects of this product group are to be considered important from the perspective of the environment. Choosing the organic product over the non-organic product is preferred as more natural products and less products containing hazardous substances are used.

So besides looking at lost CO_2 storage in the raw material acquisition phase of food, valuable research could be done with regard to catering services, by considering the following issues:

37 Instituut voor Toegepaste Milieu-economie (TME), Mondiale voetafdruk voor bedrijven, 2003. p.5.

38 Although the calculation of the direct CO_2 emissions would make a distinction between organic and non-organic lunches possible, the huge amount of assumptions would make the numbers too unreliable to be used for this analysis.

39 The meat sector is responsible for 18% of the worldwide CO_2 emission (according to the FAO) due to deforestation, manure and digestion of the ruminants. The footprint of vegetable products is consequently many times lower than animal products (Centre for energy and environment impact of the University of Groningen, research report 103a)

- Occupational health and safety of farmers producing food products, as well as kitchen personnel processing food products and cleaning the workspace;
- Environmental damage caused by intensive agricultural activity, fishing and animal production as well as cleaning of the workspace;
- Waste generation through packaging;
- High energy and water consumption in food production as well as processing;
- CO_2 emissions related to transport of raw materials as well as food products. [40]
- Insight in the CO_2 equivalents related to the raw materials acquisition as well as the production and transport of food should also be considered.

By means of an example that indicates the CO_2 impact of meat and dairy we have made the calculation for a lunch without meat and dairy products. In this example we assume that the lunch contains no dairy or meat products. The lunch consists of 1 cup of tea, 2 pieces of bread, 1 portion of jam, 1 bowl of salad and 1 cup of soup. For the calculation of this green product we used also the figures in the "Global Footprint for Companies" conducted by the Institute of Applied Environmental Economics.[41] This results in 1,88 m^2:

Table D15: Global footprint of a lunch without meat and dairy

Green lunch			
average composition	entity	m^2/kg	total (m^2)
1 cup of tea	200 ml/glass	0,72	0,14
2 pieces of bread	33,33 g/piece	2,71	0,18
2 portion of jam	10 g/sandwich	5,36	0,11
1 bowl of salad	50 g/cup	10,11	0,51
1 cup of soup	200 ml/cup	4,72	0,94
Sum			1,88

To stipulate the global footprint, the CO_2-emissions are converted into hectares. The assumption is that CO_2 is fixed in biomass (e.g. a forest). This is to say that if the calculated hectares of land had not been used for the purpose of providing food, that land could have been covered in trees that store CO_2. Wackernagel et al (2000) already assume an average CO_2-fixation of 5,26 ton/ha[42]. This is equal to 0,19 ha/kg CO_2.

The spatial occupation and the indirect energy use of one average lunch (1,88 m^2) multiplied with the global footprint (0,19 ha/kg CO_2) results in 36 g CO_2. The advice is to stimulate purchasers to purchase more alternatives for meat and dairy products.

40 http://ec.europa.eu/environment/gpp/toolkit_en.htm

41 Instituut voor Toegepaste Milieu-economie (TME), Mondiale voetafdruk voor bedrijven, 2003. The source which is used in this study is "Groen Kookboek" van RUG/IVEM Gerbens-Leenes, P.W., 2000, appendix A1indirect ruimte- en energiebeslag per levensmiddel.

42 Instituut voor Toegepaste Milieu-economie (TME), Mondiale voetafdruk voor bedrijven, 2003. The source which is used in this study is Wackernagel, Mathis, Nocky Chambers and Craig Simmons, "Sharing Natures Interest, Ecologal Footprints as an Indicator of Sustainability", Oxford/Oackland, August 2000 p.94).

D.5 Gardening

As described in Chapter 1, we take gardening services and machinery as a representative product for this product group. Therefore, the calculation of the CO_2 impact and the CO_2 ratios will be based on gardening services and machinery only.

D.5.1 CO_2 emission impact

The fuel type of gardening machines is relevant for calculation of its CO_2 emissions. However, different fuel types have different CO_2 emissions and a high level of detailed information is required from the respondents in order to have all the relevant data for calculating indicator 3. Therefore, this criterion is not used in our calculation for the CO_2 impact of gardening.

The calculation of a green and non-green product in the product group gardening services is based on the CO_2 emissions related to the use of peat as fertiliser in the usage phase. The avoidance of peat is considered the most relevant indicator for calculating the CO_2 impact in this study as peat stores CO_2 in the growing phase.

For the non-green product we take peat as fertiliser. The amount of carbon in peat depends on the quality of peat. Peat that contains sufficient nutrients to be used for fertilisation purposes contains between 240 and 260 kg C/m^3 peat respectively[34]. The average amount is (240 + 260 / 2) = 250 kg C/m^3 peat.

The conversion factor for C to CO_2 is 22/6.[35] With this information the amount of CO_2 in peat can be calculated: 250 kg C/m^3 peat * 22/6 CO_2/C = 917 kg CO_2/m^3 peat.

D.5.1.1 CO_2 emission ratio of core and comprehensive green vs. non-green

For both the core and comprehensive green products we assume no peat, but instead the necessary amount (to enrich the quality of the soil) of food waste is used as fertiliser. The CO_2 emission for both green products is 0 kg CO_2/m^3 peat, which is represented in the table below:

Table D16: CO_2 emission per m^3 peat

CO_2 emission per m^3 peat	
product	emission (kg CO_2/m^3 peat)
non-green	917
core / compr. green	0,0

D.5.1.2 CO_2 emission impact of GPP per m^3

From the above we can conclude that the ratios of CO_2 emissions are the same for core and comprehensive green products and equal 0, as no CO_2 is emitted by the core and comprehensive green products compared to the non-green product. This means that the CO_2 emission related to the core green as well as the comprehensive green product is 0% of the CO_2 emission of the non-green product. In other words the impact of a green product compared to the non-green product is 100%. This is shown in Table D17:

Table D17: CO_2 ratios per functional unit of GPP for catering

Gardening - *Gardening services and machinery*		
CO_2 impact	CO_2 ratios	
	core / non-green	compr. / non-green
peat as fertilizer	0,00	0,00

D.5.2 Suggestions for further research

Besides considering the impact of CO_2 emissions when looking at the product group gardening, in line with the GPP Training Toolkit we suggest the following aspects also be taken into account in further research:

- Negative effects on the environment as a consequence of the inappropriate use herbicides and fertilisers and the use of toxic lubricant oils;
- The use of non-renewable resources;
- Waste generation;
- Environmental impacts during the production of ornamental plants
- Noise and atmospheric pollution from gardening machinery.[36]

34 IPCC guideline: www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_07_Ch7_Wetlands.pdf
35 This is the weight ratio of the weight of a CO_2 molecule and a C atom (Table of Mendeljev).
36 http://ec.europa.eu/environment/gpp/toolkit_en.htm

D.6 Office IT equipment

As described in Chapter 1, we take computers (desktops & laptops) and monitors as representative products for this product group. Therefore, the calculation of the CO_2 emissions and the CO_2 emission ratios will be based on computers and monitors only.

D.6.1 CO_2 emission impact

CO_2 emissions related to the usage phase of office IT equipment play a role in two settings. First it is important to consider the life time of a computer. The life of a computer is extended by providing that the memory is readily accessible and can be changed and the hard disk and, if available, the CD drive and/or DVD drive, can be changed (easily). However, calculation of CO_2 emission as a result of longer life of a computer is complicated. Assumptions have to be made concerning the composition and the CO_2 emissions of the materials. Also the effect of conservation of the PC (in case of replacing a small part) should be taken into account. The use of this criterion is therefore out of the scope of this study.

Secondly, the energy consumption of office IT equipment during use also plays a major role in terms of CO_2 emissions. The calculation of the CO_2 emission of a green and non-green product in the product group office IT equipment is based on the yearly CO_2 emission related to the use of electricity in the usage phase of a computer including a monitor and the yearly CO_2 emission related to the use of electricity in the usage phase of a laptop. Only a core green product was chosen because the distinctions between both levels of GPP criteria are not relevant for the calculation of CO_2 .

The emission of the non-green product is related to the average of electricity use in three modes (On / Idle mode, Stand-by and Off mode) of desktops, laptops and monitors using average values for computers, laptops and monitors. The emission of the green product is related to the average electricity use in three modes of Energy Star (version 4.0) labelled desktops and laptops.[34] As the Energy Star label no longer really distinguishes monitors from one another as LCD/TFT monitors are all relatively energy efficient, we set the power consumption for monitors at the same level as for non-green.[35]

D.6.1.1 CO_2 emission ratio of core green vs. non-green

The CO_2 emissions of the above described products are summarised in Table D18.

34 Jönbrinck and Zackrisson (2007) in Costs and Benefits of Green Public Procurement in Europe. Part 1: Comparison of the Life Cycle Costs of Green and Non-green Products. Öko-Institut e.v. and ICLEI, July 2007.

35 See also Öko-Institut and ICLEI (2007), page 114-115

Table D18 Power consumption ratios in usage phase[37]:

		No. of hours in mode	Power Consumption in Watt				Difference	
			non-green version		green version			
			Watt	kWh	Watt	kWh	Watt	relative
Desktop	On/Idle mode	2279	81,70	186,19	50,00	113,95	31,70	39%
	Stand-by	3196	3,20	10,23	4,00	12,78	-0,80	-25%
	Off mode	3285	2,00	6,57	2,00	6,57	0,00	0%
Laptop	On/Idle mode	2613	32,00	83,62	24,00	62,71	8,00	25%
	Stand-by	2995	3,00	8,99	1,70	5,09	1,30	43%
	Off mode	3153	1,50	4,73	1,00	3,15	0,50	33%
Monitor	On/Idle mode	2586	36,00	93,10	36,00	93,10	0,00	0%
	Stand-by	3798	1,60	6,08	1,60	6,08	0,00	0%
	Off mode	2375	1,00	2,38	1,00	2,38	0,00	0%
Average		**2920**	**18,00**	**44,65**	**13,48**	**33,98**	**4,52**	**13%**

For the calculation of the CO_2 emissions related to the electricity consumption, we base our calculations on the emissions of the country specific mix of energy sources. The CO_2 emission per kWh is for every country mentioned in the table below:

Table D19: CO_2 emissions of the conventional energy mix per country[36]

Country	Gram CO_2 /kWh
Austria	205
Denmark	334
Finland	253
Germany	517
Netherlands	440
Sweden	44
United Kingdom	455

The country specific CO_2 emissions for both the non-green and green products can be calculated by multiplying the CO_2 emissions for a specific country, for example to calculate the emission of the non-green product for Austria, we take the average power consumption of the non-green product divided by 1.000 (in order to express the amount in kW) and multiply it by the number of hours in use. So for the non-green product for Austria the calculation is: 205 g/kWh * ((18 Watt * 2.920 hours)/1000) = 10.775,4 g CO_2, which equals 10,78 kg CO_2. The emission of the green product is calculated in the same way, by using the average power consumption of the green product.

36 Changement climatique et électricité. Facteur Carbone européen. Comparaison des émissions de CO_2 des principaux électriciens européens", de PWC et ENERPRESSE, novembre 2005 (données pour année 2004)

37 Öko-Institut and ICLEI (2007)

The CO_2 emission ratio between the non-green product and the green product is calculated by dividing the emission of the green product by the emission of the non-green product. For Austria: 6,97 kg / 9,15 kg = 0,76. This means that in Austria, on average a green product consumes 76% of the power that a non-green product consumes. **The reason that the ratios are the same for all countries is that both the non-green and the green product are calculated based on the same but country specific emission of CO_2 from the standard fuel mix.**[38] The results for all countries are presented in Table D20 below:

Table D20: Country specific CO_2 emission and ratio for core green product

Country	Gram CO_2 /kWh	non-green product emission (kg)	green product emission (kg)	CO_2 ratio
Austria	205	9,15	6,97	0,76
Denmark	334	14,91	11,35	0,76
Finland	253	11,30	8,60	0,76
Germany	517	23,09	17,57	0,76
Netherlands	440	19,65	14,95	0,76
Sweden	44	1,96	1,50	0,76
United Kingdom	455	20,32	15,46	0,76

D.6.1.2 CO_2 emission impact of GPP per computer

The conclusions from the above are presented in Table D21 below:

Table D21: CO_2 ratios per functional unit of GPP for IT services

IT services - *Computers, laptops and monitors*		
CO_2 impact	CO_2 ratios	
	core / non-green	compr. / non-green
power consumption	0,76	0,76

D.6.2 Suggestions for further research

Other than CO_2 emissions, the GPP Training Toolkit also mentions the following key environmental impacts, which we suggest to include in further research:

- Air, soil and water pollution, ozone formation (smog), bio-accumulation or food chain exposure and effects on aquatic organisms due to hazardous constituents e.g. mercury content of LCD displays and flame retardants;
- Negative impact on the health of employees due to noise, causing stress for those sensitive to such sounds;
- Use of energy, finite resources and harmful emissions related to the production of IT products;
- Generation of waste material including packaging and final disposal.[39]

38 See the Glossary of terms for an explanation of the fuel mix.
39 http://ec.europa.eu/environment/gpp/toolkit_en.htm

D.7 Paper

As described in Chapter 1, we take copying & graphic paper as a representative product for this product group. Therefore, the calculation of the CO_2 impact and the CO_2 ratios will be based on copying & graphic paper only.

D.7.1 CO_2 emission impact

To determine the CO_2 emission of paper we look at the raw material acquisition phase and the production phase of paper, focussing on the energy consumption. Other than the direct consumption of energy and its related CO_2 emission, there is a relation between CO_2 and the use of chlorine which causes a difference in CO_2 emissions between bleached and non bleached paper. However, at the moment there are no relevant figures available to base our calculations on this criterion and chlorine is used less for bleaching. Therefore this element was not considered and we focus only on the direct energy consumption.
We assume the non-green product is printing paper made of 98% of wood pulp[34] and 2% of waste paper[35].

Recycled paper:
The recycling of old paper requires energy, which is normally based on fossil sources.[36] Based on the performance of Swedish mills, the 'best practice' of fibre recovery is estimated to be 0,3 GJ steam/ton air dried product and 330 kWh electricity/ton air dried product, which equals 1,18 GJ/ton air dried product[37]. This results in a total energy use of 1,5 GJ/ton air dried product.

The paper machinery uses 6,7 GJ steam and 640 kWh electricity/ton air dried product37. This results in a total energy use of 9,0 GJ/ton air dried product.

The total energy value for recycled paper made of 100% waste paper is (1,5 + 9,0 =) 10,5 GJ/ton air dried product.

Wood pulp-based paper:

Direct emissions
For the calculation of the total CO_2 emission for this product group, we look at several different types of emission in the raw materials acquisition phase and production process phase of paper made from wood pulp, starting with the energy consumption for cutting trees and the emissions related to the transportation of the wood. In addition, the pulping process and actual production of paper are relevant in terms of the emission of CO_2 The energy consumption for cutting trees is 0,17 GJ/ton air dried wood dust[38] and for transport the consumption is 0,19 GJ/ton air dried product.[39]

The pulping process uses steam and electricity but electricity is also generated in the process37. The net electricity consumption is -15 kWh/ton air dried product. The total CO_2 emission of the pulping process is the CO_2 emissions related to the use of fossil fuels by the lime kiln minus the CO_2 reduction due to the export of electricity. The lime kiln uses 1,5 GJ/ton air dried product (based on best practice figures), minus the 15 kWh (equals 0,054 GJ) export of electricity which results in 1,446 GJ/ton air dried product.

The paper machinery uses 6,7 GJ steam and 640 kWh electricity/kg air dried product for the actual making of the paper37. This results in a total energy use of 9,0 GJ/ton air dried product. The energy consumption related to the use of lignin is not included as the CO_2 consumption of plants during the growing phase is equal to the CO_2 emission caused by combustion. This in fact means that the energy consumption in this phase can be set to 0 GJ/ton air dried product. Therefore we assume the CO_2 emission is 0 kg CO_2/ton air dried product.

The table below summarises the energy consumption per phase:

34 The main part of timber has its origin of production forests in Scandinavia, South-West Europe and North-America. Those forests are sustainable managed (www.vrom.nl), dossier papier en karton)
35 Worrell et al., New gross energy-requirement figures for materials production, 1994.
36 Worrell et al., New gross energy-requirement figures for materials production, 1994.
37 Price et al., World Best Practice Energy Intensity Values for Selected Industrial Sectors, 2007.
38 We assume that no energy is lost in the process between wood dust and the air dried product.
39 Worrell et al., New gross energy-requirement figures for materials production, 1994.

Table D22: Energy consumption wood pulp based paper

	Logging (GJ/ton)	Transport (GJ/ton)	Pulping (GJ/ton)	Paper making (GJ/ton)	Subtotal of paper made of wood pulp (GJ/ton)
All countries	0,17	0,19	1,446	0	**1,81**

In order to calculate the total energy consumption for non-green paper made of 98% of wood pulp and 2% of waste paper (excluding the CO_2 emission from biomass[40]) is (1,5 + 9,0) * 2% + (0,17+0,19+1,446) * 98% = 1,98 GJ/ton paper.

Indirect emissions

Apart from direct emissions related to the raw materials acquisition phase and the production phase of paper, the production of paper from virgin pulp also has implications for the capacity of trees to store CO_2. As a result of the logging of trees, the storage of CO_2 in those trees becomes impossible. We therefore calculate the lost storage of CO_2 implied by the production of paper. In order to do so we make the following assumptions:

Lost CO_2-storage per hectare:
The paper industry uses timber from trees that are about twenty years old[41]. An average tree lives for eighty years. The lost CO_2-storage of timber that has been logged is calculated over the remaining sixty years: 5,6 ton CO_2/ha/year[42] (the average storage capacity of forests per hectare) * 60 years = 336 ton CO_2/ha.[43]

The amount of timber per hectare is: 198 m^3/ha[44].

The amount of timber (in tons) per hectare:
Paper is made of different types of wood. Here we assume the composition consists of 65% of maple wood, 25% of birch wood en 10 % of poplar wood[45]. The densities of maple, birch and poplar wood are respectively 610, 650 and 450 kg/m^3.[46] The average density of wood used for the paper industry is (65%*610 kg/m^3) + (25%*650 kg/m^3) + (10%*450 kg/m^3) = 604 kg/m^3. The amount of timber per hectare is 198 m^3/ha * 604 kg/m^3 =119.592 kg/ha = 119,592 ton timber/ha.

The amount of paper (in tons) per hectare:
For the production of one ton of paper 3,3 ton of timber is needed.[47] Here we base our calculation on 3,3 ton timber/ton paper, in other words 0,30 ton paper/ton timber. The amount of paper per hectare is 119.592 * 0,30 = 35, 98 ton paper/ha.

Lost ton CO_2-storage per ton paper:
Per hectare 36,24 ton of paper can be produced and the avoided CO_2-storage is 336 ton. The avoided CO_2 storage per ton of paper is (336/36,24=) 9,27 ton CO_2/ton of paper.

Total CO_2 emission:
In order to calculate the total CO_2 emission of non-green paper, we need to add up the amount of CO_2 related to the energy consumption for the recycling of paper, as well as the CO_2 emissions related to the consumption of energy in the raw materials acquisition phase and production phase, and the amount of CO_2 not captured by trees used for the production of wood pulp based paper. The CO_2 emission related to the consumption of energy is based on the country specific mix of energy sources for the production of electricity[48]. The total CO_2

40 The energy consumption related to the use of lignin is not included as over the whole life cycle of the lignin the CO_2 emission is neutral based on the storage of CO_2 in the growing phase of the tree.

41 The paper industry uses mainly thinning wood, like small trees and branches. The thicker parts of the tribes and the larger trees are used for the construction, furniture and packaging industry (www.vrom.nl), dossier papier en karton).

42 Ecofys, Binnenlands biomassapotentieel, in opdracht van ministerie van LNV, 2008.

43 this simple calculation does not take into account the reforestation, which probably is the case in the countries that deliver wood for the paper industry.

44 bron: HOSP-opname 2002 (www.avih.nl/output/output_70.html)

45 SchoolTV (http://www.schooltv.nl/beeldbank/clip/20060411_papier01)

46 Wikipedia, http://nl.wikipedia.org/wiki/Houtsoorten

47 Schoone Papierfabriek (http://www.nschoone.eu/fremo_links.php?pagetype=FREMO&mode=spf)

48 IEA Statistics, CO_2 emissions form fuel combustion 1971-2003, 2005 edition.

emission for non-green paper per country is mentioned in the table below.

Table D23: CO_2 emission of non-green paper

Non-green paper					
	98% wood pulp 2% waste paper (GJ/ton paper)	kg CO_2/GJ	kg CO_2/ton paper	avoided CO_2 storage (ton CO_2/ton paper)	total CO_2/ton paper
Austria	1,98	53,77	106	9084,60	9191
Denmark	1,98	64,69	128	9084,60	9213
Finland	1,98	46,18	91	9084,60	9176
Germany	1,98	58,78	116	9084,60	9201
Netherlands	1,98	54,58	108	9084,60	9193
Sweden	1,98	36,59	72	9084,60	9157
UK	1,98	55,63	110	9084,60	9195

D.7.1.1 CO_2 emission ratio of core green vs. non-green

As both recycled and sustainable wood for primary pulp paper are considered core green compliant but there is no specification of the respective percentages, the CO_2 emission ratio for the core green product is based on the average CO_2 emission of the two products.[49] This means that the average of (1) the CO_2 emission related to 100% recycled paper and (2) the CO_2 emission related to the production of sustainably produced paper that is certified is calculated for the CO_2 emission ratio.[50]

Recycled paper:
The CO_2 emissions related to recycling paper were described above, and add up to 10,5 GJ/ton of air dried product. The total CO_2 emission for recycled paper made of 100% waste paper is per country mentioned in the table below. The CO_2 emission is based on the country specific mix of energy sources[51].

49 The cost ratio of ECF/TCF has been taken out of the cost elements, as based on talks with experts it turned out that there is only very little paper left in the market that is not produced ECF at least, or otherwise TCF. This is confirmed by the results of our questionnaire. This means that there is no difference in price based on this cost element between non-green and core or comprehensive green paper.

50 This means that the paper is made of 100% primary pulp and that of that pulp at least 70% of the wood is PEFC – comparable to FSC – certified. The rest is to come from non-controversial forests. The reason for choosing PEFC rather than FSC is that FSC can include recycled paper, and also has different percentages of actually used FSC wood, whereas PEFC uses only the 70% standard and only primary pulp. Source: ModoVanGelder, personal communication; http://www.modovangelder.nl/

51 IEA Statistics, CO_2 emissions form fuel combustion 1971-2003, 2005 edition.

Table D24: CO_2 emission of recycled paper

100% recycled paper			
	GJ/ton paper	kg CO_2/GJ	kg CO_2/ ton paper
Austria	10,5	53,77	565
Denmark	10,5	64,69	679
Finland	10,5	46,18	485
Germany	10,5	58,78	617
Netherlands	10,5	54,58	573
Sweden	10,5	36,59	384
UK	10,5	55,63	584

Table D25: CO_2 emission of wood pulp based paper

Wood pulp based paper			
	GJ/ton paper	kg CO_2/GJ	kg CO_2/ ton paper
Austria	1,81	53,77	97,11
Denmark	1,81	64,69	116,83
Finland	1,81	46,18	83,40
Germany	1,81	58,78	106,16
Netherlands	1,81	54,58	98,57
Sweden	1,81	36,59	66,08
UK	1,81	55,63	100,47

Wood pulp-based paper:
We assume that the CO_2 emission related to the raw materials acquisition phase and the production phase of paper made from fibre originating from sustainably managed forests, is equal to that of paper made from fibre not originating from sustainably managed forests. Reforestation in sustainably managed forests however largely avoids the loss of CO_2 storage that we calculated for paper fibre retrieved from non-sustainably managed forests. The CO_2 impact for core green wood pulp-based paper can therefore be calculated by using the exact same calculation for the non-green product minus its indirect CO_2 emission caused by the loss CO_2 storage. This means we can use the direct CO_2 emission figures calculated for the non-green would pulp-based product. As shown in section D.7.1, the energy consumption there equals 1,81 GJ/ton air dried product.

Conclusion:
In order to calculate the average CO_2 we take the average of the emissions per country related to the recycling of paper and the emissions per country related to the raw material acquisition phase and production phase of wood pulp based paper. For example for Austria this means: (50% * 565 kg CO_2/ton paper) + (50% * 97 kg CO_2/ton paper) = 331 kg CO_2/ton paper. When this amount is divided by the emission of the non-green product, we have the ratio: 331 kg CO_2/ton paper / 9,191 kg CO_2/ton paper = 0,036. This means that the core green product, based on the calculations we did, only emits 3,6% of the CO_2 that the non-green product emits in the raw materials acquisition and production phases.

D.7.1.2 CO_2 emission ratio of comprehensive green vs. non-green

The CO_2 ratio of the emission of non-green paper versus the emission of paper that complies with the criteria of the EU Ecolabel is used to calculate the CO_2 ratio for comprehensive green paper. According to the criteria for the EU Ecolabel, the maximum emission for the pulp and paper production combined is 1.000 kg CO_2/ton paper.[52] We take this amount as the CO_2 emission for comprehensive green paper. As this is an absolute maximum, there is no need to adjust the numbers per country:

52 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32002D0741:EN:HTML

Table D26: CO_2 emission of core green paper

average CO_2 emission for core green paper					
	non-green	recycled paper	wood pulp from sust. managed forests	core green	ratio non-green / core green
	kg CO_2 / ton paper	kg CO_2 / ton paper	kg CO_2 / ton paper	kg CO_2 / ton paper	
Austria	9191	565	97	331	0,036
Denmark	9213	679	117	398	0,043
Finland	9176	485	83	284	0,031
Germany	9201	617	106	362	0,039
Netherlands	9193	573	99	336	0,037
Sweden	9157	384	66	225	0,025
UK	9195	584	100	342	0,037

Table D27: CO_2 emission for comprehensive green paper

CO_2 emission for comprehensive green paper			
	non-green	compr. green	ratio non-green / core green
	kg CO_2 / ton paper	kg CO_2 / ton paper	
Austria	9191	1.000	0,109
Denmark	9213	1.000	0,109
Finland	9176	1.000	0,109
Germany	9201	1.000	0,109
Netherlands	9193	1.000	0,109
Sweden	9157	1.000	0,109
UK	9195	1.000	0,109

Table D28: CO_2 ratios per functional unit of GPP for paper

Paper *copying & graphic paper*		
Country	CO_2 ratios	
	core / non-green	compr. / non-green
Austria	0,036	0,109
Denmark	0,043	0,109
Finland	0,031	0,109
Germany	0,039	0,109
Netherlands	0,037	0,109
Sweden	0,025	0,109
UK	0,037	0,109

D.7.1.3 CO_2 emission impact of GPP per ton of paper

From the table above, we see that the result is not entirely in line with what one would expect: the core green product causes the least CO_2 emissions. This reflects the fact that CO_2 is not the most relevant environmental criterion to consider when looking at the environmental impact of paper. This is explained in more detail in the next section, D.7.2. From the above we conclude the following:

D.7.2 Suggestions for further research

The calculations based on CO_2 as an indicator for only the phases of raw material acquisition and production is a too simplified analysis for several reasons:

- Firstly, the overall process chain including alternative uses of biomass material and old paper streams should for such an assessment be taken into account, rather than only the raw materials acquisition and production phases with regards to wood pulp based paper.

- Secondly, the CO_2 emission is not the most relevant indicator for the environmental impact of paper. More relevant indicators are the land use, the origin of wood, the way of pulp making (chemical/mechanical), the deinking process, bleaching, the use of chemical additives, the water use and the electricity use. It would be more complete to use an indicator based on the CO_2 emission as well as on the land use. If paper is recycled, the land can be used for other purposes, like trees as biomass for fuel or as a resource for medical purposes.
- Thirdly, we advise for future research to take into account not only the lost CO_2 storage but also to take a closer look at the CO_2 storage due to reforestation, rather than assuming that reforestation means no loss of CO_2 storage.

When we look at the GPP Toolkit, many of the above issues are covered by the Key Environmental Impacts of paper, besides emissions:

- Deforestation and potential loss of bio-diversity;
- Energy and water consumption during production;
- Chemical consumption during production;
- Waste generation during production such as rejects and sludge.

D.8 Textiles

As described in Chapter 1, we take clothing as a representative product for this product group. Therefore, the calculation of the cost ratios will be based on clothing only.

D.8.1 CO_2 emission impact

The calculation of a green and non-green product in the product group textiles is based on the CO_2 emission in the cultivation and production phase of cotton used in one piece of clothing, which was identified as the only relevant CO_2 related aspect of the product.

The CO_2 emission of the cultivation and production phases combined of normal cotton is 1763,842 g CO_2 per kg textile product93.

D.8.1.1 CO_2 emission ratio of core green vs. non-green

The CO_2 emission of the cultivation and production phases combined of eco cotton[34] is 421,84 g CO_2 per kg textile product[35],[36].

Organic cotton is planted and harvested by hand, without mechanisation, and because organic farming does not use petroleum based chemical fertiliser, pesticide or herbicide, it is less dependant on reliant on fossil fuels[37].

The table below shows how the non-green product and the core green product compare in terms of CO_2 emission:

Table D29: CO_2 emission of core green textile

Textiles - *Clothing*		
CO_2 impact	CO_2 emission in g CO_2 / kg textile product	
	non-green	green
textile produced	1763,842	421,84

D.8.1.2 CO_2 emission impact of GPP per kg textile product

Based on the above calculations, the ratio of CO_2 emissions can be summarised as follows:

Table D30: Ratios per functional unit of GPP for textiles

Textiles - *Clothing*		
CO_2 impact	CO_2 ratios	
	core / non-green	compr / non-green
textile produced	0,24	0,24

D.8.2 Suggestions for further research

In further research we recommend to use all figures for organic cotton (if available), to take into account the consumption of CO_2 by the cotton plant and environmental damage caused by the use of certain pesticides and fertilisers in the production of fibres, and substances used during the processing of fibres and final textile products. Another aspect to be taken into consideration is the possible negative impact on the occupational health of users due to residues of certain substances harmful to human health.[38]

34 For organic cotton no figures are available, therefore we choose to make use of he figures for eco cotton. Eco cotton is unlike normal cotton not bleached or painted.

35 SimaPro, database IDEMAT 2001, figures are from 1992. CO_2 eq are based on the IPCC-method.

36 CO_2 consumption during the grow of the cotton plant is not taken into account, probably because the figures are not of a recent date.

37 Earth Positive, www.earthpositiveonline.com

38 http://ec.europa.eu/environment/gpp/toolkit_en.htm

D.9 Transport

As described in Chapter 1, we take passenger cars and light duty vehicles as representative products for this product group. Therefore, the calculation of the CO_2 impact and the CO_2 ratios will be based on passenger cars and light duty vehicles only. Only a core green product was identified because the distinctions between both levels of GPP criteria are not relevant for the calculation of CO_2.

D.9.1 CO_2 emission impact

The calculation of a green and non-green product in the product group transport is based on the yearly CO_2 emission per kilometre of passenger cars[34] in the usage phase.

For the comparison of green and non-green products we have chosen a type of car that has a green and a non-green version. This is the case for VW who has green versions: the VW Golf Bluemotion and the VW Passat Bluemotion. Also Audi has green versions, as well for the Audi A3 Standard as the Audi A3 Sportback. The CO_2 emission per non-green car in g CO_2 per kilometre is shown in the table below.

Table D31: CO_2 emission for different cars44

Type	g CO_2/km
VW Golf Bluemotion	145
VW Passat Bluemotion	151
Audi A3 Standard e	135
Audi A3 Sportback e	127

The average distance of one passenger car a year is 15.000 km. This results for the VW Golf in 2.175 kg, the VW Passat in 2.265 kg, de Audi A3 Standard in 2.025 kg and the Audi A3 Sportback in 1.905 kg CO_2/vehicle.

D.9.1.1 CO_2 emission ratio of core green vs. non-green

The CO_2 emission per kilometre for the green versions is shown in the table below.

Table D32: CO_2 emission for different cars[35]

Type	g CO_2/km
VW Golf Bluemotion	119
1 VW Passat Bluemotion	136
Audi A3 Standard e	119
Audi A3 Sportback e	119

The average distance of one passenger car a year is 15.000 km. This results for the VW Golf en de Audi A3 (Standard en Sportback) in 1.785 kg and for the VW Passat in 2.040 kg CO_2/vehicle.

D.9.1.2 CO_2 emission impact of GPP per km

In order to calculate the ratio between the core green and the non-green product, we divide the emission of the core green average by the non-green average.
The results from that calculation are summarised in the table below. These numbers mean that on average, the green product emits 88% of CO_2 of the non-green product.

Table D33: Ratios and environmental impact per functional unit of GPP for transport

Transport - *Passenger cars and light duty vehicles*	
	CO_2 ratios
product	core / non-green
VW Golf	0,82
VW Passat	0,90
Audi A3 Standard	0,88
Audi A3 Sportback	0,94
average	0,88

34 Light duty vehicles are excluded in the calculation of the product. The size of a passenger car and a light duty vehicle is so different that it is not useful to make a calculation of an average green and non-green car based on both passenger cars and light duty vehicles.

35 www.volkswagen.nl and www.audi.nl

D.9.2 Suggestions for further research

The EU Energy Label is based on the relative energy efficiency of cars[36]. Distinction is made between 9 segments from small and compact cars to vans and transporters. The choice for the relative energy efficiency of cars means that in the segment of larger vehicles you also find cars that use less energy (label A) than other cars in that segment (up to label G). So in every class you can choose relatively energy saving cars. If the purchaser really wants to make a difference the absolute energy efficiency of vehicles should be taken into account instead of the relative energy efficiency. This will result in a fleet with more small and compact cars[37].

The GPP Training Toolkit also mentions other relevant environmental impacts resulting from the product group transport, for which we suggest further research:

1. Air pollution through the emission of other exhaust gases that can cause:
    a. Local health (especially respiratory) problems
    b. Damage to the environment, buildings and monuments
2. Noise pollution
3. Waste generation[38]

36 European Union Energy Label, European Commission (ec.europa.eu). Since 2001 the energy label for passenger cars is obligated. The implementation of the energy label is a consequence of the European strategy to reduce the energy use of new passenger cars (Directive 1999/94/EC).

37 http://ec.europa.eu/environment/gpp/toolkit_en.htm

38 It is important to note the difference between the criteria for Construction and Paper here, as the criteria for Construction as identified in the GPP Toolkit refer to “legal sources” for timber, whereas the criteria for Paper based on virgin fibre refer to sources that must be “legally and/or sustainably harvested”. In terms of CO_2 emissions there is no difference between legal and non-legal forests, whereas reforestation of sustainably managed forests leads to a reduction of lost CO_2 storage.

D.10 Furniture

As described in Chapter 1, we take office furniture as a representative product for this product group. Therefore, the calculation of the cost ratios will be based on office furniture only. Only a core green product was identified because the distinctions between both levels of GPP criteria are not relevant for the calculation of CO_2.

D.10.1 CO_2 emission impact

In terms of CO_2 emissions, the following aspects of furniture are relevant:
The use of recycled plastic furniture: For the calculation of the CO_2 emissions a data search is needed, to find information about the composition of plastic furniture and the LCA of plastics. We do not use this criterion for calculating the CO_2 emissions related to the use of plastic furniture, because the extensive data search required is beyond the scope of this report.

The use of solid wood or wood-based materials that come from forests that are verified as being managed sustainably is also relevant for the calculation of the CO_2 emissions. The principle of sustainable forest management is forest conservation. Also the recovery of the forest after the felling guarantees optimal carbon storage.[34]

The core green product was identified as containing wood that originates from sustainably managed forests. This relates to the raw materials acquisition phase of furniture. The criteria selected for the green version of office furniture suggest that wood is a substantial element with respect to office furniture. However, from thorough desk research and conducting interviews with office furniture suppliers[35] we found that this is no longer the case: the amount of actual wood used in office furniture is negligibly small; the use of chipboard and comparable products has almost entirely taken over the original role of wood in office furniture.

Even though FSC and PEFC certified board material exists, no reliable data was found on the CO_2 emission related to the raw materials acquisition phase, or on the production phase of chipboard. Chipboard consists for a large part of wood particles. However, of the wood particles only a small part stems directly from wood, others are residue material from wood processing for other purposes, which implies a different CO_2 emission than the raw material acquisition or production of pure wood.

D.10.1.1 CO_2 emission ratio of core green vs. non-green

Based on the above we come to the conclusion that not enough reliable data exists at this time to calculate the CO_2 emission for the core green product of office furniture and that the CO_2 emission impact of FSC or PEFC certified office furniture is not readily available.

D.10.1.2 CO_2 emission impact of GPP per piece of furniture

Based on the above we come to the conclusion with regards to the CO_2 emission ratios for wood-based furniture that no adequate data is available. Therefore, we do not include it in our analysis to calculate the CO_2 emission impact of GPP.

D.10.2 Suggestions for further research

CO_2 emission is only a limited part of the possible negative effects on the environment relating to the production of office furniture. As we can also see in the GPP Training Toolkit, many other aspects play a role and we suggest looking further into the following for further research:

- The impact of the use of hazardous substances, in particular for the production of plastics;
- The consumption of non-renewable resources and water;
- The generation of waste, mainly related to packaging;
- The impact of mining activities on the landscape;
- The impact of logging on biodiversity, soil erosion and degradation;
- The impact of early replacement of furniture due to a lack of reparability options, low durability, ergonomics or furniture not fit for purpose.

34 Fast Office Furniture; Samas; Fetim Best Hout en Plaatmaterialen; Iboma Lopik BV; SpanoGroup; Markant; Ahrend; Rik Smeenk; Lathouwers; De Key, Amsterdam

35 Fast Office Furniture; Samas; Fetim Best Hout en Plaatmaterialen; Iboma Lopik BV; SpanoGroup; Markant; Ahrend; Rik Smeenk; Lathouwers; De Key, Amsterdam

E Indicator 4 cost structures and cost ratios per product group

In this Appendix, we provide the calculations and assumptions regarding the cost structures of all ten product groups and their relevant cost ratios, as presented in tables 3.4 and 3.5. In the final section of this Appendix, we list the various country-specific correction factors that are used to determine a country-specific cost structure.

The general approach for the calculation of the cost structures and the cost ratios are described in section 3.2.

It has to be noted that, although the questionnaire includes questions concerning compliance with EU Ecolabel and other labels, this cannot be understood as meaning that a purchasing authority could require products to be certified as such: the label is only one possible means of demonstrating compliance with the criteria.

E.1 Cleaning products and services

As described in Chapter 1, we take cleaning services (including cleaning products) as a representative product for this product group. Therefore, the calculation of the cost structure and the cost ratios will be based on cleaning services only.

E.1.1 Cost structure

We base our calculations on the figures in a recent report by the Öko-Institut and ICLEI[99]. For the product group cleaning services, this report describes a market analysis that was performed in Germany, Sweden, Czech Republic and Spain. Below we list the results of this market research in Germany. For the cost element cleaning products, the data applies to products that do not comply with green criteria.

Table E1: Annual cost data for cleaning services in Germany (Öko-Institut and ICLEI, 2007).

cost element	price (€)
Wages cleaning staff	231
Social insurance	55
Other labour	75
Wages other staff	22
Cleaning products	7
Machines	5
Other costs	9
Risk and profits	12

With the use of these numbers, we can calculate the cost structure needed in our study. See the table below for the result:

Table E2: Cost structure for cleaning services in Germany.

cost element	%
Labour costs	92 %
Cleaning products	2 %
Other costs	6 %

Having determined the cost structure of cleaning services of a baseline country (Germany), we can apply the various correction factors of table E3 in order to determine the cost structure for the other six countries. For labour cost, the percentage is corrected with the use of the labour cost index. Concerning cleaning products and other costs for cleaning services, we correct the percentages using comparative price levels.

E.1.2 Cost ratios

With the use of the criteria that are included in the questionnaire, we determine the cost ratios of core and comprehensive levels of green procurement of cleaning services in the following two paragraphs. Based on these figures, we calculate the financial impact of GPP per m^2 cleaned office space in the final paragraph of this section.

Table E3: Cost structures for cleaning services in the Green-7

LCC relevant costs	Correction factor	LCC cost structure							
		Baseline *(Germany)*	Austria	Denmark	Finland	Germany	Nether-lands	Sweden	UK
Labour costs	labour cost index	92%	92%	91%	93%	92%	93%	93%	93%
Cleaning products	price levels (other)	2%	2%	2%	2%	2%	1%	2%	1%
Other costs	price levels (other)	6%	6%	7%	6%	6%	5%	6%	5%

99 Costs and Benefits of Green Public Procurement in Europe. Part 1: Comparison of the Life Cycle Costs of Green and Non Green Products. Öko-Institut e.V. and ICLEI, July 2007.

E.1.2.1 Cost ratio of core green vs. non-green

The only core criterion for cleaning services that is included in the questionnaire is the use of cleaning products without hazardous substances. This criterion has an impact on the purchase price of cleaning products, and therefore determines the cost ratio of cleaning products that comply with core levels of GPP. In Öko-Institut and ICLEI (2007), a market research was performed on prices between green and non-green versions of all purpose cleaners, floor cleaning and floor care products. The difference between the green and the non-green version is compliance of the cleaning products with the EU Ecolabel. EU Ecolabelled products are known to comply with more criteria than the absence of non-hazardous products. For example, attention is paid to packaging, indicated user-instructions, professional training for users, fitness for use and biodegradability of the product[100]. However, it is reasonable to assume that the largest impact on the price difference between Ecolabel products and regular products lies in the avoidance of hazardous substances. Hence, we can use the results of aforementioned study for the purposes of this report. See the table below for the results, from which we can calculate that the cost ratio is equal to 1,39.

Table E4: Price difference between green and non-green cleaning products in Germany

Price per 100 litres suds (use concentration)		Price difference	
non-green version	green version	absolute	relative
€ 2,80	€ 3,90	€ 1,10	39%

E.1.2.2 Cost ratio of comprehensive green vs. non-green[101]

In the questionnaire, two comprehensive criteria for cleaning services are included.

- Training of employees
- Use of reusable microfiber cloths and/or dry-cleaning techniques

Regarding the training of employees, this can be regarded as common practice in the cleaning services industry in the Green-7. Furthermore, there is no additional cost to train staff in the use of green products compared to the cost to train staff in the use of non-green cleaning products, neither for the provider nor for the client. Hence the cost ratio of applying criteria concerning training is 1.

On the one hand the use of reusable microfiber cloths and/or dry-cleaning techniques leads to labour costs reduction of up to 10%. This cost reduction is explained by the fact that the use of microfiber cloths means less manual labour for the staff and a higher hourly performance rate (no filling or carrying of buckets with water and cleaning products, changing water etc.). Furthermore, it means healthier working conditions for staff (less hazardous substances inhaled), which lead to fewer working hours per square meter and less absence due to illness and physical problems.

On the other hand however, the purchase cost of microfiber cloths is approximately 15% higher than the purchase cost for regular cleaning products like detergents, buckets etc. Even though the use of microfiber cloths does not exclude for 100% the use of traditional cleaning methods (water and detergent), it accounts for a negligible part of the total cleaning cost. We therefore assume that the cost of comprehensive cleaning services consists of 100% use of microfiber cloths.

As a result of the analysis above, the cost ratio of comprehensive levels of GPP for labour costs is equal to 0,9 and the cost ratio of comprehensive levels of GPP for cleaning products is equal to 1,15. This means that comprehensive green cleaning products are 15% more expensive than non-green cleaning products.

E.1.2.3 Financial impact of GPP per m² cleaned office space

Using the figures as calculated above, all cost ratios for cleaning services are shown in table E5. The cost ratios for those elements that are not influenced by green criteria are equal to 1.

According to the GPP Toolkit, comprehensive green products are assumed to also comply with the core green criteria. However, in the case of cleaning products and services these criteria do not overlap. Based on information gathered, the use of cleaning products (under Core criteria: products without hazardous substances) no longer plays any significant role once one starts using microfiber cloths as almost all cleaning is done with

100 See http://eur-lex.europa.eu/LexUriServ/site/en/oj/2005/l_115/l_11520050504en00420068.pdf.

101 Analysis is mainly based on interviews with ISS cleaning services company.

microfiber cloths and hardly any with cleaning products and hot water. Also, the saving in the cost of labour is not comparable to any change in cost of labour between core green and comprehensive green products. The cost ratio of non-green vs. core green can therefore not be integrated into the cost ratio of non-green vs. comprehensive green products and we must compare non-green to core green separately from the comparison between non-green and comprehensive green products.

We can apply the cost structure of a non-green cleaning service to determine the overall financial impact of core and comprehensive levels of GPP per functional unit. Taking the average of the cost structures of the 7 countries, please find the results in table E5.

The interesting result is that the use of core green criteria (i.e. cleaning products that contain no hazardous substances) leads to a financial impact per m^2 cleaned service of only +1%. This results from the fact that green cleaning products, which are approximately 40% more expensive than its non-green version, make up only around 2% of the total costs for cleaning services. Even more interesting is the result that comprehensive levels of GPP for cleaning services lead to decreased costs by 9%, as a result of decreased labour costs when using of microfiber cloths.

Table E5: Cost ratios and financial impact per functional unit of GPP for cleaning services. A cost ratio smaller than one implies cost reductions and a cost ratio larger than one implies cost increases. For the weighted average impact, negative numbers imply costs reductions and positive numbers imply costs increases.

Cleaning products and services - *cleaning services*		
LCC relevant costs	cost ratios	
	core / no GPP	compr / no GPP
Labour costs	1,00	0,90
Cleaning products	1,39	1,15
Other costs	1,00	1,00
Financial impact per m^2	+1%	-9%

E.2 Construction

As described in Chapter 1, we take new buildings and offices as a representative product for this product group. Therefore, the calculation of the cost structure and the cost ratios will be based on new buildings and offices only.

E.2.1 Cost structure

Most unfortunately, there is no such thing as an average office or average office costs: depending on parameters such as size, geometry, outside and inside climate conditions or usage patterns, the costs for the construction and the operation of a building may vary dramatically[102]. Therefore, in our analysis for the cost structure of an office building, we have only taken into account the relevant and key elements that are needed for the estimation of the financial impact of GPP on construction. This means that the outcomes of this section are not necessarily suitable for other studies in the field of construction.

The life cycle elements of new buildings and offices can roughly be grouped into the following elements[103]:

Non-construction costs:
Non-construction costs mainly relate to costs such as site purchase and advice on design. These kinds of costs are highly variable which makes it difficult to determine average prices. For this reason and taking into account that the criteria that we examine in this study do not relate to this element, we leave it out of scope.

Construction costs:
These are the actual costs for material and labour for the construction of a building. Since the construction stage may take several months (e.g. an eight-story building of 5000 m^2 may take around 300 days to build[104]), also cost for project management are taken into account in this stage. These costs together can be estimated to be € 1100 euro per square meter[105].

For the calculation of the cost structure, also the residual value is included in construction costs. The residual value of an office building results from the fact that a building may be depreciated economically, but technically is still good enough that a new building is not needed yet. For our analysis, we assume that the technical lifetime of a building is 60 years and its economic lifetime is 30 years. As a result, the residual value of this building is half of its construction costs. These costs (corrected for inflation and net present value) are subtracted from actual construction costs.

Operational costs:
Operational costs are costs such as insurance, energy use and facilities management. In our analysis, we will only focus on costs for heating, electricity use and water use, which can be regarded as the main operational costs. For heating and electricity, an average office building has a primary consumption of 260 kWh/m^2/yr, which can be divided into 80 kWh/m^2/yr for heating and 180 kWh/m^2/yr for electricity[106, 107]. This is however, only the primary energy, which may be regarded as the energy content of fuel used for energy generation. A primary efficiency factor of 38,6% (Germany)[108] is used to convert these numbers into actual energy consumption of buildings.

- Heating: we assume that heating comes from natural gas. The average gas use is 7,64 m^3/m^2/yr (using mentioned sources and a conversion ratio of 1 kWh = 0,0949 m^3 natural gas). With the use of the average gas price (Eurostat) in our countries under scope, we calculate the yearly costs for heating.
- Electricity use: these costs include costs for cooling (i.e. airco) and general electricity use. The average electricity use is 69,48 kWh/m^2/yr (using mentioned sources). With the use of the average price for electricity in the Green-7 (Eurostat), we determine the average yearly costs for electricity use per building.

102 See e.g. Energy Efficiency in Building – Business realities and opportunities, World Business Council for Sustainable Development, 2007
103 Life Cycle Costs in Construction, October 2003, this report also shows examples of more detailed LCC in construction
104 Real estate in figures, Delft University of Technology, 2002
105 Real estate in figures, Delft University of Technology, 2002
106 Bine Informationsdienst Energieeffizientes Bürogebäude
107 Sweden and Finland belong to another climatic region (cold) unlike Germany, Netherlands, UK, Denmark and Austria (moderate). Although Sweden and Finland have more degree days, the cooling demand is much lower. Therefore we assume the energy demand is almost equal for all the participating countries.
108 IEA, Energy Efficiency Indicators for Public Electricity Production from Fossil Fuels, table: Efficiency of Electricity Production from all Fossil Fuels in Public Electricity and CHP Plants, Average 2001-2005, 2008.

- Water use: in The Netherlands, the average water use per employee is 9 m^3 water per FTE. Together with an average of 30 m^2 of office space per FTE, the water use is around 0,3 m^3/m^2 office space[109].

Maintenance costs
Maintenance costs are defined as regular daily maintenance (e.g. repairs routine component replacement and minor refurbishment) that lead to yearly costs of € 6,78 per square meter[110].

Replacement costs
Replacement cost are defined as planned maintenance (e.g. restoration or replacement of major components to their original aesthetic and functional performance[111]), which is usually done on a three-year basis. Its yearly costs are € 26,34 per square meter[112].

Disposal costs
These costs relate to costs for waste disposal, site clearing and demolition. Because we take into account the residual value of a building in our analysis, we do not assume that a building is demolished. The only costs for disposal are stripping of the interior, which can be estimated to be € 60 per square meter[113].

Below we give an overview of the mentioned parameter that we use for our Life Cycle Analysis. Inflation is set at 2% and we use a discount factor of 0,044[114] for the calculation of net present values.

Table E6: Parameters for the Life Cycle Analysis of new buildings and offices.

parameter	value
Office economic lifetime (years)	30
Office technical lifetime (years)	60
Office size (m^2)	5.239
Construction costs (€ / m^2)	1.100
Yearly gas use (m^3/m^2/yr):	7,6
Yearly electricity demand (kWh/m^2/yr):	69
Water use (m^3/m^2)	0,300
Gas price (€ / m^3)	0,384
Electricity price (€ / kWh)	0,085
Water price (€ / m^3)	1,30
Maintenance costs (€ / m^2)	6,87
Replacement costs (€ / m^2)	26,34
Disposal costs (€ / m^2)	60
Inflation	2%
Discount factor Germany	0,044

For offices with an average size of 5.239 m^2, the results of our LCC analysis are shown in table E7. We assume that after an economic lifetime of 30 years after construction, the interior of the building is disposed and that the building has a residual value of half its investment costs, based on the assumption that the technical lifetime is 60 years.

109 Benchmark public buildings, SenterNovem and Stimular, 2007
110 Source of both figures are from Dutch State Building Service (“Rijksgebouwendienst”), price level 2007
111 Life Cycle Costs in Construction, October 2003,
112 Source of both figures are from Dutch State Building Service (“Rijksgebouwendienst”), price level 2007
113 Source: PwC Facility expert
114 Costs and Benefits of Green Public Procurement in Europe. Part 1: Comparison of the Life Cycle Costs of Green and Non Green Products. Öko-Institut e.V. and ICLEI, July 2007.

Table E7: Results of the Life Cycle Analysis of new buildings and offices in The Netherlands.

Cost element	Value (€)
Construction costs	5.762.900
Costs for heating	376.777
Costs for electricity use	763.265
Costs for water use	50.404
Maintenance costs	296.655
Replacement costs	1.108.441
Disposal costs	314.340
Residual value	-1.276.732

With the use of these results, we can calculate the cost structure of new buildings and offices for the purposes of this study. Construction costs and residual value are taken together to be investment cost. Further, replacement costs are added to maintenance costs.

Table E8: Cost structure of new buildings and offices in The Netherlands.

Cost element	(%)
Investment cost	61%
Costs for heating	5%
Costs for electricity use	10%
Costs for water use	1%
Maintenance costs	19%
Disposal costs	4%

We will use this cost structure for all seven countries under scope. The figures needed to calculate this cost structure (such as €/kWh and €/m^2 maintenance) originate from various countries. Hence, we do not have to apply country-specific correction factors; this cost structure may be regarded as an average in Europe.

E.2.2 Cost ratios

With the use of the criteria that are included in the questionnaire, we determine the cost ratios of core and comprehensive levels of green procurement of new buildings and offices in the following two paragraphs. Based on these figures, we calculate the financial impact of GPP per building in the final paragraph of this section.

E.2.2.1 Cost ratio of core green vs. non-green

In the questionnaire, four core criteria are included, i.e.

- Consideration of energy-saving measures in design and usage phase of building (natural ventilation, double glazing, insulation and use of natural light)
- Water-saving technologies in kitchen and sanitary facilities
- Use of materials without hazardous substances
- Use of timber from legal sources

All of these core criteria have a financial impact on the construction stage of new offices and building. In fact, a building may be regarded as green only if it complies with all four criteria. Further, the first two criteria also have a financial impact on the operation stage of office building, through its savings in energy use (both gas and electricity) and savings in water use.
We will first calculate the financial impact of GPP on the construction phase, and will then determine the cost ratios for energy use and water use.

Cost ratio for construction phase

A building that complies with all four abovementioned criteria may be regarded as a core green building. In a study performed in the United States[115], research has been done on the average premium price for the construction of green buildings. In this study, a green building was defined as a building complying with the four levels of the LEED rating system for offices and schools[116] (certified, silver, gold, platinum). Please refer to the table below for the results.

115 The cost and financial benefits of green buildings, Greg Kats, Capital E, 2003
116 See www.usgbc.org

Table E9: Average green premium prices for offices and schools, according to LEED rating system.

LEED rating	premium price for green building
Level 1 - certified	0,66 %
Level 2 - silver	2,11 %
Level 3 - gold	1,82 %
Level 4 - platinum	6,50 %

The LEED rating system rates a building based on sustainable sites, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality and innovation & design process. In order to reach a certain standard, a certain number of points (total = 69) must be reached based on specific questions in each category. For example, a gold standard is the equivalent of 39-51 points. Since our core GPP criteria cover around 70% of the LEED criteria, we assume that the LEED gold standard may be regarded as equivalent with our core green office. This means that the cost ratio of a core green office compared to an non-green office is 1,0182.

Cost ratios for operational phase

The use of the criterion of water-saving technologies in kitchen and sanitary facilities leads to a decrease in water use costs indoors of 30% annually[117]. Therefore, we take the cost ratio of water use to be 0,70.

Energy use

In line with the calculations of indicator 3, we take the primary energy use of a core green building to be 75 kWh/m^2/yr, which can be divided into 30 kWh/m^2/yr for heating and 45 kWh/m^2/yr for electricity use. For the calculation of the cost ratios, we compare these figures with the figures as presented in the previous section for a non-green building (80 kWh/m^2/yr for heating and 180 kWh/m^2/yr for electricity). The result is that the cost ratio for heating is 0,38 (=30/80) and the cost ratio for electricity is 0,25 (=45/180).

E.2.2.2 Cost ratio of comprehensive green vs. non-green

The only comprehensive criterion that is included in the questionnaire is the use of Localized Renewable Energy Sources (L-RES). For L-RES, one may think of equipment such as sun boilers, small wind turbines or photovoltaic systems for electricity production. In alignment with the calculation of the CO_2 ratios, we assume that a comprehensive green office building has a photovoltaic system (PV-system) of 50 m^2 with a maximum yield of 112 kWh/m^2/yr[118], which leads to an amount of self-generated electricity of 5,6 MWh/yr. Using the fact that the electricity of a core green building is 91MWh/yr (see calculations for CO_2 ratios), this PV system leads to an extra decrease in electricity costs by 6%. Therefore, the cost ratio for electricity use from the use of comprehensive (including core) green criteria is 0,94*0,25=0,23.

On the other hand, the purchase and installation of a photovoltaic system gives rise to extra costs in the construction phase[119]. The costs of a PV-system are around € 4 / peak Watt[120], which is the power that a system generates when the sun fully shines on it. A general rule is that 1m^2 has the capacity to deliver 100 peak Watt[121], from which we calculate a total of € 20.000 for the system of 50 m^2. These costs (for the system alone) are around 60% of the total costs for the construction of the system[122]. The other 40% are from installation and wiring and transformation (so-called "Balance of System"), which make the total cost of the system for the user € 33.300. This means extra investment costs of 0,57%.
Assuming that a PV system has no residual value, the cost ratio for the construction phase from the use of comprehensive (including core) green criteria is 1,0057*1,0182 = 1,0240. This means that a comprehensive green building is 2,4 % more expensive than a non-green building.

117 The cost and financial benefits of green buildings, Greg Kats, Capital E, 2003
118 Ecofys, 2008
119 It must be noted that in many countries, PV systems are subsidized. In our analysis, we make calculations for a non-subsidized PV system.
120 Ecofys, 2008
121 SenterNovem, http://duurzaambouwen.senternovem.nl/begrippen/wattpiek_(wp)/
122 SenterNovem, http://www.senternovem.nl/duurzameenergie/DE-technieken/Zonnestroom/

E.2.2.3 Financial impact of GPP per building

Using the figures as calculated above, all cost ratios for new offices and buildings are shown in table E10. The cost elements that are not influenced by green criteria are equal to 1. We can apply the cost structure of a non-green building to determine the overall financial impact of core and comprehensive levels of GPP per functional unit. Please find the results in table E10.

The interesting result is that the use of core green leads to a financial impact per building of only -10%. This results from the fact that, although green buildings are a bit more expensive than non-green buildings and the investment costs build up 61% of the total cost in the life cycle, the enormous savings in operational costs make up for it.
Comprehensive levels of GPP for new buildings and offices lead to the same cost reduction of -10%. The actual figures are even a bit below 10%, while core criteria are a bit above 10%. The difference is negligible though.

Table E10: Cost ratios and financial impact per functional unit of GPP for new offices and buildings. A cost ratio smaller than one implies cost reductions and a cost ratio larger than one implies cost increases. For the weighted average impact, negative numbers imply costs reductions and positive numbers imply costs increases.

Construction - *New buildings and offices*		
LCC relevant costs	cost ratios	
	core / no GPP	compr / no GPP
Investment cost	1,02	1,02
Costs for heating	0,38	0,38
Costs for electricity use	0,25	0,23
Costs for water use	0,70	0,70
Maintenance costs	1,00	1,00
Disposal costs	1,00	1,00
Financial impact per building	*-10%*	*-10%*

E.3 Electricity

As a result of differences in the fuel mix per country, we have chosen to look at the financial impact of GPP for electricity at a country specific level.
Needed for the calculation is the price ratio of the purchase cost of 'grey' electricity in every country (here defined as electricity from the standard fuel mix of a country, and as such possibly including a percentage of RES-E) versus the purchase cost of 50% RES-E electricity in every country versus the purchase cost of 100% RES-E electricity in every country.

E.3.1 Cost structure

Since the only costs that are incurred by the procurement of electricity, are the actual purchasing costs themselves, a cost structure is not applicable for this product. We will only focus on purchase prices for the calculation of cost ratios.

E.3.2 Cost ratios

With the use of the criteria that are included in the questionnaire, we determine the cost ratios of core and comprehensive levels of green procurement of electricity in the following two paragraphs. Based on these figures, we calculate the financial impact of GPP per kWh of consumed electricity in the final paragraph of this section.

The data needed for the calculation of this cost ratio has proven not to be available as such and therefore a series of calculations are performed to determine the cost ratios. The following steps are taken to arrive at the end result:

Step 1:
The price of 'grey' electricity is taken from Eurostat for every country in 2005[123]:

Table E11: Electricity prices for standard electricity per country

Country	Price incl tax, € / kWh
Austria	0,0992
Denmark	0,1086
Finland	0,0699
Germany	0,1047
Netherlands	0,1070
Sweden	0,0468
UK	0,0696

Step 2:
The percentage of RES-E as part of the total standard electricity consumption is taken per country from the EurOberv'ER[124]:

Table E12: Percentage of RES-E in standard fuel-mix. Please note that nuclear energy is not defined as a RES-E.

Country	%
Austria	66,19%
Denmark	31,68%
Finland	27,60%
Germany	11,31%
Netherlands	6,72%
Sweden	56,21%
UK	4,02%

Step 3:
Based on the price-increase per kWh in Germany from the standard fuel-mix, which relates to an increase of 11,31% RES-E to 100% RES-E, we calculate the price increase per percentage more RES-E, based on data found in Öko-Institut and ICLEI (2007).[125] For Germany this amounts to € 0,1226 (maximum price for 100%

123 Eurostat - Gas and electricity prices for structural indicators
124 http://www.eurobserv-er.org/, see Interactive Database
125 Costs and Benefits of Green Public Procurement in Europe. Part 1: Comparison of the Life Cycle Costs of Green and Non Green Products. Öko-Institut e.V. and ICLEI, July 2007.

green electricity in Germany) - € 0,1186 (price for grey electricity from standard fuel mix) / 89,9 (% increase in green electricity from grey tot 100% green) = € 0,0000448543 / % increase in RES-E.

Based on the country specific prices for electricity, we then calculate a country-specific price increase per percentage more RES-E by multiplying the increase by the ratio of the German price for electricity versus the price in the specific countries, for example for Austria 0,0000448543*(0,0992/0,1047) = 0,0000424980. The final step of the calculation is shown in the two following paragraphs.

E.3.2.1 Cost ratio of core green vs. non-green

The core green product is determined by the criterion that 50% of consumed electricity consists of RES-E. Based on the above calculated country-specific price increase, as well as the percentage of RES-E already represented in the standard fuel-mix, the prices and ratios are calculated for core green products compared to non-green products:

Table E13: Cost ratios for core green product

	Non-green	Core green - 50% RES-E	
	€ / kWh, incl tax	€ / kWh, incl tax	% price increase
Austria	0,099	0,099	0,00%
Denmark	0,109	0,110	0,78%
Finland	0,070	0,070	0,96%
Germany	0,105	0,106	1,66%
Netherlands	0,107	0,109	1,85%
Sweden	0,047	0,047	0,00%
UK	0,070	0,071	1,97%

E.3.2.2 Cost ratio of comprehensive green vs. non-green

The comprehensive green product is determined by the criterion that 100% of consumed electricity consists of RES-E. Based on the above calculated country-specific price increase, as well as the percentage of RES-E already represented in the standard fuel-mix, the prices and ratios are calculated for core green products compared to non-green products:

Table E14: Cost ratios for comprehensive green product

	Non-green	Comprehensive green - 100% RES-E	
	€ / kWh, incl tax	€ / kWh, incl tax	% price increase
Austria	0,099	0,101	1,45%
Denmark	0,109	0,112	2,93%
Finland	0,070	0,072	3,10%
Germany	0,105	0,109	3,80%
Netherlands	0,107	0,111	4,00%
Sweden	0,047	0,048	1,88%
UK	0,070	0,072	4,11%

E.3.2.3 Financial impact of GPP per kWh

Based on the figures as calculated above, all cost ratios per kWh for electricity are shown in table E15. As there is only one relevant cost element, but the ratios differ per country as explained in paragraph E.3, the table shows all the cost ratios per country for non-green electricity (standard fuel-mix of a country) versus core green electricity, as well as for non-green electricity versus comprehensive green electricity.

It is important to note that the ratios that equal 1 in the comparison of non-green and core green electricity (for Austria and Sweden), are explained by the fact that the standard fuel-mix of these two countries already consist of more than 50% RES-E. This means that there is no increase in percentage of RES-E in the fuel-mix, and therefore no increase in price. In general it is interesting to see the limited financial impact of GPP on this product group - the average cost ratio of all countries for core green is 1,0103 and for comprehensive it is 1,0304.

Table E15: Cost ratios and financial impact per functional unit of GPP for electricity. A cost ratio smaller than one implies cost reductions and a cost ratio larger than one implies cost increases. For the weighted average impact, negative numbers imply costs reductions and positive numbers imply costs increases.

Electricity - *Electricity*		
LCC	cost ratios	
Purchase cost	core / no GPP	compr / no GPP
Austria	1,00	1,01
Denmark	1,01	1,03
Finland	1,01	1,03
Germany	1,02	1,04
Netherlands	1,02	1,04
Sweden	1,00	1,02
UK	1,02	1,04
Financial impact per kWh (average)	*+1,03 %*	*+3,04 %*

E.4 Catering & food

As described in Chapter 1, we take catering services (including food) as a representative product for this product group. Therefore, the calculation of the cost structure and the cost ratios will be based on catering services only.

E.4.1 Cost structure

In the catering business, three types of contracts between client (public institution) and caterer are common, i.e. the open book contract, the contract with a contract sum and the commercial contract[126]. In an open book contract, the client (public institution) takes all the risks and all the profits, i.e. all procuring costs and selling costs are on the client's account. The caterer only has a facilitating role in this contract and receives an annual management fee for its work. In The Netherlands, around 25% of business catering has this form.

In a contact with a contract sum, arrangements regarding selling prices and fees are made with the caterer. Management fees do take place, but to a lower extent. 40% of the contracts in the Netherlands are of this type. Finally, in a commercial contract, all risks and profits are with the caterer. The only role that a public organisation plays is the facilitation of its premises. The client does not interfere with prices and a management fee does not exist in this type of contract. In the Netherlands, around 35% of the catering contracts are commercial contracts. In general, one can state that the larger the organisation, the higher the chance that one might find a commercial contract.

Since public entities may range from police stations to large ministries, we assume that the contract with a contract sum is most representative for our purpose. An average cost structure of such a catering contract can be estimated to as follows[127],[128]:

Table E16: Cost structure of catering services in The Netherlands

Cost element	(%)
Labour costs	50%
Procurement of food	40%
Other costs (e.g. kitchen equipment)	6%
Management fee	4%

Having determined the cost structure of catering services of a baseline country (The Netherlands), we can apply the various correction factors of table E17 in order to determine the cost structure for the other six countries.

Table E17: Cost structures for catering services vehicles in the Green-7

LCC relevant costs	Correction factor	LCC cost structure							
		Baseline (Nether-lands)	Austria	Denmark	Finland	Germany	Nether-lands	Sweden	UK
Labour costs	labour cost index	50%	43%	39%	44%	43%	50%	44%	47%
Procurement of food	price levels (food)	40%	48%	50%	47%	47%	40%	47%	44%
Other costs	price levels (other)	6%	6%	6%	6%	6%	6%	6%	5%
Management fee	price levels (other)	4%	4%	4%	4%	4%	4%	4%	4%

126 Source: Dutch association of caterers, www.veneca.nl
127 Source: HTC Catering advice
128 Source: Foodstep Wageningen

For labour costs, the percentage is corrected with the use of labour cost indices. Concerning the procurement of food, we correct the percentages using comparative price levels for food. For other costs (e.g. kitchen equipment) and the management fee, we make corrections using comparative price levels.

E.4.2 Cost ratios

With the use of the criteria that are included in the questionnaire, we determine the cost ratios of core and comprehensive levels of green procurement of catering services in the following two paragraphs. Based on these figures, we calculate the financial impact of GPP per lunch in the final paragraph of this section.

E.4.2.1 Cost ratio of core green and comprehensive green vs. non-green

There are only two criteria for catering services included in the questionnaire, being the organic production of food and the use of seasonal products based on the geographic location where the service is provided.

The second criterion, which is a core criterion, relates to the use of seasonal product. According to the head of procurement at Albron, a Dutch caterer, the premium prices that are paid when using this criterion do exist, but are negligibly small. Therefore, we do not take this criterion into account.

Concerning the price difference between organically and non-organically produced food, we determine the cost ratios on the basis of interviews both with experts in the field of catering and with catering companies itself. A thorough market analysis for a representative part of lunch products, which would be needed to attain high levels of accuracy, is beyond the scope of this study.

From our interviews[129],[130], we found that there can be a high variance in cost ratios per lunch product group. For example, the prices of organically produced dairy products are very much comparable with non-organically produced dairy product, while the price for organically produced meat can be up to 30% - 40% higher. Organically produced bread is usually around 20% more expensive, and vegetables and fruit are around 10% more expensive. In conclusion, we take an average of a premium of 15% that is added to the purchase price of organically produced lunch products, compared to products that are not organically produced.

We assume that the premium price of organically-produced food is paid for by the client (i.e. the public organisation) and not by the person who actually pays for its lunch. The reasoning behind this is that if a public organisation truly intents to procure sustainably, it will also pay for an eventual premium price. Furthermore, from the results of the questionnaire, we know that around 27% of the procured lunch products are produced organically[131]. Using this percentage, we determine the cost ratio to be 1 + (27% * 0,15) = 1,0405. This means that organically produced food is 4,05% more expensive (on average) than non-organically produced food.

E.4.2.2 Financial impact of GPP per lunch

Using the figures as calculated above, all cost ratios for catering services are shown in table E18. The cost elements that are not influenced by green criteria are equal to 1.

We can apply the cost structure of a non-green catering service to determine the overall financial impact of core and comprehensive levels of GPP per functional unit. Please find the results in table E18. The cost ratios for core and comprehensive green products are equal, since no comprehensive criteria are taken into account.

The interesting result is that the use of green criteria (i.e. lunch products that are produced organically) leads to a financial impact per lunch prepared of only +2%. Even though organically produced food may be 15% more expensive, not all lunch products are organically produced (typically only 27%). Furthermore, procurement of lunch products itself is the only element in the cost structure that leads to increases in costs (labour costs, management fee and other costs are not influenced by

129 Head of procurement, Albron catering

130 HTC Catering advice

131 The GPP Toolkit does not set percentages for core and comprehensive, The criterion is: “[X] % of [either a defined product group such as dairy, meat, vegetables, or a list of specific products e.g. potatoes, tomatoes, beef, eggs] to be used in carrying out the service must be organically produced…”

organic production of food). Since the procurement of food only accounts for 46% of the total costs, the financial impact of GPP per lunch is only +2%.

Table E18: Cost ratios and financial impact per functional unit of GPP for catering services. A cost ratio smaller than one implies cost reductions and a cost ratio larger than one implies cost increases. For the weighted average impact, negative numbers imply costs reductions and positive numbers imply costs increases.

Catering & Food - *Catering services*		
LCC relevant costs	cost ratios	
	core / no GPP	compr / no GPP
Labour costs	1,00	1,00
Procurement of food	1,04	1,04
Other costs	1,00	1,00
Management fee	1,00	1,00
Financial impact per lunch	*+2 %*	*+2 %*

E.5 Gardening

As described in Chapter 1, we take gardening services and machinery as a representative product for this product group. Therefore, the calculation of the cost structure and the cost ratios will be based on gardening services and machinery only.

E.5.1 Cost structure

Concerning gardening services, we base our analysis on a report of the Dutch Association of Horticulturist and Green space workers (VHG)[132]. The report describes an annual study on business comparison between horticultural companies in The Netherlands. The company types that are under scope are:

- Small horticultural companies, private sector (< 4 FTE)
- Middle-sized horticultural companies, private sector (4-9 FTE)
- Larger horticultural companies, private sector (> 9 FTE)
- Horticultural companies, commercial sector and private sector
- Horticultural companies, commercial sector
- Green area workers
- Horticultural companies / green area workers
- Tree keepers
- Social Work companies
- Garden centres

First, we have made an analysis, based on the average figures in mentioned report, on the market shares of the various company types in the public sector. See below for the results. The remaining one percent of the remaining company types is neglected. We use these market shares to weigh the various cost elements of the four company types.

Table E19: Public sector market shares of gardening companies in the Netherlands (VNG 2006)

Company type	Market share public sector
Green area workers	34 %
Horticultural companies / green area workers	19 %
Tree keepers	7 %
Social Work companies	34 %

Below we have listed the average costs for the four company types that are active in the public sector. The column on the right shows the relative percentages of the cost elements, weighted by relative market share of the four company types (see table E19 above). Please note that the percentages under material costs (non-shaded rows) are relative with regard to other material costs (e.g. transport costs make up 25% of total material costs)

132 Groei in groen? Bedrijfsvergelijkend onderzoek VHG 2006, SEO economisch onderzoek, December 2007.

Table E20: Average costs per company for four gardening company types in the Netherlands (VNG 2006).

	Green area workers (€)	Horticultural companies / green area workers (€)	Tree keepers (€)	Social Work companies (€)	%
Labour costs	1.616.469	1.588.773	283.123	6.046.000	**71 %**
Material costs	627.649	643.780	156.602	1.285.068	**19 %**
Transport costs*	103.269	162.091	50.615	198.600	25 %
Machinery costs*	181.000	176.591	27.846	159.200	27 %
General costs	64.962	66.636	18.077	83.700	12 %
Housing costs	59.577	102.000	21.231	107.300	14 %
Office costs	32.385	35.273	13.769	41.800	6 %
Equity costs	37.110	40.280	7.910	84.068	9 %
Commercial costs	21.692	31.636	11.000	5.900	3 %
Accounting costs	12.346	17.182	3.385	2.000	1 %
Clothing	8.577	8.909	2.000	42.300	4 %
Procurement costs	430.000	639.500	110.923	453.400	**10 %**

* These costs include costs like fuel, depreciation of machinery/vehicles and taxes.

Table E21: Average procurement costs per company for four gardening company types in the Netherlands (VNG 2004).

	Green area workers (€)	Horticultural companies / green area workers (€)	Tree keepers (€)	Social Work companies (€)	%
Solid matter (e.g. concrete, sleepers)	237.222	454.167	45.800	81.000	61%
Organic matter (e.g. plants)	63.778	148.583	53.900	50.333	22%
Procurement gardening centers	20.389	4.250	17.700	0	3%
Other matter (e.g. soil improvers, compost)	26.222	49.833	21.300	63.833	14%

A split of procurement costs (i.e. variable costs in business) is not available in the 2006 VNG report. However, in table below, we show the procurement cost split into solid matter, organic matter and other matter based on the figures in the 2004 report. Assuming that gardening is a continuous business, we can apply these percentages to the total procurement costs of 2006.

From the tables above, we can calculate the cost structure that is used in this study for gardening services. Please refer to the table below for the result:

Table E22: Cost structure for gardening companies in the public sector in The Netherlands

cost element	%
Labour costs	71%
Transport costs*	5%
Machinery costs*	5%
Other material costs (e.g. housing costs)	9%
Procured matter (e.g. soil improvers)	1%
Other procured matter (e.g. plants)	9%

* These costs include costs like fuel, depreciation of machinery/vehicles and taxes.

Table E23: Cost structure for gardening services in the Green-7

LCC relevant costs	Correction factor	LCC cost structure							
		Baseline *(Netherlands)*	Austria	Denmark	Finland	Germany	Netherlands	Sweden	UK
Labour costs	labour cost index	71%	69%	66%	70%	68%	71%	70%	72%
Transport costs	0,5 euro / litre diesel, 0,5 price levels (transport)	5%	5%	5%	4%	5%	5%	5%	5%
Machinery costs	price levels (machinery)	5%	5%	5%	5%	5%	5%	5%	4%
Other material costs	price levels (other)	9%	10%	11%	10%	10%	9%	10%	9%
Procured matter (soil improvers)	price levels (other)	1%	2%	2%	1%	2%	1%	1%	1%
Other procured matter	price levels (other)	9%	10%	11%	9%	10%	9%	9%	9%

Having determined the cost structure of gardening services of a baseline country (Netherlands), we can apply the various correction factors of table E23 in order to determine the cost structure for the other six countries. For labour cost, the percentage is corrected with the use of the labour cost index. Transport costs are partly corrected by diesel prices and partly by comparative price levels of vehicles. Machinery costs are corrected using comparative price levels of machinery products and finally other material costs, procured matter and other procured matter are corrected using comparative price levels of other products. See the table below for the results.

E.5.2 Cost ratios

With the use of the criteria that are included in the questionnaire, we determine the cost ratios of core and comprehensive levels of green procurement of gardening services in the following two paragraphs. Based on these figures, we calculate the financial impact of GPP per m^2 gardening services in the final paragraph of this section.

E.5.2.1 Cost ratio of core green and comprehensive green vs. non-green

As was already shown in the previous section, gardening services include various activities and hence various cost items, ranging from transport to gardening machinery to procurement of soil improvers. Of the criteria in the questionnaire, two of them relate to soil improvers (one core criterion and one comprehensive criterion) and one relates to gardening machines. We will first treat the criteria concerning soil improvers.

Soil improvers[133]

The environmental impact of soil improvers comes from the use of peat and sewage sludge, which are to be excluded if soil improvers are to meet core criteria. Comprehensive green soil improvers have to comply with the criteria underlying the EU Ecolabel, which are stricter than just the exclusion of peat and sewage sludge.

133 The analysis is based on the following sources: Anglian Garden & Building suppliers, personal communication; Eurolab, http://www.eurolab.nl/meststof-bodemverbetering-g.htm; Bogro, supplier of a.o. soil improvers, personal conversation

Nowadays, many alternatives to peat and sewage sludge exist, of which composted bark and composted green waste are the most common. These alternatives usually have no extra costs, since they are simply waste that can be recycled. Another alternative on the market is cocopeat, which is made of coconut shell leftovers. However, this cocopeat may be around 2 times more expensive than peat, and does therefore not have a large market share yet. In summary, the financial impact of using alternatives to peat and sewage sludge is minimal. Hence, for the core criterion regarding soil improvers, we set the cost ratio to 1.

Comprehensive green soil improvers that comply with the criteria underlying the EU Ecolabel are usually a bit cheaper than garden compost. For example, a bag of ecolabel soil improver may cost € 1,30 per bag, while normal garden compost may cost € 1,45 per bag (incl. VAT). Since a thorough market research on the actual price difference between normal soil improvers and ecolabel soil improvers is beyond the scope of this study, we assume that these prices are representative for the market. Therefore, we set the cost ratio of comprehensive green soil improvers to 0,9. This means that comprehensive green soil improvers are 10% cheaper than non-green soil improvers.

Garden machinery[134]

The final criterion of gardening services requires gardening machines to be able to run on one or more of the following fuel grades: unleaded petrol with a benzene-content of <1.0 % by volume, alkylate petrol, class A diesel oil, or biofuel-based engine fuel. This criterion relates to gardening machinery, of which 50% of the costs can be assumed to be for fuel use. (see also previous section). The other 50% is accounted for by purchasing costs.

There are no real 'green' alternatives for purchasers of gardening machinery that runs on diesel. The machinery on offer will meet legal requirements with regard to emissions, but there is no big demand, and therefore limited availability, for more efficient machinery. The only possibility for improving emissions is to have a gas (LPG) tank placed on an existing machine, but this is only feasible in certain cases, requires a significant investment and most importantly, is hardly ever asked for by the purchaser. As this only plays such a small role, this element will not be taken into account for the calculation of the cost ratio and therefore the non-portable machinery will not be taken into consideration when calculating the cost ratio.

In principle gardening machinery that runs on gasoline also runs on Aspen. Aspen is an alkylate type of petrol containing hardly any hazardous emissions for humans, like benzene, toluene or sulphur but is approximately twice as expensive as standard petrol. About 80% of the machines purchased by gardening services are gasoline based. As explained earlier, 50% of the LCC of machinery is determined by the cost of fuel use. Therefore the cost ratio for non-green machinery versus core green machinery is 100% (price increase between standard fuel and Aspen) * 80% (percentage of machines that run on gasoline) * 50% (percentage of cost fuel use in total LCC of machinery) = 40% which equals a ratio of 1,4.

Remarks: Another way of looking at gardening machinery reveals that we can roughly distinguish two types of machinery: portable and non-portable machinery.

With regards to the portable machinery purchasers to a certain degree do have a choice in terms of energy efficiency of machinery on offer and thus for purchasing a machine that is more environmentally friendly. The more efficient version of for example a leaf-blower will save up to 30% of fuel. That makes using this machine with Aspen fuel an attractive possibility for purchasers looking for sustainable ways to improve the health related working conditions of their employees with acceptable cost implications.

The discussed leaf-blower will cost 66% more in terms of purchase cost (€ 395 versus € 655), which is approximately representative for other product choices, but as pointed out will reduce fuel costs by up to 30% (which is also representative for other product choices). Furthermore, the lifespan of the machinery will be extended by the use of Aspen, as it is produced specifically for the use of garden machinery.

134 The analysis is based on the following sources: A.J. van de Werf gardening services, personal communication; O. de Leeuw Groentechniek, personal communication; http://www.aspen-benelux.nl/showpage.asp?pag_id=363; CF Tuintechniek, personal communication

E.5.2.2 Financial impact of GPP per m^2 of gardening services

Concerning the use of green criteria in gardening services, we have found that only machinery costs and costs for procured matter (soil improvers) are influenced by GPP. It was found that comprehensive green soil improvers are around 10% cheaper than non-green soil improvers. Machinery costs are around 40% higher due to the use of more expensive Aspen fuel, which complies with green criteria.

In the table below we see that, although the cost impact of using Aspen fuel is very significant, it is largely annulled by the fact that it only accounts for half of the 5% of the cost of machinery in the total LCC. As a result, we find that the use of green criteria leads to 2% increases in costs per m2 gardening services

Table E24: Cost ratios and financial impact per functional unit of GPP for gardening services. A cost ratio smaller than one implies cost reductions and a cost ratio larger than one implies cost increases. For the weighted average impact, negative numbers imply costs reductions and positive numbers imply costs increases.

Gardening – *gardening services and machinery*		
LCC relevant costs	cost ratios	
	core / no GPP	compr / no GPP
Labour costs	1,00	1,00
Transport costs	1,00	1,00
Machinery costs	1,40	1,40
Other materials costs	1,00	1,00
Procured matter (mainly soil improvers)	1,00	0,90
Other procured matter	1,00	1,00
Financial impact per m2	*+2 %*	*+2 %*

E.6 Office IT equipment

As described in Chapter 1, we take computers (desktops & laptops) and monitors as representative products for this product group. Therefore, the calculation of the cost structure and the cost ratios will be based on computers and monitors only.

E.6.1 Cost structure

We base our calculations of the cost structure of computers and monitors on the figures in a report by the Öko-Institut and ICLEI[135]. This report describes a market analysis that has been performed in Germany, Sweden, Czech Republic and Spain. Below we list the results of this market research in Germany, which is based on an assumed lifetime of four years for the computers and monitors.

Table E25: Life cycle costs for desktop and laptop computers and monitors in Germany (Öko-Institut and ICLEI, 2007).

cost element	Desktop computer (€)	Laptop computer (€)	Monitor (€)
Investment costs	802	1.398	317
Costs for electricity demand	86	41	47
Costs for repairs	138	138	-
Costs for upgrading	4	4	-

The desktop computer is defined as an average desktop computer that does not comply with Energy Star (version 4.0) and on site service of three years. Its technical specifications are: dual core processor with ±1,8 GHz; Pentium D with 3,0 GHz), on board graphic, ±160 GB SATA 7.200 rpm hard drive, 1.024 MB RAM (upgrade to 2.048 MB is possible), DVD writer, ±3 USB 2,0, VGA and/or DVI, 100MBit LAN, WLAN.

The laptop computer is defined as an average notebook that does not comply with Energy Star (version 4.0) and without additional warranty. Its technical specifications are: dual core processor ±1,6 GHz), on board graphic, ±80 GB SATA 5.400 rpm/7.200 rpm hard drive, 1.024 MB RAM (upgrade to 2.048 MB is possible), DVD writer, ±USB 2,0, VGA and/or DVI, 100 MBit LAN, WLAN.

The monitor refers to an average 17" flat screen certified with TCO'03 (including Energy Star) and with a producers' warranty of 3 years.
It must be noted that for computers and monitors, the WEEE[136] directive states that electronic equipment from public authorities can be disposed free of charge in the EU. Therefore, costs for disposal are not relevant for this product group.

With the use of these numbers, we can calculate the cost structure which is needed in our study. See the table below for the result (averaged between desktop and laptop computers and monitors):

Table E26: Cost structure for computers and monitors in Germany

cost element	%
Purchase price	85 %
Electricity use	6 %
Maintenance costs	10 %

Having determined the cost structure of computers and monitors of a baseline country (Germany), we can apply the various correction factors of table E27 in order to determine the cost structure for the other six countries. For purchase prices, the percentage is corrected with the use of comparative price levels. Concerning electricity use and maintenance costs, we correct the percentages using costs per kWh and labour costs indices respectively.

135 Costs and Benefits of Green Public Procurement in Europe. Part 1: Comparison of the Life Cycle Costs of Green and Non Green Products. Öko-Institut e.V. and ICLEI, July 2007.

136 For more information please visit http://ec.europa.eu/environment/waste/weee/index_en.htm

Table E27: Cost structures for computers and monitors in the Green-7

LCC relevant costs	Correction factor	LCC cost structure							
		Baseline *(Germany)*	Austria	Denmark	Finland	Germany	Nether-lands	Sweden	UK
Purchase price	price levels (other)	85%	85%	88%	86%	85%	83%	86%	83%
Electricity use	euro/kWh	6%	5%	3%	3%	6%	6%	3%	5%
Maintenanc e costs	labour cost index	10%	10%	9%	11%	10%	11%	11%	11%

As mentioned before, an LLC analysis was also performed in Sweden for computers and monitors by Öko-Institut and ICLEI (2007). In table E28, we compare the cost structure in Sweden based on these results (approach 1) with the cost structure in Sweden as calculated by applying country-specific correction factors to the German cost structure (approach 2). The table shows that the figures from both approaches compare very well, which gives us confidence that the application of correction factors results in accurate figures when calculating country-specific cost structures.

Table E28: Cost structure for computers and monitors in Sweden.

cost element	Approach 1 %	Approach 2 %
Purchase price	86,17%	86,07%
Electricity use	3,70%	3,38%
Maintenance costs	10,13%	10,56%

E.6.2 Cost ratios

Since no comprehensive criteria are specifically included in the questionnaire, we will only calculate the ratio of core green versus non-green.

E.6.2.1 Cost ratio of core and comprehensive green vs. non-green

Concerning the cost ratios of IT office equipment, we make a distinction between desktops & laptops on the one hand and monitors on the other hand. For both of these, Energy Star requirements are a relevant criterion.

Furthermore, the ease of disassembly of desktops and laptops are a criterion in the questionnaire.

Cost ratios for desktops and laptops

We will first focus on the costs that are incurred by Energy Star requirements of desktop and laptops. According to Öko-Institut and ICLEI (2007), the ratio of the purchase cost of a non-green desktop or laptop vs. the purchase cost of an Energy Star labelled desktop or laptop is the following for Germany:

Table E29: Purchasing costs of green on non-green desktops and laptops in Germany

Purchasing cost desktop/laptop Germany				
	LCC		Difference	
	non-green version	green version	absolute	relative
Desktop	€ 802,00	€ 820,00	€ 18,00	2%
Laptop	€ 1.398,00	€ 1.416,00	€ 18,00	1%
Average	**€ 1.100,00**	**€ 1.118,00**	**€ 18,00**	**2%**

The Energy Star requirement also influences the cost of the usage of a computer, through the fact that it decreases the energy use. The electricity cost of a non-green desktop or laptop and the electricity cost of an Energy Star labelled desktop or laptop are the following for Germany (Öko-Institut and ICLEI, 2007), based on an average computer lifetime of four years:

Table E30: Electricity costs of green and non-green desktops and laptops in Germany

Electricity cost desktop/laptop Germany				
	LCC		Difference	
	non-green version	green version	absolute	relative
Desktop	€ 86,00	€ 56,00	-€ 29,00	-34%
Laptop	€ 41,00	€ 30,00	-€ 11,00	-27%
Average	**€ 63,50**	**€ 43,00**	**-€ 20,00**	**-31%**

It is important to note that the ratio as calculated above is not the same as the CO_2 ratio of computers and monitors as calculated in section D.6. This is a result of the fact that the costs used to calculate the cost ratios are corrected for inflation and net present value.

Secondly, concerning the ease of disassembly of computers, it has become clear[137] that there are no desktops or laptops that are easier to disassemble than other for the purpose of recycling. Therefore the ratio of this element can be set at 1,00.

Cost ratios for monitors

For monitors the only relevant green criterion is compliance with Energy Star requirements. As the Energy Star label no longer really distinguishes monitors from one another as LCD/TFT monitors are all relatively energy efficient, we set both cost ratios (for purchasing costs and cost from electricity use) to 1,00.[138]

E.6.2.2 Financial impact of GPP per computer

The cost ratios can be concluded from the above and are presented in table E31 below. The cost ratios for core and comprehensive green products are equal, since no comprehensive criteria are taken into account. It is interesting to note, that despite the significant reduction in the costs of electricity use, the final financial impact is still positive because of the heavy weight assigned to the purchase price in the LCC.

Table E31: Cost ratios and financial impact per functional unit of GPP for office IT equipment. A cost ratio smaller than one implies cost reductions and a cost ratio larger than one implies cost increases. For the weighted average impact, negative numbers imply costs reductions and positive numbers imply costs increases.

Office IT equipment – *computer and monitors*		
LCC relevant costs	cost ratios	
	core / no GPP	compr / no GPP
Purchase price	1,02	1,02
Electricity use	0,85	0,85
Maintenance costs	1,00	1,00
Financial impact per computer	*+1 %*	*+1 %*

137 MyCom sales representative, personal communication

138 See also Öko-Institut and ICLEI (2007), page 114-115

E.7 Paper

As described in Chapter 1, we take copying & graphic paper as a representative product for this product group. Therefore, the calculation of the cost ratios will be based on copying & graphic paper only.

E.7.1 Cost structure

Since the only costs that are incurred by the procurement of paper are the actual purchasing costs themselves, a cost structure is not applicable for this product. We will only focus on purchase prices for the calculation of cost ratios.

E.7.2 Cost ratios

In order to calculate the cost ratio for core green paper, we look at the price difference between standard white A4 80 grams copying paper and different types of green paper.

E.7.2.1 Cost ratio of core green vs. non-green

As both recycled and paper based on legally and/or sustainably managed wood for primary pulp paper are considered core green compliant but there is no specification of the respective percentages, the cost ratio for the core green product is based on the average cost ratio of the two products.[139] This means that the average of (1) the purchase cost of paper that is 100% recycled and (2) the purchase cost of paper that is based on sustainably managed wood (such as PEFC certified wood) is calculated for the cost ratio.[140]

The price ratios are summarized in table E32 below[141].

Table E32: Purchase cost of non-green and core green paper

Purchasing cost non-green paper vs core green paper			
Brand	Type	LCC	Difference
Standard	*no certificates*	1,00	n/a
Evolve Business	100% recycled	1,20	20%
Balans	100% PEFC primary pulp	1,10	10%
Average Core Green	50% recycled 50% PEFC primary pulp	1,15	15%

E.7.2.2 Cost ratio of comprehensive green vs. non-green

The ratio of the purchase cost of paper that does not comply with any labels (see also paragraph E.7.2) versus the purchase cost of paper that is certified with an Ecolabel, being Nordic Swan or EU Eco-label[142], is used to calculate the cost ratio for comprehensive green paper. Please refer to the table below for an overview.

Table E33: Purchase cost of non-green and core green paper

Purchasing cost non-green paper vs comprehensive green paper			
LCC		Difference	
Non-green paper	Certified paper	Non-green paper	Certified paper
€ 2,10	€ 2,50	€ 0,40	19,0%

139 The cost ratio of ECF/TCF has been taken out of the cost elements, as based on talks with experts it turned out that there is only very little paper left in the market that is not produced ECF at least, or otherwise TCF. This is confirmed by the results of our questionnaire. This means that there is no difference in price based on this cost element between non-green and core or comprehensive green paper.

140 This means that the paper is made of 100% primary pulp and that of that pulp at least 70% of the wood is PEFC – comparable to FSC – certified. The rest is to come from non-controversial forests. The reason for choosing PEFC rather than FSC is that FSC can include recycled paper, and also has different percentages of actually used FSC wood, whereas PEFC uses only the 70% standard and only primary pulp. Source: ModoVanGelder, personal communication; http://www.modovangelder.nl/

141 ModoVanGelder, personal communication; www.modovangelder.nl

142 Océ, personal communication

E.7.2.3 Financial impact of GPP per kg paper

From the above information we can conclude that the cost ratios are the following:

Table E34: Cost ratios and financial impact per functional unit of GPP for paper. A cost ratio smaller than one implies cost reductions and a cost ratio larger than one implies cost increases. For the weighted average impact, negative numbers imply costs reductions and positive numbers imply costs increases.

Paper - *Clothing*		
LCC relevant costs	cost ratios	
	core / non-green	compr / non-green
purchase price	1,15	1,19
Financial impact per kg paper	*+15 %*	*+19%*

E.8 Textiles

As described in Chapter 1, we take clothing as a representative product for this product group. Therefore, the calculation of the cost ratios will be based on clothing only. Only a core green product was identified

E.8.1 Cost structure

Since the only costs that are incurred by the procurement of clothing are the actual purchasing costs themselves, a cost structure is not applicable for this product. We will only focus on purchase prices for the calculation of cost ratios.

E.8.2 Cost ratios

In order to calculate the cost ratio for textile the purchase cost of non-EU Ecolabel certified clothing is compared to EU Ecolabel certified clothing. A second green criterion relevant for textile production is compliance with Öko-Tex 100 standards. Considering the large overlap in criteria between Öko-Tex and the EU Ecolabel, we assume that compliance with both sets of criteria have the same financial impact. As a result, the cost ratio for core compliance with Öko-Tex Standards and comprehensive compliance with EU Ecolabel criteria levels are equal.

It has to be noted that, although the questionnaire includes questions concerning compliance with EU Ecolabel and other labels, this cannot be understood as meaning that a purchasing authority could require products to be certified as such: the label is only one possible means of demonstrating compliance with the criteria.

E.8.2.1 Cost ratio of core and comprehensive green vs. non-green

It is particularly difficult in the case of clothing to speak of standard prices because of the impact that brands can have on pricing schemes. As a consequence of this, the cost ratios of core green versus non-green clothing are to be considered an estimate. As the difference in price between non-EU Eco-label certified and EU Eco-label certified clothing lies between 5% and 10%, the cost ratio is taken to be 1,075.

E.8.2.2 Financial impact of GPP per kg textile

Based on the above, the following conclusion can be drawn:

Table E35: Cost ratios and financial impact per functional unit of GPP for textile. A cost ratio smaller than one implies cost reductions and a cost ratio larger than one implies cost increases. For the weighted average impact, negative numbers imply costs reductions and positive numbers imply costs increases.

Textiles - *Clothing*		
LCC relevant costs	cost ratios	
	core / non-green	compr / non-green
purchase price	1,08	1,08
Financial impact per kg textile	*+7,5 %*	*+7,5 %*

E.9 Transport

As described in Chapter 1, we take passenger cars and light duty vehicles as representative products for this product group. Therefore, the calculation of the cost structure and the cost ratios will be based on passenger cars and light duty vehicles only.

E.9.1 Cost structure

For the calculation of the cost structure of passenger cars and light duty vehicles, we base ourselves on the results of a report by the Öko-Institut and ICLEI[143]. In this report, LCC analyses are performed for passenger cars and light duty vehicles in Germany, Sweden Spain and Czech Republic. Below we show the results of this research in Germany, for which the assumption was used that a vehicle is diesel-fuelled, drives 15.000 km per year and has a service life of five years.

Table E36: Life cycle costs for passenger cars and light duty vehicles in Germany (Öko-Institut and ICLEI, 2007).

Cost element	Citroen C3 (€)	VW Touran (€)	VW Caddy (€)
Investment	14.034	19.405	15.639
VAT	2.666	3.687	2.972
Admission fee	25	25	25
Motor vehicle tax	1.021	1.391	1.391
Fuel costs	3.481	4.702	4.821
Maintenance, material costs	1.148	1.537	1.313
Maintenance, personnel costs	467	521	663
Disposal	-4.882	-8.469	-6.525

The figures apply for the following cars:

- Citroen C3 HDi 70 Comfort, which is a diesel-fuelled small car with 50 kW engine power, a fuel consumption of 4,4 l/100km, CO_2 emissions of 115 g/km and a cylinder capacity of 1.398 ccm.
- Volkswagen Touran 1.9 TDI 77 kW Trendline, which is a diesel-fuelled medium-sized car with 77 kW engine power, fuel consumption of 5,9 l/100km, CO_2 emissions of 156 g/km and a cylinder capacity of 1.896 ccm.
- Volkwagen Caddy Kombi 1.9 TDI, , which is a diesel-fuelled delivery van with 77 kW engine power, fuel consumption of 6,1 l/100km, CO_2 emissions of 165 g/km and a cylinder capacity of 1.896 ccm.

With the use of the Life Cycle Analyses of these three cars, we can calculate the average cost structure in Germany for passenger cars and light duty vehicles (see table E37). Disposal costs are subtracted from investment costs to result in purchase price.

Table E37: Cost structure for passenger cars and light duty vehicles in Germany.

cost element	%
Purchase price	63%
Road tax	6%
Fuel costs	21%
Maintenance costs	9%

Having determined the cost structure of passenger cars and light duty vehicles of a baseline country (Germany), we can apply the various correction factors of table E38 in order to determine the cost structure for the other six countries. For purchase prices, the percentage is corrected with the use of comparative price levels for transport. Concerning road tax and fuel use, we correct the percentages using road taxes and costs per litre diesel respectively. For maintenance cost, we assume that 30% of the costs are determined by labour cost and 70% by prices for material, which is based on the figures in table E38.

143 Costs and Benefits of Green Public Procurement in Europe. Part 1: Comparison of the Life Cycle Costs of Green and Non Green Products. Öko-Institut e.V. and ICLEI, July 2007.

Table E38: Cost structures for passenger cars and light duty vehicles in the Green-7

LCC relevant costs	Correction factor	LCC cost structure							
		Baseline *(Germany)*	Austria	Denmark	Finland	Germany	Nether-lands	Sweden	UK
Purchase price	price levels (transport)	63%	67%	71%	66%	63%	59%	67%	64%
Road tax	road tax	6%	6%	6%	7%	6%	16%	3%	3%
Fuel costs	euro / litre diesel	21%	19%	16%	17%	21%	17%	20%	23%
Main-tenance costs	0,3 labour cost index; 0,7 price levels (other)	9%	9%	8%	9%	9%	9%	9%	10%

E.9.2 Cost ratios

Since no comprehensive criteria are specifically included in the questionnaire, we will only calculate the ratio of core green versus non-green.

E.9.2.1 Cost ratio of core green vs. non-green

In the questionnaire, two core criteria for passenger cars and light duty vehicles are included.

- Compliance with Euro 5 standards for vehicles
- Maximum average CO_2 emissions per vehicle segment

The Euro standards for vehicles lay restrictions on the exhaust emissions of CO (carbonmonoxide), HC (hydrocarbons), NOx (nitrogen oxide) and PM10 (particulate matter). For passenger cars and light duty vehicles, the Euro 5 standards will only be mandatory as from 2010. As a result, the availability of Euro 5 vehicles in these vehicle segments is very low[144], which inherently limits the possibility of making price comparisons between vehicles for which the only difference is Euro standards. Therefore, we do not take this criterion into account to assess the financial impact.

The second criterion concerns the maximum average CO_2 emissions per vehicle segment, of which the limits are shown in table E39. The vehicle segments that relate to passenger cars and vans are small cars, compact cars, middle class cars and vans.

Table E39: Maximum CO_2 emissions for various vehicle segments (GPP Toolkit Transport, 2008)

Segmentation	Maximum CO_2 emissions [g/km]	Example of vehicle within segment
Small car	= 120	VW Polo
Compact car	= 140	VW Golf, Jetta
Middle class	= 160	BMW 3er
Upper middle class	= 200	Mercedes E-Klasse
Upper class	= 270	BMW 7er
Cross-country vehicle	= 210	Toyota RAV 4
Van	= 150	Opel Zafira, Renault Scenic
Transporter	< 250	VW Transporter, Caravelle

Even though we only focus on passenger cars and light duty vehicles, there is still an enormous amount of cars and models available in the market, which may differ in weight, fuel consumption, engine power, cylinder

144 SenterNovem, Duurzaam Inkopen, criteria voor Dienstauto's. Version 20 September 2007.

capacity, etc. When making price comparisons between green and non-green vehicles, we will compare vehicles for which the difference is determined only by CO_2 emissions (i.e. fuel consumption). In practice, this implies that our analysis is performed for vehicles of which the green and the non-green version is the same except for its CO_2 emissions.

Currently, the most common car models that match this description are the Bluemotion version of the Volkswagen Golf and the Volkswagen Passat and the e-version in the Audi A3. A third common green vehicle is the Ecomotive version of the Seat Leon, however the normal Seat Leon and the Seat Leon Ecomotive differ in gear box type as well (automatic and manual respectively), which also has an impact on the price of a car.

In tables E40 and E41, the technical specifications for the cars that we compare are listed. The only main difference between the green and non-green versions of these cars is fuel consumption (and thus CO_2 emissions).
Purchase prices of these cars are including all taxes and are UK re-seller prices for the Audi A3 Standard, Austrian prices for the Audi A3 Sportback, German prices for the VW Golf and Dutch prices for the VsW Passat.

Table E40: Technical specifications and prices of green and non-green versions of the Audi A3

	Audi A3145		Audi A3146	
	Standard 1.9 TDI	Standard 1.9 TDI e	Sportback attraction TDI	Sportback attraction TDI e
Cylinder capacity [ccm]	1.896	1.896	1.896	1.896
Engine power [kW] / bhp	77/105	77/105	77/105	77/105
Euro standard	Euro 4	Euro 4	Euro 4	Euro 4
Fuel type	diesel	diesel	diesel	diesel
CO_2 emissions [g/km]	135	119	127	119
Weight	1.295	1.295	1.335	1.320
Fuel consumption [l/100km]	4,2	3,8	5,0	4,6
Price (incl all taxes)	**£17.780**	**£17.695**	**€ 25.420**	**€ 25.090**

Table E41: Technical specifications of green and non-green versions of the Volkswagen Golf and Volkswagen Passat

	Volkswagen Golf147		Volkswagen Passat148	
	Trendline 1.9 TDI DRF 77	Trendline Bluemotion 1.9 TDI DRF 77	Comfortline 1.9 TDI DRF 77	Comfortline Bluemotion 1.9 TDI DRF 77
Cylinder capacity [ccm]	1.896	1.896	1.896	1.896
Engine power [kW] / bhp	77/105	77/105	77/105	77/105
Euro standard	Euro 4	Euro 4	Euro 4	Euro 4
Fuel type	diesel	diesel	diesel	diesel
CO_2 emissions [g/km]	145	119	151	136
Weight	1.262	1.261	1.397	1.397
Fuel consumption [l/100km]	5,5	4,5	5,7	5,1
Price (incl all taxes)	**€ 21.950**	**€ 22.275**	**€ 31.650**	**€ 31.650**

145 Source: www.audi.co.uk
146 Source: www.audi.nl
147 Source: www.volkswagen.nl. Fuel consumptions and CO_2 emissions are from www.groenopweg.nl
148 Source: www.volkswagen.nl. Fuel consumptions and CO_2 emissions are from www.groenopweg.nl

Concerning purchase prices, it is interesting to note that the difference is minimal. Green cars with low CO_2 emissions are usually a bit more expensive than its normal counterpart, but this difference is offset by registration taxes and admission fees. As a result, the purchase price ratio of green cars compared to non-green cars is 1,00.

For the cost ratio of fuel costs, we make use of the fuel consumption figures of these four vehicles. As mentioned before, it is the fuel consumption that mainly determines the CO_2 emissions of a car. Our result is that the cost ratio for fuel costs between a green car and a non-green car is 0,88.

The calculation of annual road taxes varies from country to country. In the UK for example, the main driver for the determination of road taxes is CO_2 emissions[149], while in Finland the main driver is engine power (kW)[150]. The results of the various cost ratios are shown in table E42.

Table E42: Cost ratios for road taxes between green and non-green vehicles in the Green-7

Country	cost ratio
Austria	1,00
Denmark	1,00
Finland	1,00
Germany	1,00
Netherlands	1,00
Sweden	0,75
United Kingdom	0,43

E.9.2.2 Financial impact of GPP per vehicle

Using the figures as calculated above, all cost ratios for passenger cars and light duty vehicles are shown in table E43. The cost elements that are not influenced by green criteria are equal to 1. Road tax, which has a country-specific cost ratio, has been averaged for the seven countries under scope in this table. Further, since no comprehensive criteria are included in the questionnaire, the ratios are the same as the core ratios.

We can apply the cost structure of a non-green vehicle to determine the overall financial impact of core levels of GPP per functional unit. Taking the average of the cost structures of the 7 countries, please find the results in table E43.

The interesting result is that the use of core green criteria (i.e. vehicles with low CO_2 emissions) leads to a financial impact per vehicle of -3%. This results from the fact that green road taxes (depending on country) and fuel use are around 12% lower for green cars compared to its non-green counterpart. It was found that purchase prices (including taxes) are hardly influenced by setting limits on CO_2 emissions.

Table E43: Cost ratios and financial impact per functional unit of GPP for passenger cars and light duty vehicles services. A cost ratio smaller than one implies cost reductions and a cost ratio larger than one implies cost increases. For the weighted average impact, negative numbers imply costs reductions and positive numbers imply costs increases.

Transport – *passenger cars & light duty vehicles*		
LCC relevant costs	cost ratios	
	core / no GPP	compr / no GPP
Purchase price	1,00	1,00
Road tax	0,88	0,88
Fuel costs	0,88	0,88
Maintenance costs	1,00	1,00
Financial impact per vehicle	*-3%*	*-3%*

149 Source: http://www.vcacarfueldata.org.uk/search/vedSearch.asp
150 Taxes in Europe database, European Commission

E.10 Furniture

As described in Chapter 1, we take office furniture as a representative product for this product group. Therefore, the calculation of the cost ratios will be based on office furniture only.

E.10.1 Cost structure

Concerning disposal costs, which is the only extra cost that may be relevant next to costs for purchasing, public procurers typically include the take-back of products in a tendering procedure for new products. Furthermore, old furniture is also often given to charity organisations or personnel for free. Therefore, we do not take disposal costs into account and a cost structure is not applicable for this product. We will only focus on purchase prices for the calculation of cost ratios.

E.10.2 Cost ratios[151]

The criteria selected for the green version of office furniture suggest that wood is a substantial element with respect to office furniture. This however is no longer the case: the amount of actual wood used in office furniture is negligibly small; the use of chipboard and comparable products has almost entirely taken over the original role of wood in office furniture.

E.10.2.1 Cost ratio of core green vs. non-green

Although FSC and PEFC certified board material exists, it is hardly used for the mass production of office furniture, but mainly for interior design purposes (more tailored solutions). Although the market is developing and certified office furniture is becoming available, there is not enough reliable data to calculate a cost ratio at this point.

However, it is interesting to note that the sale price of raw board materials (which is sold to furniture manufacturers) is sold at roughly only € 1 or € 2 more per 4 m^2. This means that in those cases in which FSC or PEFC certified board material is used for manufacturing office furniture, the price difference will be negligible compared to the cost of other material used for the furniture.

We therefore come to the conclusion that the green criteria used in the questionnaire are not relevant for identifying a furniture product as green. Since wood is not a substantial element of office furniture, the criteria of the toolkit focusing on wood are not suitable for our analysis. The criteria concerning metals, plastics, padding and textiles in furniture might be more suitable.

E.10.2.2 Financial impact of GPP per piece of furniture

Based on the above we come to the conclusion with regards to the costs for wood-based furniture that no adequate data is available. Therefore, we have not been able to calculate the financial impact of GPP.

151 The analysis is based on the following sources: Fast Office Furniture; Samas; Fetim Best Hout en Plaatmaterialen; Iboma Lopik BV; SpanoGroup; Markant, Ahrend, Rik Smeenk; Lathouwers; De Key, Amsterdam

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