Statistics on Environmental Accounts

Pilot studies for the development of Environmental Accounting: Norwegian Economic and Environmental Accounts (NOREEA) Project 2005

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1 Executive Summary

The ***NOR****wegian* ***E****conomic and* ***E****nvironmental* ***A****ccounts* (NOREEA) project is established as a cooperative project between the Division for National Accounts and the Division for Environmental Statistics at Statistics Norway. This final report describes the results from the NOREEA project that ran from 1. January 2005 until 31. March 2006. Partial funding for this work was from DG Environment through Eurostat grant Contract N^{o}. ESTAT 200471401002 and from the Norwegian Ministry of the Environment.

The project objectives include:

1. Improvements to the Norwegian NAMEA-air system include:
   a) the improvement in databases to enable easier reporting to the standard NAMEA-air tables;
   b) evaluate the inclusion of CO_2 emissions from biofuels;
   c) further developing the NAMEA energy accounts; and
   d) performing decomposition analyses.
2. Work related to environmental expenditure accounts includes:
   a) identifying the dataflow for economic information regarding water;
   b) establishing routines needed to implement the development of annual environment related expenditure statistics at the central government level;
   c) making preliminary estimates of environmental subsidies; and
   d) establishing environmental taxes as official statistics.

The main purpose of the NAMEA actions is to improve the existing datasets that are included in the Norwegian hybrid accounts, to investigate the possible use of decomposition analyses on a regular basis and to prepare for the annual reporting requirements from Eurostat. The purpose of the environmental expenditures actions is to expand the current work and to establish routines for the regular production and publishing of central government's environmental protection expenditure and environmental taxes.

The following provides a brief summary of the various work performed as a part of this NOREEA project.

NAMEA-work related to databases
After evaluating several different options regarding the organization of the NAMEA data and the various software programs available, it was decided to use the StatBank since it had the most flexible approach for setting up the tables needed for reporting the NAMEA data to Eurostat. Since the two digit level data contains confidential data, these tables will only be available internally to Statistics Norway. They will not be available to the public. This will not change the publicly available data, which is currently on the Statistics Norway web site.

NAMEA-work related to including CO_2 emissions from biofuels
Currently the Norwegian NAMEA-air data does not include CO_2 emissions from biomass. For this project the biomass emissions will be distributed to the two digit NACE level and examined to see whether they are of good enough quality to include in the NAMEA air emissions data set and reporting.

If CO_2 emissions from biomass would be included in the Norwegian 2003 NAMEA data, the total CO_2 emissions would increase from 54.8 million tonnes CO_2 to 60.7 million tonnes. This is an 11 per cent increase. After evaluating the 2-digit distributed figures it was decided that the quality of these statistics are not of very high quality and we will not be including them in the annual NAMEA data set. We will only report the totals of CO_2 emissions from biomass to Eurostat and not distributed by industry. Additional work on this time series needs to be made before it can be considered for inclusion as official statistics. Due to the problems with quality for these CO_2 emissions from biofuels, the Norwegian NAMEA air data does not exactly follow the definitions prescribed for NAMEA.

NAMEA-work related to further developing the NAMEA energy accounts

In 2002, there was a proposal to expand the standard set of NAMEA tables to include a new table on energy use related to the combustion of fuels causing emissions to air. Currently the status of this work is unclear, however, some type of energy use reporting will most likely take place in connection with the NAMEA reporting. It is possible for Statistics Norway to report to the energy table. However before further work is done, the reporting requirements to Eurostat need to be clarified. The data will need to be processed separately, since it does not come from official statistical sources. One problem with the proposed NAMEA energy table from the Norwegian perspective, is the exclusion of energy from air emissions free energy forms. Since nearly all electricity in Norway is generated from hydropower there it is little connection between the total energy consumption for the economy and the NAMEA energy table. It is unclear at this time, exactly what is the purpose of the NAMEA energy table. These issues should be clarified before any further data collection by Eurostat is attempted.

NAMEA-work related to decomposition analysis

A decomposition analysis of the NAMEA air data could provide valuable additional information for understanding the changes in the air emissions data. Initially an input-output methodology was considered but the input-output tables from the national accounts are not available until t-3. This is too long a time lag to be of particular interest to the Ministry of Environment. Ideally, the Ministry would like to have this information in connection with the preliminary national level air emissions data, which are published in approximately April, t-1. Bruvoll and Medin (2000) made a decomposition analysis of the Norwegian energy and air emissions data between the years of 1980 and 1996 using the most detailed data available and a methodology which uses volume indicators.

In this current analysis, we have used a similar methodology but using the NAMEA data, which includes emissions and economic data but no energy data from 1990 to 2003. It was possible to decompose the changes observed in the data set into three components, a scale component, a composition component and an other technological changes component. This analysis was done at the economy wide level and also at an aggregated industries level. It appears that the scale and composition components contribute in a more consistent way, whereas the contribution from the other technological changes component varies greatly from year to year. The industry level analysis showed that both the extraction industry and the manufacturing industry were responsible for major changes in the emissions between 1990 and 2003, making the analysis between two years provide some interesting information. However the time series data provides even greater information when looking at long term changes. Since useful results were obtained, as soon as some questions relating to levels of aggregation are considered, it is hoped that these types of decomposition analyses can become part of the annual production routines for the NAMEA air statistics.

Work related to environmental expenditure accounts for water

The work connected to reporting to the various water statistics and water accounts questionnaires brought to light the fact that privately owned waterworks are not included in the national accounts. Since this missing information was identified, this project changed focus a little in order to determine whether this missing data was of major importance.

The only source of economic information about the private waterworks was located at the Norwegian Institute of Public Health. The data was examined and it was concluded that although 36 per cent of the waterworks in Norway are privately owned, the income from fees for these privately owned waterworks accounts for only 4 per cent of the total fee income. Based on this information, it was concluded that the current situation, which only includes the local government production in NACE 41, does capture most of the economic activity. Based on this conclusion, the reporting to the SEEA water tables was made from the information available in the national accounts. The division for national accounts is considering trying to include the privately owned waterworks into NACE 41 although this is not currently being given a high priority.

Work related to environmental expenditure accounts in central government

The work on environmental protection expenditure for the central government has focused on improving previously established budget analysis methodologies. By trying to refine this methodology, we are hoping to establish this approach in the development of regular and official statistics. New estimates for 2001 and 2002 environmental protection expenditures by CEPA-categories have been developed. Currently only COFOG statistics are considered official statistics. The budget analysis, CEPA based statistics, produce figures which were over twice as high as the COFOG-based statistics for central government and nearly 4 times greater for the local government level. It would be ideal if in the future the COFOG statistics would provide the environmental protection expenditure account statistics for the local, regional and central governments. In order to be able to reach this goal, a number of major changes would need to be made regarding the COFOG statistics and the databases for public finances. Further work will be needed before the EPEA budget analysis statistics can be made official.

Work related to environmental expenditure accounts regarding environmental subsidies

There has been very little statistical work done regarding environmental subsidies at national or international levels. Internationally work has focused on environmental taxes and not subsidies. The challenge with environmental subsidies focuses on the definition of what is an environmental subsidy (we have not considered environmentally harmful subsidies, this is even more difficult). There are currently two definitions being used, the motivation approach and the effect approach. The motivation approach is more consistent with the environmental protection expenditure accounts definitions, whereas the effect approach is more consistent with the environmental taxes definition. The difference basically ends up focusing on the treatment of transportation subsidies. Our analysis has shown that before further work can be done in establishing this as an official statistical area, it is necessary that some harmonization of the definitions is made regarding which subsidies are included and excluded, according to consistent criteria, i.e. either effect or motivation.

Work related to environmental expenditure accounts regarding environmental taxes

The work done in order to develop official statistics on environmental related taxes divided by industries is more complex and extensive than first assumed. Currently no taxes broken down by industries are published at all by Statistics Norway. Work is continuing by the Division for national accounts to change the structure of the various databases, as well as to work on the distribution keys used for assigning the environmental taxes to the different industries. We were able to publish the environmental taxes at the national level, and also to show the connection between the polluter pays principle for some aggregated industries.

2 NAMEA-work related to databases

Based on the decision of the Environmental Statistics plenary meeting in September 2003, that there will be regular reporting of the NAMEA-air, bridge table, transport and energy tables, we need to set up a system that enables us to update our time series in order to do the reporting to Eurostat. Since the air emissions data is updated annually for all years of the time series, beginning from 1990 the entire time series needs to be reported to Eurostat.

Currently our system is only set up for national publication and the extra detail that Eurostat requires currently takes a lot of time consuming handwork using Excel. So, for the air emissions reporting we need to make improvements. Also the transportation table needs to be included in the new system since this is not currently published at the national level, and there is no system developed yet for reporting to this table since it was a new table in the last reporting period. The energy tables still need to be developed, so this will not be included in this work. The major activity will involve setting up databases and data programming.

Initially, we considered using SAS to try to program the tables, but this meant that the usefulness of the data set was limited to reporting according to Eurostat instead of also allowing access to this data by others. Our second attempt to organize this data was to establish a database and use the table-creating software "Supercross". This software did not allow for the inclusion of blank spaces to any easy degree. Given that certain rows and columns will be blank, the use of Supercross did not work very well.

The solution we have come up with is 2 tables that will be very similar to those that are found on our web site by following the link to the StatBank. The public access database uses the quarterly national accounts industry set up, which is not 2-digit NACE-codes. In order to report at the 2-digit level the calculations need to be run again. The reason we use the quarterly national accounts is because we can have more current data (t-2) available for public use which is the earliest the industry level emissions data can be produced. Rather than have to wait until the final national account figures at t-3. Reporting to Eurostat at 2-digit NACE level means that we can only report economic data at t-3.

The new NACE 2-digit tables will only be available in Statistics Norway's internal databases due to confidentiality of some of the data.

3 NAMEA-work related to biofuels

The standard Eurostat reporting tables for NAMEA-air requires the reporting for CO_2 emissions from biofuels. Although CO_2 emissions from biofuels are reported as a total in the IPCCC reporting for Norway, this information has yet to be developed at the NACE 2-digit level here in Norway. The focus of this portion of the work will be to distribute the CO_2 emissions from biofuels at the NACE 2-digit level and evaluate whether the data are of good enough quality to be reported on a regular basis in the context of the NAMEA-air reporting to Eurostat.

The Norwegian air emissions model distributes the various energy products by industry before calculating the emissions from those energy products. This approach is in contrast to some countries, for example, Italy, that calculate the emissions from the various energy products first and then distribute them according to industries for their NAMEA-air statistics. Since the energy products are already distributed by industry it was not terribly difficult for us to calculate the CO_2 emissions resulting specifically from biofuels. In this context, biofuels is defined to include fire wood, waste of wood (wood chips), and hazardous waste.

The emission factor used for all three types of biofuels is 1.8. In other words, 1 tonne of biofuel results in 1.8 tonnes CO_2 emissions.

Since ocean transport and international air traffic do not use biofuels, the totals for the UNFCCC and the NAMEA-air totals are the same.

Table 3.1 shows that households (HH) and the paper and pulp industry (NACE 21) account for the majority of the CO_2 emissions from biomass. From 1998 until 1997 these two categories accounted for 99 per cent of CO_2 emissions from biomass. In 2003 they accounted for only 93 per cent of the total, a trend which shows that the use of biomass is increasing in other industries.

Biomass would increase Norway's total CO_2 emissions from 54 786 to 60 731 thousand tonnes CO_2, an 11 per cent increase or a 9 per cent increase in terms of Global Warming Potentials (GWP) (from 66 453 327 to 72 398 438 CO_2-equivalents).

Table 3.1 also shows that the time series for NACE 01 (Agriculture) and 45 (Construction) need to be extended backwards in time. These values were obtained by including a new question in existing surveys and the necessary work for including this information back over in time has not yet been done.

The pattern observed for NACE 40 (Electricity, Gas, Steam and Hot Water Supply) shows that new district heating incineration plants have been built and municipal waste is used as the primarily heating fuel for producing heat. New district heating incineration plants came online in 2001 and this has resulted in a general increase of CO_2 emissions from biofuel for this industry.

The value for 2001 in the metal industry (NACE 27) has recently been revised to a level of approximately 20 per cent less than that of 2002. We are currently trying to revise this time series for this industry because there is one large enterprise which began reporting in 2001 and it is necessary to find out if this is a real change between 2002 and 2001, for example a change in equipment or plant, or whether it was only that the company started to report in 2001 or whether biomass has been used all the time. Later revisions for the metal industry need to be made before this data can be considered reliable.

Time series for the Non-metallic Mineral Products industry (NACE 26) and the manufacturing of furniture (NACE 36) also show some variation. This variation is also found in the reporting information obtained from the enterprises and so would appear to be real changes and not simply a residual effect in the calculations of the statistics.

The information for households regarding their use of firewood is obtained from the household consumption survey.

The quality of this data is not terribly high or consistent over time. One main reason for this is simply that CO_2 emissions from biomass is only a memo item to table 10s1 of the UNFCCC reporting system and is not part of any international air emissions agreement. Also only a total figure for CO_2 from biomass is reported and not a detailed industry breakdown.

Since these statistics are not of the highest quality we are hesitant to include them in our annual NAMEA-air publications at this time. Additional work on the time series for certain industries and harmonization in the European Union needs to occur. In addition, the data quality would need to be improved before we would also confidently publish these statistics at such a detailed level. The figures presented here should be considered only as preliminary calculations.

Table 3.1 Emissions of CO_2 from biomass, preliminary calculations. 1 000 tonnes. 1990-2003*

NACE	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003*
UNFCCC Total	4 717.37	4 407.64	4 335.87	4 606.74	4 973.04	5 021.54	5 122.07	5 368.06	5 363.24	5 594.62	5 635.28	6 267.71	5 778.01	5 945.11
Total	4 717.37	4 407.64	4 335.87	4 606.74	4 973.04	5 021.53	5 122.07	5 368.06	5 363.24	5 594.62	5 635.28	6 267.71	5 778.01	5 945.11
01									7.49	7.49	7.49	7.49	7.49	7.49
02														
05														
11														
12														
13														
14												0.10	1.08	0.00
15	3.46	0.13	0.46	0.08	0.31	0.34	0.10	1.94	0.46	0.53		0.95	0.46	1.73
16	1.35	1.35	1.35	1.35	1.35	5.69	0.70	0.78						0.54
17	0.04									0.02	0.02		0.00	
18													0.00	
19							0.01	0.01		0.02	0.01	0.01	0.01	
20	472.62	468.45	456.24	514.76	525.70	532.83	569.55	645.21	586.04	732.90	793.17	775.73	435.01	411.04
21	2 005.41	1 924.26	1 920.01	1 856.55	2 067.29	2 144.98	2 017.77	2 100.64	2 212.72	2 252.36	2 137.53	2 487.12	2 046.87	2 107.82
22	1.39	0.92	0.92	0.93	0.92	0.92		0.00				0.06	0.00	
23														
24	16.16	14.71					0.61	0.61	14.43					93.71
25														
26					0.74	1.16	1.79	2.63	10.36	18.56	23.62	9.49	11.29	10.56
27	0.75	0.87	0.15	0.28	0.25	0.09	0.09	0.05	0.00			117.91	23.56	25.00
28					0.14	0.74	0.04	0.04	1.91	0.17	0.12	0.08	0.35	0.43
29								0.00		0.06	0.00		0.14	
30														
31							0.18	0.18						
32														
33														
34				0.07			6.27	7.22				0.07	0.04	
35				0.34				0.50		0.00	0.02			0.20
36	12.62	11.58	4.81	3.85	3.89	4.45	37.50	17.26	44.39	50.61	64.23	44.79	18.96	28.55
37														
40	15.35	15.35	19.84	19.98	14.96	20.35	27.59	28.78	46.08	38.07	43.12	145.73	187.59	212.91
41														
45						12.30	12.65	13.82	14.80	14.77	14.88	14.65	14.24	14.23
50-52														
55														
60														
61														
62														
63														
64														
65-67	0.04	0.04	0.04	0.04	0.04	0.04								
70-74														
75														
80														
85														
90														
91														
92														
93														
HH	2 188.20	1 969.99	1 932.06	2 208.53	2 357.47	2 297.66	2 447.21	2 548.37	2 424.56	2 479.07	2 551.05	2 663.54	3 030.91	3 030.91

HH = Households

4 NAMEA-work related to further developing the NAMEA energy accounts

In 2002, Eurostat decided to expand the Standard set of NAMEA-tables with a new table including data on energy use related to the combustion of fuels causing emissions to air. Since then, it has been questioned how such a table should appear and also whether or not to include such a table. At the April 2006 meeting in Luxembourg on the NAMEA questionnaire, it was decided to exclude the datasheet on energy from the NAMEA standard tables. It was considered to include data on energy use by industry in a separate survey or to simply request total energy use by industry. This may be done in the 2006 data collection exercise but currently it is unclear exactly what the future plans will be regarding energy reporting.

4.1 Background

When receiving the first draft version of the NAMEA energy tables, work was carried out to see if Statistics Norway or other institutions were producing data on energy use that met the requirements and definitions set out in the NAMEA energy table. Statistics Norway does not publish data on energy use defined in this way, meaning that the reporting of data on energy use according to NAMEA standards needs special computations. This differs from the reporting in the other NAMEA tables, where the data are taken from official statistical sources available at Statistics Norway.

In 2002, Statistics Norway sent the NAMEA draft energy table filled out for the year 1999 to Eurostat. Although we had managed to report energy use by industries according to the requirements and definitions set out in the NAMEA energy table, it also left open some questions for further examination. Statistics Norway has not after the trial study reported NAMEA energy tables to Eurostat, but based on the results from the first reporting, work has been undertaken to improve the data input in order to meet potential future requests in this area.

A revised version of the NAMEA energy table was received for comments from Eurostat in March 2006. The energy table was now revised, with the main change being the aggregation of the use of different energy goods into one energy group called "Use of energy relevant for emissions".

Although it is uncertain whether Eurostat will include the datasheet on energy in the 2006 NAMEA reporting, considerable work has been carried out in Statistics Norway in order to meet the NAMEA standards for filling out the original set of energy use datasheets for the NAMEA standard tables. Based on the latest decisions from Eurostat, conclusions have not yet been drawn in Statistics Norway regarding further development of the statistics on energy use causing air emissions.

This article therefore summarizes all work so far done by Statistics Norway in order to report data on energy use according to NAMEA standards.

4.2 What to report in the NAMEA energy table - energy actually consumed

The NAMEA energy table is designed for reporting data on energy use by industries and households that is consistent with the corresponding emissions to air, i.e. only the combustion of fuels causing air emissions is to be reported. This means that the inputs of fuels that are transformed from one form into another are not recorded, as they are not consumed. Fuels used as raw materials and combustible fuels that are not used for energy purposes should therefore not be reported in the NAMEA energy table.

Energy use in the NAMEA energy table means fuels combusted to produce heat or power
- and consequently air emissions

The directions for what to report in the NAMEA energy table are given by:

- Presentation of the energy use table for the NAMEA standard tables (Eurostat, August 2002, B1 - National accounts methodology, statistics for own resources).
- Draft energy use table for NAMEA standard tables (Eurostat, December 2002, B1 - National accounts methodology, statistics for own resources).

There are no official statistics published in Norway covering energy use by industries and households by the definitions required for in the NAMEA standards. The energy accounts in NAMEA are not the same as the use tables of energy products in monetary terms available in the national accounts that record the total purchases of energy products including those for transformation purposes and for use as raw materials. They are also not the same as the data presented in the energy statistics, this describes a comprehensive/balanced system of supply, transformation and use of different energy products. Reporting of this table on a regular basis needs to be approved before it would be possible to provide this data on a regular basis.

4.2.1 What sources to use?

Statistics Norway and the Norwegian Pollution Control Authority construct energy data for calculations of combustion to air as a step towards producing the Norwegian Emission Inventory. With the exception of data concerning electricity and coke, the data material on energy use by industries and households used as input in the Norwegian Emission Inventory Model is the main source for input to the NAMEA energy table. See table 4.1 for sources used to calculate energy use causing air emissions.

Table 4.1 Main sources for data to the NAMEA energy table

Name of source:	Contains:	Responsible for the data:
Energi.xls	Energy use by industries and household causing emissions to air divided into detailed energy groups.	Division for environmental statistics, Statistics Norway The Norwegian Pollution Control Authority
Sft.xls	Use of natural gas causing air emissions in Oil and gas extraction and Service activities incidental to oil and gas	The Norwegian Pollution Control Authority
Edat.xls	Total energy use by industries and households divided into detailed energy groups.	Division for environmental statistics, Statistics Norway Division for Energy and Industrial Production Statistics, Statistics Norway

4.2.2 Industry classification

In the NAMEA energy table, energy categories that are compatible to the headings in the energy statistics published by Eurostat are applied, and the same economic classification as used in the NAMEA air tables is used, i.e. NACE 2-digit plus extra selective breakdowns for some selected industries (NACE categories 26, 27, 40, 60 and 61).

Table 4.2 gives an overview of NACE categories that in the directions from Eurostat need special attention. Comments are also given in the table on how these areas have been handled in the Norwegian NAMEA energy tables.

Table 4.2 Implementation of energy use in specified NACE categories

Categories in the first NAMEA energy draft tables	Eurostat's NAMEA directions for completing the tables	Norwegian NAMEA energy tables
NACE 05 Fishing	Should incl. fuel bunkering abroad by national fishing vessels, and excl. fuel bunkering by foreign fishing vessels within the national territory.	Incl. fuel bunkering abroad but not fuel bunkering by foreigners in Norway (NAMEA directions followed).
NACE 11 Extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction excluding surveying	Fuel used in the extraction process of natural resources should be included. But flaring or venting of natural gas should be excluded.	NAMEA directions followed.
Lorries and buses (NACE 60), ships (NACE 61) and airplanes (NACE 62) engaged in international transport activities.	Energy purchased by national residents abroad should be incl., while energy purchased by non-residents on the national territory is to be excluded.	Energy purchased by national residents abroad is included. No data regarding non-residents on the national territory, so no corrections are made. Nace 60.24 is defined as 'Other land passenger transport, freight transport by road'
Not allocated	Not allocated energy should have the same coverage as used in NAMEA-air and NAMEA for economic data.	NAMEA directions followed, but no data is reported as "Not allocated"
Energy consumption in household transport activities, incl. leisure-gardening equipment.	Incl. fuels used as propellant, even when used for purposes other than transport. Report the consumption of propellant fuel used for purposes other than transport in the row 'of which leisure-gardening equipment'.	NAMEA directions followed for total transport activities, but not able to report both energy and economical data for leisure-gardening activities. We are able to specifically report energy used for these purposes, but not to report the corresponding economical data. We are therefore not able to split the TRANSPORT category in the NAMEA tables.
Energy consumption in household heating activities.	Incl. the combustion of fuel for heating and cooling houses and flats by households, but also cooking and hot water producing energy use	Data reported under this category include cooking and hot water producing energy use, both in the economical data and in the data for energy

4.2.3 Energy categories and energy units used

The energy categories and economic classifications used in the NAMEA energy table are compatible with the energy statistics and national accounts statistics published by Eurostat. However, special treatments for nearly all energy categories have been necessary in order to report Norwegian data in accordance with the NAMEA definitions.

The detailed energy categories outlined in the first NAMEA draft energy tables are not directly compatible to the energy categories in the data material used as sources. For some NAMEA energy categories it is not straight forward what types of fuels to include. All data in the NAMEA energy table should also be reported in a common energy unit (TJ). The energy unit in the data material used as input to the NAMEA energy table is given in other energy units than requested for in the NAMEA tables.

Energy use related to combustion of fuels causing air emissions are in Norwegian energy statistics reported in ktonnes, the use and production of electricity is reported in GWh, the use of natural gas is reported in Sm^3 and the use of wood is reported in kfm^3. The conversion factors from these different energy units to TJ differ, as well as the conversion factor from ktonnes to TJ also vary between the different energy goods. Hence, recalculations of the different energy goods to one common energy unit have to be done irrespective of the aggregated level of the energy categories.

The conversion factors used are composed by the Division for energy and industrial production statistics at Statistics Norway. The factors are published as part of the annually energy statistics (http://www.ssb.no/emner/10/08/10/nos_energi/). These factors may differ from country to country, but according to the Division for energy and industrial production statistics are the factors used in Norway not very different from international standards. The conversion factor for electricity is a fixed international standard, while the conversion factor for natural gas is decided annually from the Norwegian petroleum Directorate. See appendix table 1 for a list of conversion factors used.

In most cases it is straight forward to recalculate the amount consumed of an energy good from one energy unit to another. However, we met some problems related to recalculating a few energy goods into one common energy unit. The use of the energy group "wood" is such an example, since the aggregated group of wood consists of wood, black liquor and wood waste, which have different converting formulas from ktonnes to TJ. We have so far not been able to split up the aggregated group of wood. We also lack converting factor for other gasoline used in airplanes. The converting factor for gasoline for cars has been used.

4.2.4 Cases of doubt regarding what to report

Some of the energy products are partly dedicated to energy use and partly to non-energy use. Since energy data reported are in relation to air emissions, non-energy use is excluded and only the amounts actually related to the production of heat and power are to be reported. Losses of natural gas during distribution due to leakage should be included. Flaring of natural gas by the extraction industry should not be included as this is not considered as energy use.

The different ways of handling losses of natural gas during distribution due to leakages and flaring seems a contradiction in terms. In general flaring when it is part of extraction (i.e. on the platforms) it is not included in energy consumption (it is more like incinerating household waste without energy recovery). On the other hand, leakage of natural gas from distribution pipes is included. None of these activities are related to “energy use” meaning “fuels combusted to produce heat or power”, i.e. these activities should not be included in the NAMEA energy table. On the other hand, both these activities are included in the energy data that forms the basis when calculation the national emission inventory data. Additionally, the reporting data on energy use in the NAMEA energy table should, according to the guidelines, be reported in a way that is consistent with the corresponding air emissions. In the Norwgian NAMEA energy and emissions from flaring are included.

The key issue for these two things is how NAMEA, UNFCCC and energy statistics tackle (the emissions from) flaring during extraction and losses during distribution. Since UNFCCC includes both, NAMEA would also include both. The question is under what category - energy use related emissions or 'non-energy use emissions'. At the moment we have accepted energy statistics which for the energy table brings flaring under “non-energy” but leakages of natural gas during distribution into “energy related”. This question could also be seen from the National Accounts point of view. In the National Accounts, the flaring of gas related to oil extraction would be an internal use of the gas, not a use of marketed gas. So the gas that is flared does not cross the production border of the extractor, and the flared gas is not considered part of the production of the extractor. According to the National Accounts point of view, the gas lost during handling before measuring the amount marketed is also regarded as not produced, the marketed amounts are however produced even though some of it might be lost in transition to the end user.

According to the National Accounts treatment, the flaring of gas is seen as part of the production process of producing oil. The emissions arising from this activity should accordingly be attributed to the production of the industry oil extraction. Excluding flaring from energy uses should not imply excluding the related emissions from the extraction industry.

4.3 Overview of data reported

The tables in chapter 4.3.1 and 4.3.2 give an overview of the computations done in order to be able to report the use of energy in accordance with the NAMEA standards. Although the uncertainty related to the lay-out of the energy table, and if it ever will be re-established, we have chosen to use the NAMEA energy categories suggested in the first NAMEA draft energy tables, because they are compatible to the headings in the energy statistics published by Eurostat.

4.3.1 Energy categories causing air emission

Table 4.3 NAMEA energy category: Lignite

Source for input data:	Energi.xls
Corresponding energy goods in statistics sources at SSB:	Use of lignite is included in the reported data for coal. When reporting data to Eurostat in 2002, it was not possible to extract data for lignite from the totals of coal.
Energy unit in statistics sources at SSB:	-
Conversion factor used:	-
Corrections made to meet NAMEA standards:	-
Other comments:	Norway does not produce lignite, but does import some.

Table 4.4 NAMEA energy category: Coal

Source for input data:	Energi.xls
Corresponding energy goods in statistics sources at SSB:	Coal
Energy unit in statistics sources at SSB:	ktonnes
Conversion factor used:	28,1 * ktonnes = TJ
Corrections made to meet NAMEA standards:	None, except from converting the energy good from ktonnes to TJ.
Other comment:	Only coal burnt to produce heat and power is to be taken into account. The amount of coal that is converted into coke is to be excluded from this table whereas the coke and the coke oven gas are to be included when they are burnt.

Table 4.5 NAMEA energy category: Natural Gas

Source for input data:	Energi.xls (sheet "Energi") and Sft.xls
Corresponding energy goods in statistics sources at SSB:	Natural gas
Energy unit in statistics sources at SSB:	Mill Sm3
Conversion factor used:	40,3 * Mill Sm3 = TJ (1999)
Corrections made to meet NAMEA standards:	Special treatment of Nace 10.1 - 40.3 (corresponding industries in Energy.xls: 231000-234040), Nace 60.3 (corresponding industry in Energy.xls: 236080, where only energy use related to turbines is included) and Nace 24.14, 24.16-17 (corresponding industry in Energy.xls: 232416, where use of natural gas at Tjeldbergodden is subtracted from the total).
Other comment:	See ch.4.2.4 for further discussion.

Table 4.6 NAMEA energy category: Wood

Source for input data:	Energi.xls (wood fuel and wood waste) and Edat.xls (sheet: INN_NN) (black liquor).
Corresponding energy goods in statistics sources at SSB:	Wood fuel (consumed in households), black liquor (consumed in Nace 21) and wood waste (consumed in all industries except Nace 21 and households).
Energy unit in statistics sources at SSB:	ktonnes (black liquor and wood waste), kfm^3 (wood fuel)
Conversion factor used:	The different energy goods included in the NAMEA energy category "Wood", all have different conversion factors from ktonnes to TJ: Wood fuel: kfm^3 * 8,4 = TJ (Humidity in wood = 18%) Black liquor: ktonnes * 14 = TJ Wood waste: ktonnes * 16,8 = TJ
Corrections made to meet NAMEA standards:	None, except from converting the energy goods from ktonnes and kfm^3 to TJ.
Other comment:	Only the wood burnt for heat and power purposes is to be included and wood used for construction, pulp and papermaking, manufacture of furniture etc. is to be excluded. The combustion of waste-wood is included.

Table 4.7 NAMEA energy category: Other biofuels

Source for input data:	Energi.xls
Corresponding energy goods in statistics sources at SSB:	Other gas
Energy unit in statistics sources at SSB:	ktonnes
Conversion factor used:	Fuel gas: 50 * ktonnes = TJ
Corrections made to meet NAMEA standards:	The energy group "other gas" is divided into three different groups depending upon the industry that has produced it. a) "Other gas" produced in Nace 232710 - 232750 and Nace 232411 - 232470 is fuel gas. b) "Other gas" produced in Nace 234040, Nace 239000 and Nace 259000 is landfill gases. c) "Other gas" produced in Nace 231000, Nace 232310 and Nace 232322 is refinery fuel. Note that refinery fuel is included in NAMEA energy category "Other petroleum products", and is not a part of the category "Other biofuels".
Other comment:	This category includes all kinds of bio-fuels of which the combustion produces emissions, such as ethanol based on sugar or starch crops, bio-diesel produced from oil crops, energy from straw as well as waste-based bio-gas (including landfill gas, sewage gas and gas from animal slurries). Landfill gas etc. that is not used for energy purposes should not be included. Flaring and venting of methane in NACE 90 is included.

Table 4.8 NAMEA energy category: Peat and other

Source for input data:	No data for peat used as energy source in Norway.
Corresponding energy goods in statistics sources at SSB:	-
Energy unit in statistics sources at SSB:	-
Conversion factor used:	-
Corrections made to meet NAMEA standards:	-
Other comment:	The NAMEA energy category "Peat and other" includes other solid, liquid and gaseous primary forms of energy (like e.g. peat) used for power and heating purposes.

Table 4.9 NAMEA energy category: Waste

Source for input data:	Energi.xls
Corresponding energy goods in statistics sources at SSB:	Waste oil, paint and varnish etc.
Energy unit in statistics sources at SSB:	ktonnes
Conversion factor used:	40,6 * ktonnes = TJ
Corrections made to meet NAMEA standards:	None, except from the conversion from ktonnes to TJ.
Other comment:	Industrial and municipal waste combusted to produce heat or power are to be reported here. Waste-wood is preferably reported under the category "Wood". Waste incinerated without energy recovery should be excluded. Also the burning of garden refuse or the clearing of land by fire should be excluded

Table 4.10 NAMEA energy category: Coal coke

Source for input data:	Energi.xls
Corresponding energy goods in statistics sources at SSB:	Coal coke
Energy unit in statistics sources at SSB:	ktonnes
Conversion factor used:	28,5 * ktonnes = TJ
Corrections made to meet NAMEA standards:	None, except from the conversion from ktonnes to TJ
Other comment:	-

Table 4.11 NAMEA energy category: Coke and other gases

Source for input data:	Edat.xls
Corresponding energy goods in statistics sources at SSB:	Blast furnace gas and refinery fuel.
Energy unit in statistics sources at SSB:	ktonnes
Conversion factor used:	Blast furnace gas: 9,96 * ktonnes = TJ Refinery fuel: 48,6 * ktonnes = TJ
Corrections made to meet NAMEA standards:	None, except for the conversion from ktonnes to TJ.
Other comment:	This category includes all other gases used for power and heating purposes such as coke oven gas and blast furnace gas.

Table 4.12 NAMEA energy category: Fuel oil

Source for input data:	Energi.xls
Corresponding energy goods in statistics sources at SSB:	Heavy fuel oil.
Energy unit in statistics sources at SSB:	ktonnes
Conversion factor used:	40,6 * ktonnes = TJ
Corrections made to meet NAMEA standards:	None, except for the conversion from ktonnes to TJ.
Other comment:	-

Table 4.13 NAMEA energy category: Diesel oil

Source for input data:	Energi.xls
Corresponding energy goods in statistics sources at SSB:	Auto diesel, fuel oil, heavy distillates and marine oils
Energy unit in statistics sources at SSB:	ktonnes
Conversion factor used:	43,1 * ktonnes = TJ
Corrections made to meet NAMEA standards:	None, except for the conversion from ktonnes to TJ.
Other comment:	-

Table 4.14 NAMEA energy category: Motor gasoline

Source for input data:	Energi.xls
Corresponding energy goods in statistics sources at SSB:	Motor gasoline and other gasoline used in small planes, boats etc.
Energy unit in statistics sources at SSB:	ktonnes
Conversion factor used:	43,9 * ktonnes = TJ
Corrections made to meet NAMEA standards:	None, except for the conversion from ktonnes to TJ.
Other comment:	-

Table 4.15 NAMEA energy category: LPG

Source for input data:	Energi.xls
Corresponding energy goods in statistics sources at SSB:	LPG
Energy unit in statistics sources at SSB:	ktonnes
Conversion factor used:	46,1 * ktonnes = TJ
Corrections made to meet NAMEA standards:	None, except for the conversion from ktonnes to TJ.
Other comment:	-

Table 4.16 NAMEA energy category: Jet fuel and kerosine

Source for input data:	Energi.xls
Corresponding energy goods in statistics sources at SSB:	Jet fuel and kerosine
Energy unit in statistics sources at SSB:	ktonnes
Conversion factor used:	43,1 * ktonnes = TJ
Corrections made to meet NAMEA standards:	None, except for the conversion from ktonnes to TJ.
Other comment:	-

Table 4.17 NAMEA energy category: Other petroleum products

Source for input data:	Energi.xls
Corresponding energy goods in statistics sources at SSB:	Petrol coke
Energy unit in statistics sources at SSB:	ktonnes
Conversion factor used:	35,0 * ktonnes = TJ
Corrections made to meet NAMEA standards:	In addition to the petrol coke produced, refinery fuel produced in NACE 231000, 232310 and 232322 is defined as "Other biofuels" (see table 4.7).
Other comment:	This category includes petroleum products used as refinery fuels, petroleum coke (when used in coke ovens for the steel industry or for other heating purposes) and other by-products from crude oil refinery processes that are combusted to produce heat or power. Crude oil is not included here in the energy products, as it is generally transformed into petroleum products and rarely directly burnt for heat and power purposes. Any direct use of crude oil can be reported under "Other petroleum products". Crude oil and petroleum products used as raw material in chemical and plastic industries are excluded. Flaring and venting of refinery gas in NACE 23 is included.

Table 4.18 NAMEA energy category: Other (air emission free energy forms)

Source for input data:	Statistics Norway does not have data on energy production (except from electricity) that are not based on combustion of fossil fuels.
Corresponding energy goods in statistics sources at SSB:	-
Energy unit in statistics sources at SSB:	-
Conversion factor used:	-
Corrections made to meet NAMEA standards:	-
Other comment:	This category is for any other form of energy production that is not based on fuel combustion. For example, geothermal steam and hot water and heat from nuclear power plants or solar panels are to be reported here.

4.3.2 Air emission free energy forms

Table 4.19 NAMEA energy category: Primarily electricity produced

Source for input data:	Edat.xls (sheet: INN_esek)
Corresponding energy goods in statistics sources at SSB:	Sum of total sale of electricity.
Energy unit in statistics sources at SSB:	GWh
Conversion factor used:	3,6 * GWh = TJ
Corrections made to meet NAMEA standards:	None, except for the conversion from GWh to TJ.
Other comment:	This energy category includes primarily electricity produced, i.e. not electricity used. Primary electricity produced by wind power is incl. in NACE 40.1. When own account electricity production is not based on fuel combustion, it is to be reported under this category.

Table 4.20 NAMEA energy category: Electricity sold

Source for input data:	Edat.xls (sheet: INN_esek)
Corresponding energy goods in statistics sources at SSB:	Sum of total sale of electricity.
Energy unit in statistics sources at SSB:	GWh
Conversion factor used:	3,6 * GWh = TJ
Corrections made to meet NAMEA standards:	None, except for the conversion from GWh to TJ.
Other comment:	Transformation and transmission losses, which are regarded as a use by the generator/distributor of the electricity, should be excluded.

Table 4.21 NAMEA energy category: Electricity purchased

Source for input data:	Edat.xls (sheet: INN_NN for electricity purchased and sheet: RES_EREGN_TAB for losses in the distribution net)
Corresponding energy goods in statistics sources at SSB:	Electricity.
Energy unit in statistics sources at SSB:	GWh
Conversion factor used:	3,6 * GWh = TJ
Corrections made to meet NAMEA standards:	None, except for the conversion from GWh to TJ.
Other comment:	Electricity purchased on the market should be included in this catergory. The consumption of electricity produced as an ancillary activity (own electricity production for supporting principal and secondary activities) is not to be reported here. When own account electricity production is based on fuel combustion, the corresponding energy use is already recorded earlier in the table under the relevant fuels. When own account electricity production is not based on fuel combustion, it is to be reported under the category "primary electricity produced". Losses in the distribution net are also to be included.

Table 4.22: NAMEA energy category: Heat and hot water sold

Source for input data:	Edat (sheet: INN_NN for heat and hot water sold, and sheet RES_EREGN_TAB for losses in the distribution net).
Corresponding energy goods in statistics sources at SSB:	District heating purchased
Energy unit in statistics sources at SSB:	GWh
Conversion factor used:	3,6 * GWh = TJ
Corrections made to meet NAMEA standards:	None, except for the conversion from GWh to TJ.
Other comment:	Total heat and hot water sold on the market is reported in this category. The production in the thermal power plants and the dual-purpose power plants (Nace 40.3) is defined as heat and hot water, and is put equal to sale of heat and water. Losses in the distribution net are also to be included

Table 4.23: NAMEA energy category: Heat and hot water purchased

Source for input data:	Edat.xls (Sheet INN_NN includes purchases by Norwegian industries and residents in Norway and sheet INN_esek includes purchases by energy producing industries). Use of heat and hot water by Norwegian residents abroad should also be included, but no data is recorded.
Corresponding energy goods in statistics sources at SSB:	District heating purchased
Energy unit in statistics sources at SSB:	GWh
Conversion factor used:	3,6 * GWh = TJ
Corrections made to meet NAMEA standards:	None, except for the conversion from GWh to TJ.
Other comment:	Losses in the distribution net are also to be included.

4.4 Purpose of the NAMEA energy table vs. total energy consumption for the economy?

It is important to determine what the purpose of the NAMEA energy table is. The purpose is not to determine energy balance or energy accounts. This work is already the responsibility of other reporting routines. The purpose of the NAMEA energy table is to connect the energy use directly to air emissions. The complications begin when the NAMEA energy tables also include the use of air emissions free energy forms in order to obtain the total energy consumed for each industry and for households. Energy consumption is not the same as fuel consumption. Electricity from sources other than combustion of fuels (hydro, nuclear, wind, etc.) as well as sold and purchased electricity, heat and hot water were proposed to be included.

Adding up all energy use (incl. the air emission free energy forms) industry by industry, or by final consumption category (households) in the NAMEA energy tables does not necessarily give the grand total energy consumption for the economy that is consistent with national accounts aggregates. The total for each category of energy product gives the total consumption of this energy product for the economy as a whole. However, this does not apply to electricity. Electricity generated from the combustion of fuels is not shown separately. The category “Primary electricity produced” describes supply rather than use and should be seen in conjunction with electricity sold and purchased. Electricity sold includes sales to the rest of the world (exports) whereas electricity purchased includes purchases from the rest of the world (imports). Depending on the primary data, both categories may include intra-industry deliveries (e.g. from electricity generators to electricity distributors, or transactions among electricity distributors within NACE 40). Therefore, there is no single grand total for electricity consumption in the NAMEA energy table.

Is the grand total energy consumption really the focus we want to have when conducting the NAMEA energy table? The background for development of the NAMEA energy table was that combustion of fuels is an important source of air emissions. Setting energy accounts alongside the air emission accounts in NAMEA enables users to investigate in detail the connection between air emissions and energy use, industry by industry and by household consumption purpose.

In order to show the complete picture it would be necessary to NAMEA energy table related to emissions plus the reporting of air emission free energy forms (seen as part of a “bridge table”), in order to show the connection between the NAMEA energy tables and the official standard energy statistics

4.5 Energy accounts, National accounts and NAMEA

Recently, Statistics Norway organised the Oslo city group for energy statistics. This city group shall mainly focus on methods for producing energy balances, but will also consider consistency questions related to energy accounts and emission accounts, as well as relations to the National accounts. One reason why the energy balances differ from energy accounts is the use of the domestic vs. the national concept of energy users. While the energy balance captures all use in the national territory, also when used by non-residents, the energy accounts (and the National accounts) aim at covering all use by resident units (even uses abroad). In this question, the NAMEA concept follows the national accounts, covering uses by all residents. A further difference in scope relates to the energy balance concept of autoproducers. This covers units producing energy for own use. This is recorded as production and use of energy in the energy balances, but is not considered production in the National accounts. The National accounts would, however, include any energy products that are input to this process in its intermediate consumption. On this question, the NAMEA concept seems to be in line with the National accounts concept, excluding some specific energy production of autoproducers.

The third important difference is the breakdown by industries. The energy balances has a distribution by purpose, where uses for transportation purposes are not further distributed by industry, whereas other uses are. The NAMEA energy tables follows the National accounts in that energy uses for transportation purposes should be distributed by industry

Finally, the National accounts do not distinguish between types of purposes for the energy use, so energy products used as raw materials cannot be distinguished from other types of uses. Here, the NAMEA concept makes use of the separate recording of uses of energy products as raw materials.

4.6 Concluding remarks

The work with the reporting of Norwegian NAMEA energy data has shown that we are able to report this kind of data, but that is not easily available and it requires a good deal of work to be able to produce these figures. Since the Norwegian emission inventory is based on energy accounts, we have the sources needed. It is just a matter of reclassification in accordance to the NAMEA energy account definitions. At this point in time it is unclear whether all definitions have been adequately and finally agreed upon.

At this time the status of the NAMEA energy account is unclear. There is no final guidance for the directions of the NAMEA energy accounts and there is no agreement on when (or if) this kind of data should be reported. Eurostat/Working group on Environmental Accounts has decided that energy tables will not be a part of this year's reporting of the NAMEA standard tables to Eurostat. For future work, it is uncertain whether to conduct a separate survey for this energy account or to include it as part of the NAMEA standard tables.

We will highly support a further effort to develop an energy account in accordance to the NAMEA standards. Setting energy accounts alongside the air emission accounts in NAMEA is useful to show the connection of air emissions with energy use and to expand the scope for analysis. Energy accounts are also relevant for the development of NAMEA-based decomposition analysis of emission trends. Decomposition analysis aims at quantifying the factors that drive the changes in emissions over time. Presentations made at the NAMEA-air Task Force meeting in February 2002 showed that energy data are important for this purpose (Eurostat, 2002a). Energy mix (proportion of different fuels) and energy intensity are usually among the key factors that explain changes in emissions.

Chapter 4 Appendix table 1: Conversion factors used to calculate energy use in TJ.

The Division for Energy and Industrial Production Statistics at Statistics Norway is responsible for the conversion factors used to convert the use of energy from various energy units into Mega-joules (Source: Edat.xls, sheet "Faktorer").

NAMEA energy category	Energy goods included in NAMEA energy categories	Conversion factors used:
Lignite	Incl. in the reported data for coal	-
Coal	Coal	28.1* ktonnes = TJ
Natural gas	Natural gas	40.3*Mill Sm3 = TJ (1999)
Wood	Wood, black liquor and wood waste	Wood: 8.4* ktonnes = TJ Black liquor: 14* ktonnes = TJ Wood waste: 16.8* ktonnes = TJ
Other biofuels	Methane and fuel gas	Methane: 50.2* ktonnes = TJ Fuel gas: 50* ktonnes = TJ
Peat and other	Peat - not used as energy product in Norway	-
Waste	Waste oil, paint and varnish etc.	40.6* ktonnes = TJ
Coal coke	Coal coke	28.5 * ktonnes = TJ
Coke and other gases	Blast furnace gas and refinery fuel	Blast furnace gas: 9.96* ktonnes = TJ. Refinery fuel: 48.6* ktonnes = TJ
Fuel-oil	Heavy fuel oil	40.6* ktonnes = TJ
Diesel-oil	Auto diesel, fuel oil[1)], heavy distillates and marine oils	43.1* ktonnes = TJ
Motor-gasoline	Motor gasoline and other gasoline[1)] used in small planes etc.	43.9* ktonnes = TJ
LPG	LPG	46.1* ktonnes = TJ
Jet fuel and kerosene	Jet fuel[1)] and kerosene	43.1* ktonnes = TJ
Other petroleum products	Petrol coke	35* ktonnes = TJ
Electricity	Electricity	3.6*GWh = TJ

1) No conversion factors were given from The Division for Energy and Industrial Production Statistics

5 NAMEA-work related to decomposition analysis

The NAMEA-work relating to decomposition analysis will allow us to use the NAMEA-data in new ways and to extract more information out of this data set. Initially we considered using an input-output analysis methodology as per de Haan (2000, 2001) and Siebel (2003) but the time lag before these tables are available is too long. Instead we used a method used by Bruvoll and Medin (2000, 2003) and Bruvoll, Flugsrud and Medin (2000) in their analysis of the Norwegian energy and air emissions data from 1980 to 1996 and found that it was more appropriate to our needs with regards to analyzing the annual NAMEA-air data in connection with our annual publication.

A decomposition analysis of emissions aims at explaining the underlying causes contributing to the overall change in emissions in a defined time period. The scope of this work has consisted in acquiring information about other studies on this subject and then to try to locate a decomposition analysis method that could be applied to the NAMEA air data. Effort was then given to examine how the results of a decomposition analysis best could be presented in order to supplement the annual presentations of the Norwegian emission inventory and the NAMEA publications.

These first trial calculations only cover the three greenhouse gases CO_2, CH_4 and N_2O in the period 1990 to 2003, but similar calculations are also possible for all emission types included in the NAMEA data.

5.1 Current use of NAMEA-data

Based on NAMEA-data, Statistics Norway in 2002, published statistics comparing the development in economic growth and air emissions by aggregated industry level. Data is published at t-2 at using the quarterly national accounts industry groupings and the data is made available to the public on our website (http://www.ssb.no/english/subjects/01/06/) through the StatBank database. These data show changes over time in emissions indexing to 1990 due to the requirements outlined in the Kyoto agreement, emissions intensities are also presented which can show the extent of de-coupling of emissions from economic activity (see Figure 5.1 and 5.2). Explanations of these figures are attempted, but they are at best educated guesses based on knowledge of the basic statistics gained through the revision and production phases of the emissions inventory statistics.

Figure 5.1 Greenhouse gases and decoupling indicator, greenhouse gases intensity. Norway excluding ocean transport. 1990-2003*

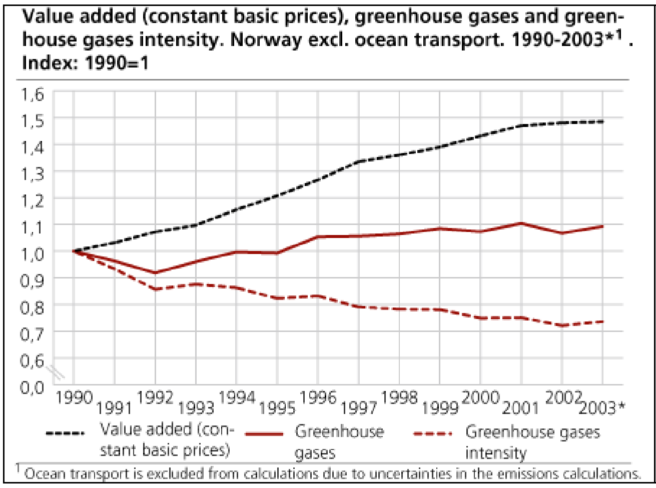
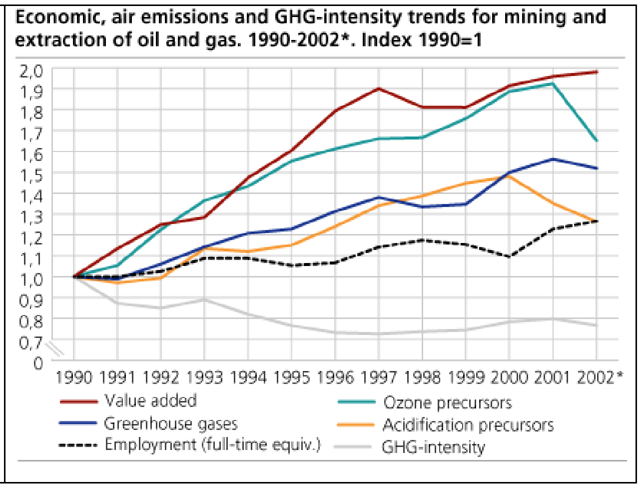


Figure 5.2 Economic, air emissions and decoupling indicator, GHG-intensity for mining and extraction of oil and gas industries. 1990-2002*



Source: http://www.ssb.no/english/subjects/01/06/)

Although changes are being shown on the figures and described briefly in the annual NAMEA-air publications the reasons for the observed changes are not possible to quantify since this is not shown directly from the data without further analyses. Since Statistics Norway has responsibility for the Norwegian emissions inventory and the energy data that are used as inputs into the emissions model, there is a good deal of understanding behind these statistics and why they might increase or decrease if there have been significant changes in certain enterprises or if new regulations or taxes have been introduced in specific industries. Also dramatic changes in the price of electricity can be the reason that some enterprises use more fuel oil instead of electricity, which is then reflected in the emissions. These dramatic changes can sometimes explain some of the changes observed, but currently there is no way that all of the small changes that occur in the Norwegian economy can be accounted for without performing more detailed analyses. The most we can do is to set up tables that can show the percentage change between two years based on the economic and emissions data, as is done in Table 5.1.

This study will focus on trying to use a simple decomposition methodology to try to quantify the effects that three components, changes in the composition of the Norwegian economy, the growth of the economy and other technological changes, have on greenhouse gas emissions. This type of analysis may help to identify the structural changes that are the key drivers of this environmental pressure. The changes shown in the last column of Table 5.1, Per cent change in CO_2-equivalents, will be the specific focus of this analysis.

Table 5.1 Gross value added (GVA) and greenhouse gas emissions (GHG-emissions) for 1990, 2003 and the changes of GVA and GHG-emissions between 1990 and 2003, by aggregated industries. GVA in million NOK, Constant 1995-prices. GHG-emissions in tonnes CO_2-equivalents.

	GVA 1990 (constant 1995-prices)	GVA 2003 (constant 1995-prices)	Per cent change in GVA	GHG-emission 1990 CO_2-eqv.	GHG-emission 2003 CO_2-eqv.	Per cent change in CO_2eqv.
Total	**691 942**	**1 026 609**	**48.4 %**	**58 540 439**	**65 276 983**	**11.5 %**
Agriculture, forestry and fishing	19 531	28 593	46.4 %	6 683 095	6 488 349	-2.9 %
Mining and extraction	69 521	135 854	95.4 %	8 450 491	14 379 052	70.2 %
Manufacturing	107 198	112 002	4.5 %	13 741 133	14 177 449	3.2 %
Energy and water supply and construction	55 458	58 611	5.7 %	774 339	1 205 440	55.7 %
Wholesale, maintenance, hotels and restaurants	83 164	163 559	96.7 %	598 881	514 263	-14.1 %
Transport (including ocean transport)	47 615	67 885	42.6 %	17 898 406	18 320 233	2.4 %
Services	154 755	261 374	68.9 %	821 616	854 055	3.9 %
Education, health and social work	118 134	164 996	39.7 %	678 032	1 007 833	48.6 %
General government	50 610	53 698	6.1 %	2 774 136	2 144 225	-22.7 %
Household consumption	382 326	581 122	52.0 %	6 120 310	6 186 084	1.1 %

5.2 Decomposition analysis methodology

5.2.1 Background for choosing the volume indicator methodology

The major goal of this study has been to explore the use of an analytical method that can be used to analyse the sources of different causes of changes in emissions to air, so-called decomposition analysis. Input-Output analysis provides one systematic approach to decompose changes in emissions according to their causes (see de Haan 2000, Siebel 2003). This approach requires input-output tables from the national accounts which are not available until t-3. Due to this time lag input-output analysis cannot be used for the most current time periods when emissions data (t-1) and NAMEA-air data (t-2) are published. For this reason the Input-output methodology has been rejected as a useful method for the decomposition analysis of air emissions in Norway since it is only useful for analysing historic data not the most current data. We are looking for a way to perform a decomposition analysis for the most current results being published for both the NAMEA data (t-2) and the results from the Norwegian emission inventory, i.e. one year after a year's expiration (t-1).

Bruvoll and Medin (2000, 2003) base their decomposition analysis on volume indicators for eight different factors (ex. economic growth, changes in the relative size of production, changes in the use of energy) in order to study the changes in air pollution over the period 1980 to 1996. Vandille (2005) uses Belgian NAMEA air and energy data with four different factors (economic growth, changes in the structure of the economy, energy intensity of value-added creation and the emission intensity of the energy used).

The method used by Bruvoll and Medin (2000, 2003) is based on indicators that can be calculated using NAMEA air data, and not based on the input-output analysis. This method was therefore chosen to test if it could form the basis for an analytical tool that can be used on a regular basis to examine the sources of changes in emissions to air over longer time periods as well as changes on an annual basis.

5.2.2 Presentation of the calculation methodology

The decomposition method used in this study is based on the model presented by Bruvoll and Medin (2000), but eliminated the factors concerning energy use and population. Since this analysis is based on the NAMEA air data which only has air emissions and value added data, the energy use and population factors needed to be eliminated.

The total changes in emissions for a given period decomposed into the scale-, composition- and other technologic changes components can be written as:

$$\overline{P}_t = \overline{S}_t + \overline{C}_t + \overline{T}_t$$

where

$$\overline{S}_t = P_0 * \left[\frac{Y_t}{Y_0}\right] \qquad S_t = \left[\frac{\overline{S}_t}{P_0}\right] * 100$$

$$\overline{C}_t = \sum_j P_{j0} * \left[\frac{Y_{jt}}{Y_{j0}} - \frac{Y_t}{Y_0}\right] \qquad C_t = \left[\frac{\overline{C}_t}{P_0}\right] * 100$$

$$\overline{T}_t = \sum_j P_{jt} - \left[P_{j0} * \frac{Y_{jt}}{Y_{j0}}\right] \qquad T_t = \left[\frac{\overline{T}_t}{P_0}\right] * 100$$

P = Pollution
S = Scale component
C = Composition component
T = Other technological changes component
Y = Production
t = Time
j = Sectors

The scale component corresponds to the effect on air emissions from economic growth. Economic growth can be given as growth in output by kind of main activity, growth in value added by kind of main activity or growth in GDP per capita. Given constant emissions per unit produced, emissions will increase at the same rate as production.

The composition component reflects the impact on air emissions from the production structure. If the most polluting sectors grow faster than average economic growth, the change in the composition component will be positive.

The other technological changes component corresponds to the effect on emissions to air from changes in factors such as energy efficiency and changes in the intermediate consumption of energy types within an industry, improvements in technology, etc. This component may also be influenced by changes such as the entry of taxes and regulations aiming at improving the air emissions problem.

The data sources that are used in this decomposition analysis are already published figures at Statistics Norway for air emissions and the annual and quarterly national accounts. The data used are based on the publication in April 2005 and covers the period from 1990 to 2003. These data are publicly available from the StatBank link associated with the NAMEA-air annual publication (see link in left column of webpage: http://www.ssb.no/english/subjects/09/01/nrmiljo_en/). The economic data used are gross value added and household consumption data in constant 1995-prices.

5.3 Norwegian greenhouse gas emissions decomposition results

The first trial calculations are focusing on greenhouse gas emissions for CO_2, CH_4 and N_2O in the period 1990 to 2003 and focus first on the whole economy and then break down the results by aggregated industry groupings. By using the method described by Bruvoll and Medin (2000) we want to investigate whether it is possible to quantify three of the structural components that are responsible for the observed changes in the air emissions, the scale component, the composition component, and the technical changes component. In this study only CO_2-emissions, CH_4-emissions and N_20-emissions are included in the calculations for *total emissions of greenhouse gases (in CO_2-equivalents).*

5.3.1 Decomposition analysis for the Norwegian economy between 1990 and 2003

In the period from 1990 to 2003, total greenhouse gases increased by 11.5 percent or 6 736 544 tonnes CO_2-equivalents. Measured in CO_2-equivalents, the emissions of CO_2 form the major part of the total greenhouse gas emissions, with respectively 83.9 and 82.3 percent of total greenhouse gas emissions in 1990 and 2003. Of the three gases that are included in the calculation of *total emissions of greenhouse gases*, CH_4 is the only gas for which emissions have declined in the period from 1990 to 2003. For details, see table 5.2.

Table 5.2 Emissions of greenhouse gases, CO_2, CH_4, N_2O. Tonnes CO_2-equivalents. Between 1990 and 2003

	CO_2	CH_4	N_20	Total
a) Emissions in 1990	48 188 768	5 179 639	5 172 032	58 540 439
b) Emissions in 2003	54 785 818	5 074 010	5 417 155	65 276 983
c) Changes in tonnes CO_2-equivalents, between 1990 and 2003	6 597 050	-105 629	245 123	6 736 544
d) Changes in percent, between 1990 and 2003	13.7	-2.0	4.7	11.5
e) Changes as percent of total greenhouse gas emissions from 1990	11.3	-0.2	0.4	11.5

Table 5.3 shows the changes in tonnes of greenhouse gas emissions from the three components. In other words, the changes shown in line c of Table 5.2 are decomposed into the associated three components. The calculations show that the three components effect the greenhouse gas emissions in different directions. Economic growth between 1990 and 2003 has contributed to an increase in emissions to air. Given no change in the composition component and the other technological changes component, the greenhouse gas emissions would have increased with 28.3 million tonnes CO_2-equivalents. However, the total greenhouse gas emissions "only" did increase with 6.7 million tonnes CO_2-equivalents, given the negative effect on emissions from changes in the production structure and particularly the changes in the other technological changes component.

Table 5.3: Changes in greenhouse gas emissions broken down by the structural components. Tonnes CO_2-equivalents. Between1990 and 2003.

	CO_2	CH_4	N_20	Total
Scale component	23 307 142	2 505 201	2 501 523	28 313 866
Composition component	-2 154 554	-925 107	-1 025 544	-4 105 205
Other technological changes component	-14 555 539	-1 685 723	-1 230 856	-17 472 117
Sum (equals changes between 1990 and 2003)	6 597 050	-105 629	245 123	6 736 544

The decomposition analysis results shown in table 5.3 are analysing the economy as a whole. Another way to present this information is to examine the data as a percent of total emissions. Table 5.4 presents the results from the decomposition analysis as a percentage of each emission type, i.e. the growth in greenhouse gas emissions between 1990 and 2003 is given in percentage and decomposed into the effect from the three decomposition components (i.e. table 5.2, line d is explained).

The scale component's share of total emissions of respectively CO_2, CH_4 and N_2O is equal for all emission types, indicating the growth in total gross value added in the period between 1990 and 2003. Given constant emissions per unit produced, emissions will increase at the same rate as gross value added. The scale component and the other technological changes component almost have the opposite effect on emissions: while economic growth leads to increases in greenhouse gas emissions, other technological changes lower greenhouse gas emissions. Although changes in production structures also lead to lower greenhouse gas emissions, the effect on emissions from an increase in economic activities lead to an overall increase in total greenhouse gas emissions.

Table 5.4: Changes in greenhouse gas emissions broken down by structural components (scale, composition and other technological changes). Percent. Between 1990 and 2003.

	CO_2	**CH_4**	**N_20**	**Total GHG**
Scale component	48.4	48.4	48.4	48.4
Composition component	-4.5	-17.9	-19.8	-7.0
Other technological changes component	-30.2	-32.5	-23.8	-29.8
Sum (equals changes in percent)	13.7	-2.0	4.7	11.5

This information is also shown in figure 5.3. If the three components are added together for each of the emission types the total change for each emission type is obtained.

Figure 5.3 Changes in emissions broken down by structural components (scale, composition and other technological changes). Share of total. Per cent. Between 1990 and 2003.

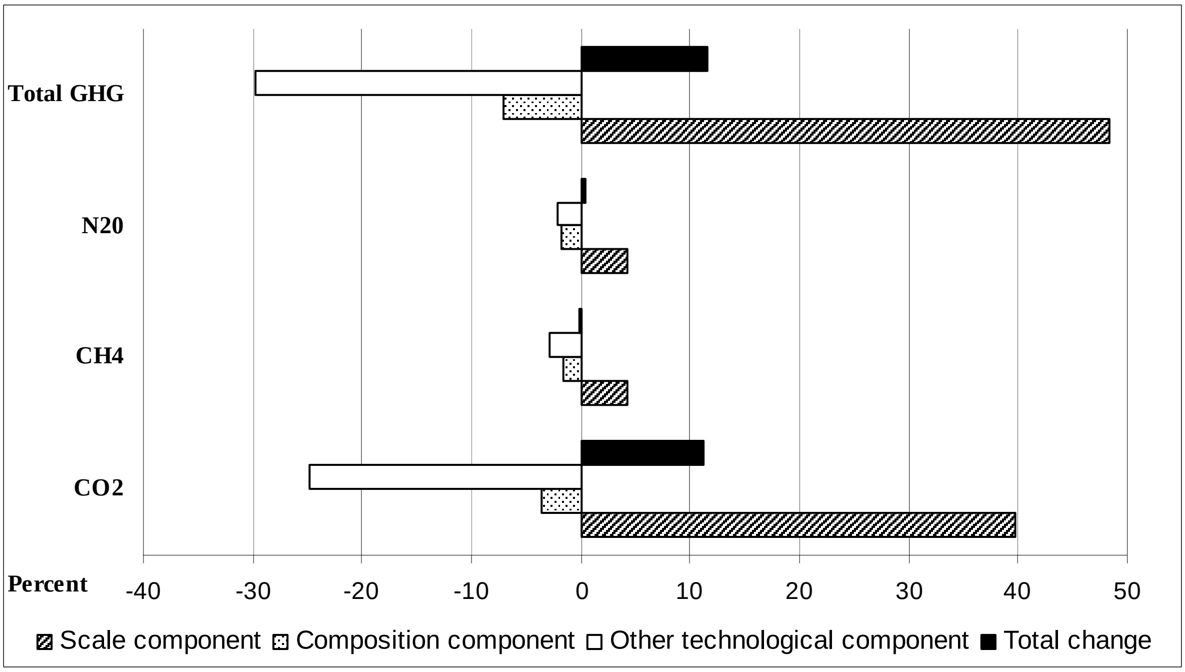
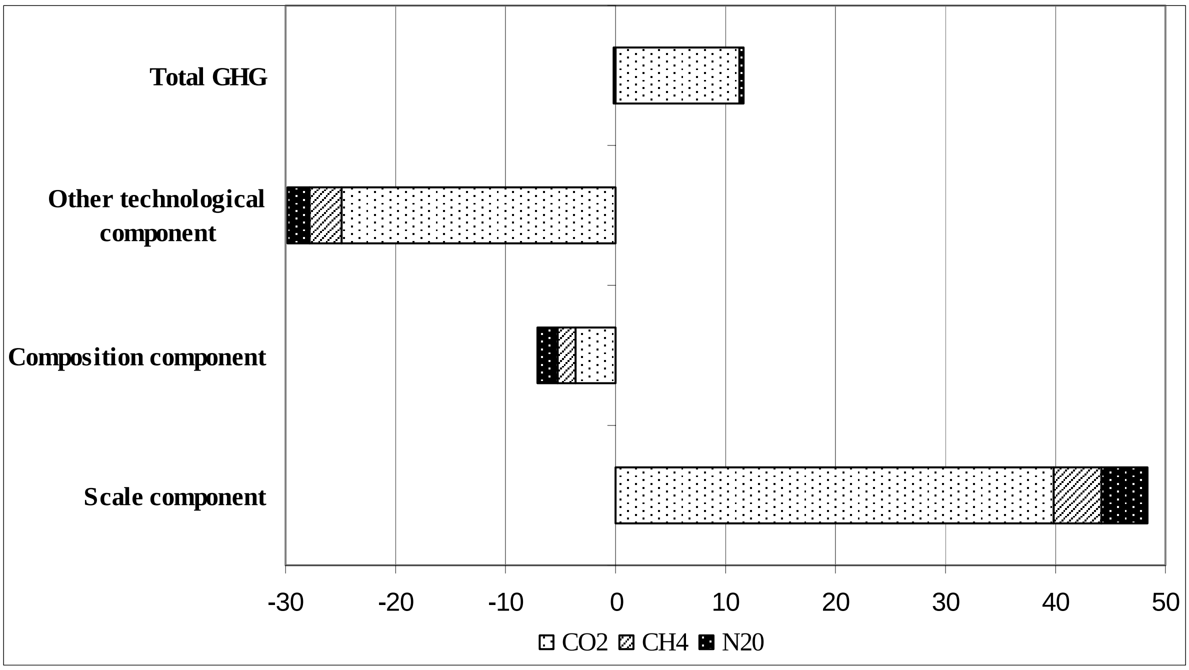


Table 5.5 presents the results from the total economy decomposition analysis as a percentage of total greenhouse gas emissions (i.e. table 5.2, line e is explained). The analysis of this dimension allows the focus to be on which one of the three greenhouse gases has the most contribution to the three components. As the results show, it is the development in emissions of CO_2 that to a great extent decides the development in emissions of greenhouse gases. Figure 5.4 illustrates these same results by showing the contribution to each of the three components that is made by the different greenhouse gases.

Table 5.5: Changes in greenhouse gas emissions broken down by structural components (scale, composition and other technological changes). Percent of total greenhouse gas emissions. Between1990 and 2003.

	CO_2	CH_4	N_20	Total GHG
Scale component	39.8	4.3	4.3	48.4
Composition component	-3.7	-1.6	-1.8	-7.0
Other technological changes component	-24.9	-2.9	-2.1	-29.8
Sum (equals changes as percent of total emissions in 1990)	11.3	-0.2	0.4	11.5

Figure 5.4 Changes in emissions broken down by structural components (scale, composition and other technological changes) and by emission type, share of total greenhouse gas emissions. Per cent. Between 1990 and 2003.

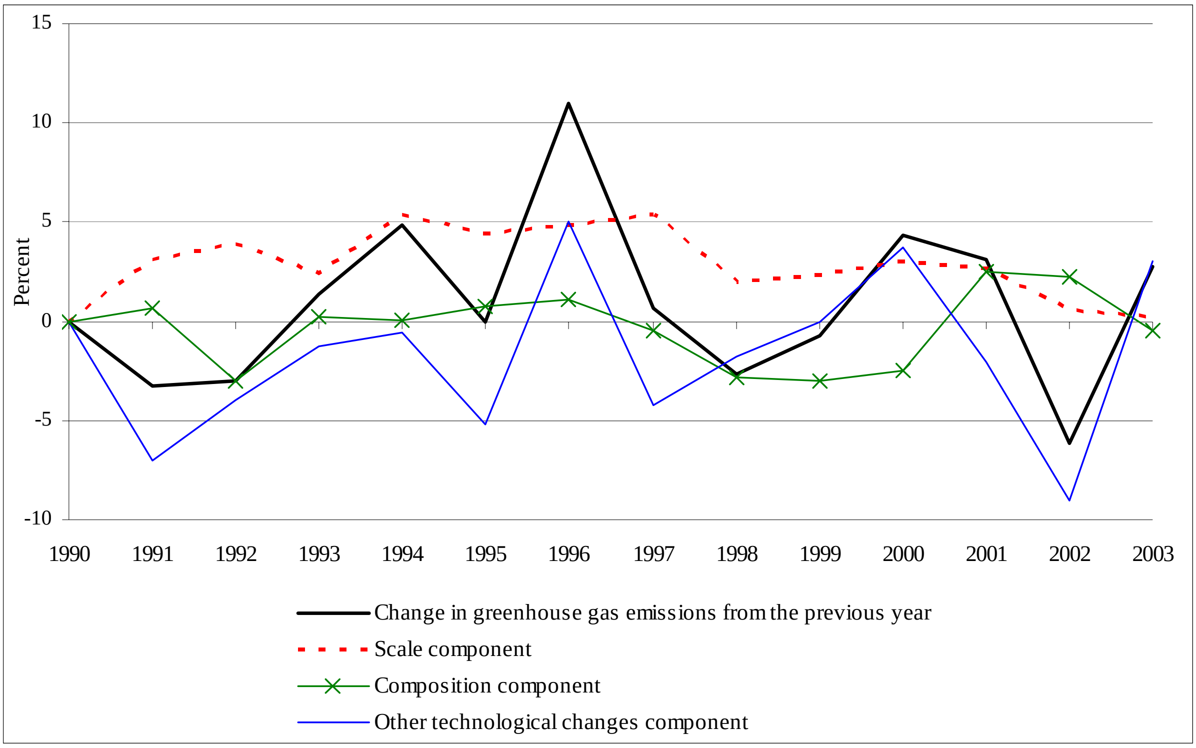


Again it is CO_2 that is the most important portion of each of the components, dominating the scale and the other technological components. By showing the analysis in this way it is easy to see which component contributes to the changes and in which direction, positive or negative. By showing the information in this way the focus is first on the three components and then the shading in the bars shows how much of the components is due to the various types of emissions. If all six types of greenhouse gases are included in future analyses this approach to presenting the results may be the most effective.

5.3.2 Decomposition analysis for the Norwegian economy, 1990 - 2003 time series

The main focus of this analysis has been between the years of 1990 and 2003, i.e. the years we currently have as the starting and ending points of the NAMEA-air data set (data for 2004 should be published in June 2006, i.e. t-2). In addition to this between two years analysis we have also performed a decomposition analyses for each year during the whole time period, 1990 to 2003. These results are shown in figure 5.5. This figure shows a time series of data which was presented as "total GHG-gases" in figure 5.3 for the previous work for the time period between 1990 and 2003. This graph shows the per cent growth of greenhouse gas emissions from one year to the next (shown in the heavy black line) which is then the arithmetic sum of the three components, scale, composition and other technical changes, shown in the figure as the other three lines.

Figure 5.5 Annual changes in greenhouse gas emissions (tonnes CO2-equivalents) broken down by the structural components. Per cent. 1990-2003.



From this time series analysis, the total change in greenhouse gas emissions from the previous year appears to be particularly influenced by the other technological changes component. Of course the scale and composition components do influence the pattern but the large variations observed in the total emissions appear to be strongly influenced by the variations shown in the third component, other technological changes. The time series also shows in which time periods the various components have the strongest effects. For example in 1993 and 1994 it was the scale component and not the composition or technology components that caused the increase in emissions. It is also interesting to note that the scale component has contributed positively to the growth in emissions during the whole time period whereas the other two components sometimes contribute positively and sometimes negatively to the emissions. This information can be combined with other information regarding the Norwegian economy, such as energy prices and rates of oil and natural gas extraction, to help us understand even more of the picture. This type of figure helps provide some better understanding regarding the changes over time rather than looking at only two specific time periods.

In addition to looking at the Norwegian economy as a whole, it is also possible to use the NAMEA-air data to perform industry level analyses. This was done using aggregated industry groups and the results are presented in the next section.

5.3.3 Applications for the economy level analyses

Now that we have made the time series calculations for the economy level from 1990 until 2003 it would be possible to repeat these calculations with the updated annual NAMEA-air data sets on a regular basis without too much additional work in order to provide some additional insights into the data and the changes being observed, both over long periods and from year to year. In order to do the economy level analyses, industry level data is needed in order to obtain the composition component and the other technological change component so it is necessary to wait until the NAMEA data is available (t-2) before the analysis can be performed. Also since the entire time series of air emissions data is revised annually the decomposition for the entire time series would also need to be performed.

5.4 Industry level decomposition analyses between 1990 and 2003

It is also possible to do decomposition analyses on an industry level using the NAMEA data. This data will be t-2 years but this is still more current than having to wait for the input-output tables from the national accounts (t-3 at the earliest) in order to do decomposition analyses using an I-O methodology.

This industry level analyses show wide variations between the different aggregated industry groups. Again the three components are able to be obtained from the available NAMEA-air data, scale, composition and other technological changes components.

The scale component reflects that the growth in the economy was not evenly distributed across the different industry groups and this in turn influences the emissions patterns. The scale component shows how the growth in the economy, measured as gross value added, would influence the growth in emissions if all other things are held constant.

Table 5.6 Changes in emissions resulting from the scale component. Tonnes CO_2-equivalents. Between 1990 and 2003.

	CO_2	CH_4	N_20	Total GHG
Total	23 307 142	2 505 201	2 501 523	28 313 866
Agriculture, forestry and fishing	975 215	985 868	1 271 285	3 232 368
Mining and extraction	3 880 568	192 477	14 148	4 087 193
Manufacturing	5 446 638	179 839	1 019 606	6 646 083
Energy and water supply and construction	355 646	1 466	17 407	374 519
Wholesale, maintenance, hotels and restaurants	286 345	1 202	2 110	289 657
Transport	8 566 623	12 626	77 555	8 656 804
Services	390 324	3 192	3 870	397 385
Education, health and social work	307 200	1 661	19 078	327 939
General government	249 003	1 046 544	46 201	1 341 748
Household consumption	2 849 579	80 327	30 263	2 960 170

The three industry groups that have the largest scale component effect for greenhouse gas emissions are the transportation industry, manufacturing and mining and extraction. Primary industries (i.e. agriculture, forestry and fishing), and households are the next largest contributors.

Table 5.7 shows the results of an industry level decomposition analysis for the composition component. The composition component describes the changes in the economic structure of the Norwegian economy. Some industries grew during this period while others did not. Even though the composition component in total contributes to reductions in greenhouse gas emissions (-4 105 205 tonnes CO_2-equivalents), the effect on emissions on an industry level varies.

Table 5.7 Changes in emissions resulting from the composition component. Tonnes CO_2-equivalents. Between 1990 and 2003.

	CO_2	CH_4	N_20	Total GHG
Total	-2 154 554	-925 107	-1 025 544	-4 105 205
Agriculture, forestry and fishing	-39 687	-40 121	-51 736	-131 544
Mining and extraction	3 774 794	187 230	13 762	3 975 787
Manufacturing	-4 941 974	-163 176	-925 134	-6 030 284
Energy and water supply and construction	-313 841	-1 293	-15 361	-330 495
Wholesale, maintenance, hotels and restaurants	285 977	1 200	2 107	289 284
Transport	-1 026 535	-1 513	-9 293	-1 037 341
Services	165 673	1 355	1 642	168 670
Education, health and social work	-55 244	-299	-3 431	-58 974
General government	-217 590	-914 520	-40 372	-1 172 482
Household consumption	213 875	6 029	2 271	222 175

Changes in the production structure between the different industries can be seen in this table. Increases are particularly seen in the mining and extraction industries which includes the extraction of oil and natural gas. Decreases are seen especially in the manufacturing industries and the transportation industry. Smaller decreases are seen in the energy water supply and construction industries and general government. Increases are seen in the services industries and household consumption. The combined effect of the changes in the production structure in the economy has meant an overall decrease in emissions if all other factors had been held constant. It is interesting to note that the changes observed due to the composition component go in the same direction for all three types of air emissions. This is different from what is observed with regards to the third component (which includes the effect of technology changes) when some of the emissions increase while others decrease in the same industry.

Table 5.8 shows the other technological changes component by industries. It is definitely this component that in the period between 1990 and 2003 draws down the total greenhouse gas emissions, especially the CO_2-emissions. In this study, the component “other technological changes” will to a large extent reflect the effect on pollution from more efficient utilisation of energy and from changes in the composition of energy types, i.e. changes in the intermediate consumption. This conclusion is drawn based on the study by Bruvoll and Medin (2000) and not from the current analysis since energy cannot be included using the NAMEA-air data. They used detailed Norwegian energy data in addition to emissions, economic and population data for their analysis between 1980 and 1996. This study showed that it was particularly the two effects of more efficient utilisation of energy and from changes in the composition of energy types that greatly influence the emissions levels. However since energy data is not being included in the current study is not possible to say anything definitive about changes in energy use. In this current study changes in energy use will also be included in this final component which also includes technology changes and efficiency improvements.

Table 5.8 Changes in emissions resulting from the other technological changes component. Tonnes CO_2-equivalents. Between 1990 and 2003.

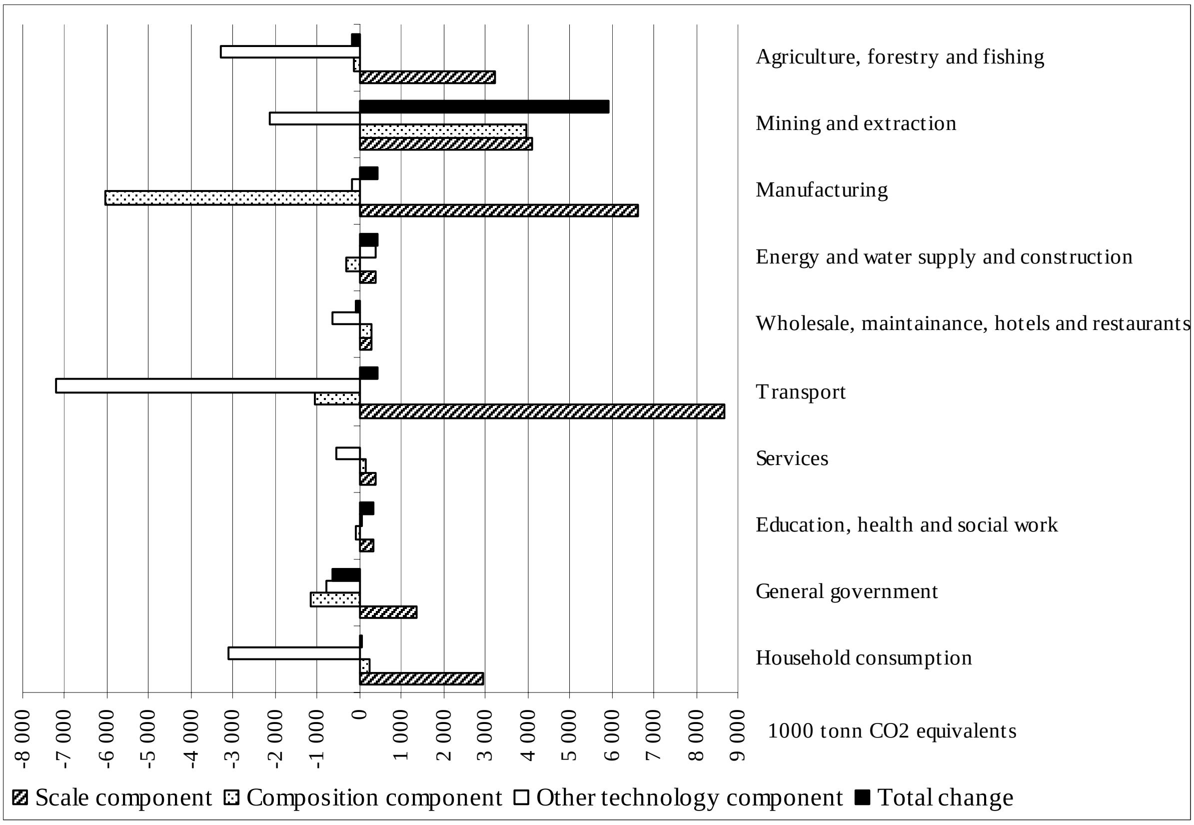
	CO_2	CH_4	N_2O	Total GHG
Total	-14 555 539	-1 685 723	-1 230 856	-17 472 117
Agriculture, forestry and fishing	-1 019 538	-989 487	-1 286 546	-3 295 571
Mining and extraction	-2 070 316	-51 460	-12 642	-2 134 418
Manufacturing	334 052	-78 788	-434 747	-179 484
Energy and water supply and construction	367 527	2 156	17 394	387 078
Wholesale, maintenance, hotels and restaurants	-670 762	-3 306	10 510	-663 558
Transport	-7 154 081	-8 691	-34 865	-7 197 637
Services	-584 302	-6 828	57 514	-533 616
Education, health and social work	40 614	-1 074	21 297	60 837
General government	-318 498	-490 966	10 287	-799 177
Household consumption	-3 480 234	-57 279	420 942	-3 116 570

The reductions in emissions from efficiency improvements in the utilisation of inputs (most likely energy) in the transport industries have strongly contributed to the relatively low increase in total greenhouse gas emissions from the transport sector. The emissions from the transport industries increased by 2 percent from 1990 to 2003, while these industries experienced a 43 percent growth in gross value added in the same period. But, also the efficiency improvements in intermediate consumption that occurred in primary industries (agriculture, forestry and fishing), the extraction industries and households have contributed to curbing the growth in emissions between 1990 and 2003.

For some industries, for example the mining and extraction industry, changes in the emissions are negative for all three of the different greenhouse gases being examined. On the other hand, for the manufacturing industry this component shows a positive direction for CO_2 emissions and negative directions for CH_4 and N_2O (all measured in CO_2-equivalents). It is not surprising that there would be mixed effects show for the different types of emissions for the different industries since this final component includes all of their changes that are not attributable to scale or composition.

In figure 5.6 the effect on emissions from the three components, scale, composition and the other technical changes, for total greenhouse gas emissions is compared on an aggregated industry level. In the transport industry, *both* the production changes and the input efficiency of have changed in a way that both components contribute to reduced greenhouse gas emissions. This effect can also be seen in the primary industries and the general government sector, but in a less significant way than for the transport industry.

Figure 5.6 Changes in emissions by components (scale, composition and other technological changes) by aggregated industries. 1000 tonnes CO_2-equivalents. Between 1990 and 2003.



Both the extraction industry and the manufacturing industry stand out from the other industries when looking at how these industries effect emissions. These two industry groups also differ from each other, although they both have had a higher growth in the gross value added than in greenhouse gas emissions in the period studied. While the composition effect contributes to a formidable increase in greenhouse gases from the extraction industries, it is more than neutralised by the formidable decrease in greenhouse gases from the manufacturing industries.

Industry level information helps to identify which industries are influences the observed changes and which components are contributing the most to those industry level changes. This type of analysis helps to understand the changes from one period to another.

With regards to industry level analyses we have not yet tested whether the aggregation level for the industries influences the results. At this time we have used a 10 industry aggregation level in these calculations. It is possible for us to use the NAMEA-air data at its most detailed level with 45 industries to see if different results are obtained with less aggregation. Bruvoll and Medin (2000) performed a sensitivity analysis comparing results for industries aggregated into 8 groups vs. 125 groups (the most detailed industry level available for the data). They found that only small changes occurred in most of the components but that the process emissions component was the most sensitive to the aggregation level since it had the fewest decomposition factors.

Based on the sensitivity analysis of Bruvoll and Medin (2000), there may be some indication that in the current analysis since there are only three components the results may be influenced by the level of aggregation. This needs to be investigated in more detail before we start to include this type of analysis in our regular NAMEA-air publishing routines.

5.4.1 Applications for the industry level analyses

Industry level analyses help provide additional information regarding changes observed in the industry level data that is not available from the industry level graphs that are currently part of the NAMEA-air annual publication. The analysis appears to be sensitive enough to provide year-to-year changes so that this type of analysis could be used to help provide information regarding changes from the previous year. By combining the decomposition analysis information together with our knowledge regarding the data used for compiling the statistics we would have a better picture of at least some of the reasons causing the changes in the emission levels we are observing.

If this type of decomposition analysis is performed on the most detailed data, i.e. 45 industries, then some specific causes may be able to be identified as well as seeing where the most important changes are occurring and to what extent. This could be helpful in trying to identify if certain policies are having the desired effects.

5.5 Future recommendations

In the near future it may be possible to establish this type of decomposition analysis as a part of the annual NAMEA-air production processes for publication. The applicability and usefulness of this methodology has been shown in the analyses performed in this project.

Before a final procedure for this analysis can be recommended, it is necessary to perform some sensitivity analyses to determine whether the aggregation level of the industries has an important effect on the results. If aggregation is important then a standard aggregation needs to be established so that the results will be consistent from one year to the next.

Since industry level information is needed in the calculation process (for the composition and the other technological changes components) the t-1 emissions data will not be able to be used in this type of analysis since only estimates for Norway as a whole are available at that time. The earliest point in time where these could be used are with the NAMEA-air data which are available t-2.

This methodology is also one which Eurostat could use in its publications regarding aggregated data for the European Union or other aggregated sets of data since input-output tables are not required. This may provide some insights which are not possible to obtain based on the current approaches being used to work with the NAMEA data.

5.6 References

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6 Work related to environmental expenditure accounts for water

Statistics Norway was not able to report physical or monetary data to the water accounts tables requested by Eurostat in 2003. In this part of the project, we take a look at the different monetary statistics available for water. Initially it was thought that there are three main sources of economic data for water in Statistics Norway: structural statistics, municipal accounts and the national accounts and that these data sources included data for both publicly-owned and privately-owned waterworks. Instead we discovered that there is currently no information at Statistics Norway available for privately-owned waterworks. Having identified this gap or inconsistency in the national accounts this portion of the project needed to evaluate the need to include privately owned waterworks in the national accounts as a part of NACE 41. Currently NACE 41 only includes the local government production (i.e. municipal and inter-municipal waterworks). Based on this work, it was decided that this was not to be given a high priority. Therefore, the trial reporting of the water accounts data is taken from the national accounts system (NACE 41), which does not include private waterworks.

6.1 Available economic data regarding the water industry

First it is important to identify the structure of the water supply and distribution industry in Norway. We find that the structure of the water supply industry is rather varied. In some areas there are a number of private companies that sometimes serve a majority of the population whereas in other parts of the country water distribution is a function of the municipalities or is a function performed by publicly owned enterprises. Based on this picture it is necessary to identify data regarding municipalities, publicly owned enterprises, and privately owned enterprises.

This chapter aims to outline the structure of the drinking water industry in Norway. In this setting structure is understood by the distribution of production, size and income between three types of waterworks. The distinction between the three different types of waterworks is attached to ownership of the enterprise, which could be municipal, inter-municipal, or privately owned. A time series that extends from 1998 to 2004 is used to describe the structure of the drinking water industry.

6.1.1 Data sources for both private and public waterworks

Data is mainly derived from the Norwegian Institute of Public Health and summarized in table 6.1. This institution collects data and maintains a register for all waterworks supplying 20 households or more. This register contains a range of variables such as water quality, number of people supplied to, income, fees, costs and investments. For municipal waterworks, however, income fee data ceases to exist in the register after year 2000. Data is instead collected by Statistics Norway through the KOSTRA accounting system. This accounting system collects economic data from all the municipalities in Norway. Hence all the municipal owned and inter-municipal owned waterworks report to this system.

To describe the size and production of the waterworks, physical data such as number of individuals supplied and number of waterworks within each category is used. In addition average number of people supplied and average fee within each category of enterprise is calculated.

Table 6.1 Data on private and public waterworks

Year	1998	1999	2000	2001	2002	2003	2004
Inter-municipal enterprise							
Number of individuals supplied	813 600	950 287	461 487	888 500	893 450	898 400	987 689
Percentage share of production	20.6	22.5	10.8	22.0	22.1	22.1	19.5
Total number of Inter-municipal waterworks	16	17	12	16	16	17	19
Percentage share of total waterworks	0.9	1.2	0.9	0.9	1.0	1.0	1.2
Income fees in mill NOK	169	208	92	150	220	227	217
Percentage share of total income fees	6.6	6.3	3.3	4.6	6.5	7.0	6.6
Average number of individuals supplied	50 850	55 899	38 457	55 531	55 841	52 847	51 984
Municipal enterprise							
Number of individuals supplied	2 894 500	3 096 062	3 618 277	2 922 000	2 929 900	2 937 800	3 864 552
Percentage share of production	73.3	73.2	85.1	72.4	72.4	72.4	76.1
Total number of municipal waterworks	1 075	919	900	1 050	1 047	1 043	1 017
Percentage share of total waterworks	59.8	66.6	67.9	62.0	62.3	62.6	62.7
Income fees in mill NOK	2 308	2 942	2 643	2 929	2 986	2 874	2 963
Percentage share of total income fees	89.9	89.4	93.4	89.4	88.7	88.5	89.5
Average number of individuals supplied	2 693	3 369	4 020	2 783	2 800	2 817	3 800
Private enterprise							
Number of individuals supplied	239 600	183 648	174 113	225 000	223 800	222 600	224 607
Percentage share of production	6.1	4.3	4.1	5.6	5.5	5.5	4.4
Total number of private waterworks	707	444	413	628	617	605	585
Percentage share of total waterworks	39.3	32.2	31.2	37.1	36.7	36.3	36.1
Income fees in mill NOK	89	142	95	198	161	146	129
Percentage share of total income fees	3.5	4.3	3.4	6.0	4.8	4.5	3.9
Average number of individuals supplied	339	414	422	358	363	368	384
Total							
Population	3 947 700	4 229 997	4 253 877	4 035 500	4 047 150	4 058 800	5 076 848
Number of waterworks	1 798	1 380	1 325	1 694	1 679	1 665	1 621
Fees in mill NOK	2 566	3 292	2 830	3 277	3 367	3 247	3 309

Source: Norwegian Institute of Public Health

6.1.2 Physical data

From the total of approximately 1600 waterworks it is evident from table 6.1 that Inter-municipal waterworks is a small share of the total number of waterworks. Only about 1 percent of the waterworks falls into this category, compared to the privately owned waterworks that varies from 39 to 30 percent. Note also that the last 60 percent of the waterworks are municipally owned.

The picture is different with respect to production. Production in this setting is understood as the percentage share of individuals supplied by an enterprise. In the period from 1998 to 2004 inter-municipal waterworks supplied 20 percent of the population. The same share for privately owned waterworks varies from 6 to 4 percent. Last, municipal waterworks has a share between 85 to 72 percent from 1998 to 2004.

A large part of the total number of waterworks is privately owned. However, these private waterworks supply only a small part of the population. On the other hand inter-municipal waterworks supply a large portion of the population from few units. The municipal sector is still the largest group with 60 percent of all the waterworks.

The inter-municipal waterworks are few, but dominate in size and supplied on average 50 000 individuals. Next municipal waterworks supplied approximately 3000 on average, while the average number supplied by privately owned enterprises were 300 individuals.

Figure 6.1 Number of waterworks in Norway by ownership. Per cent. 2004.

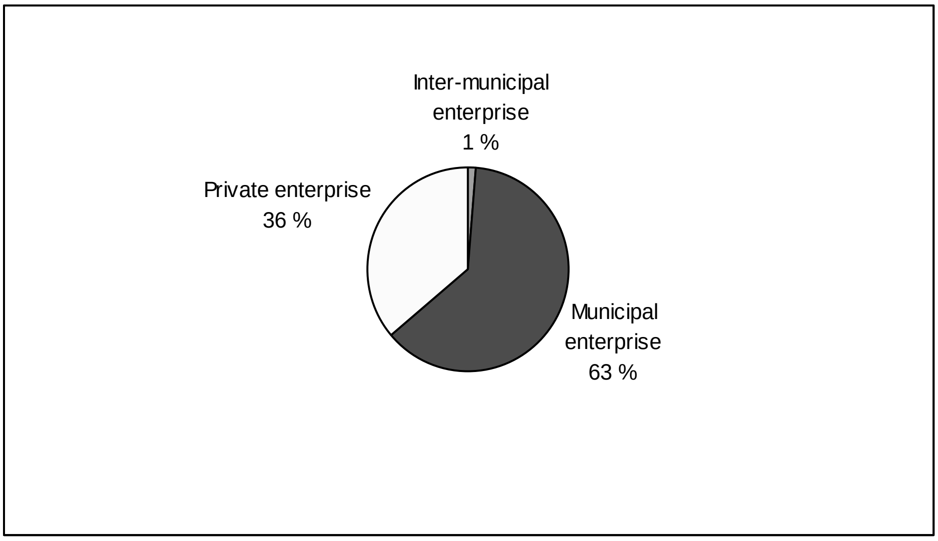
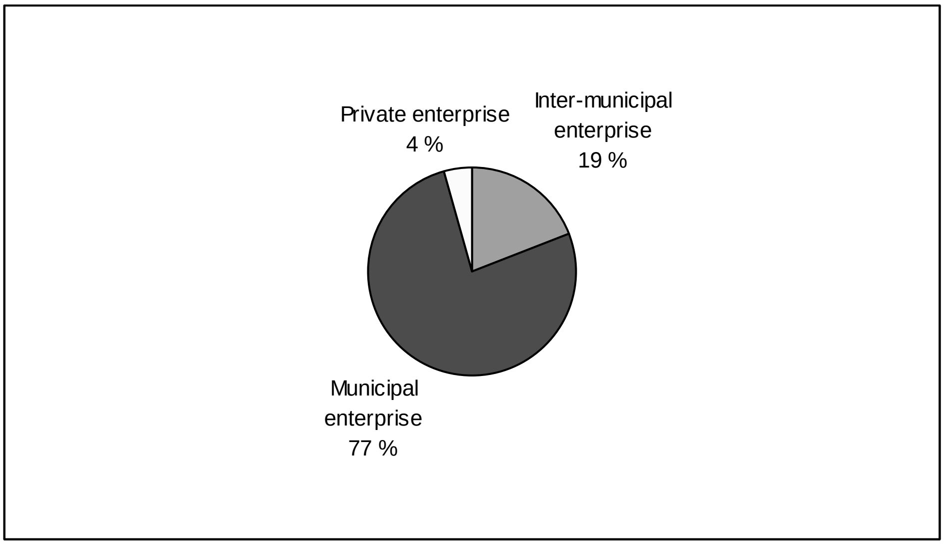


Figure 6.2 Percentage of individuals supplied by the types of waterworks. 2004.



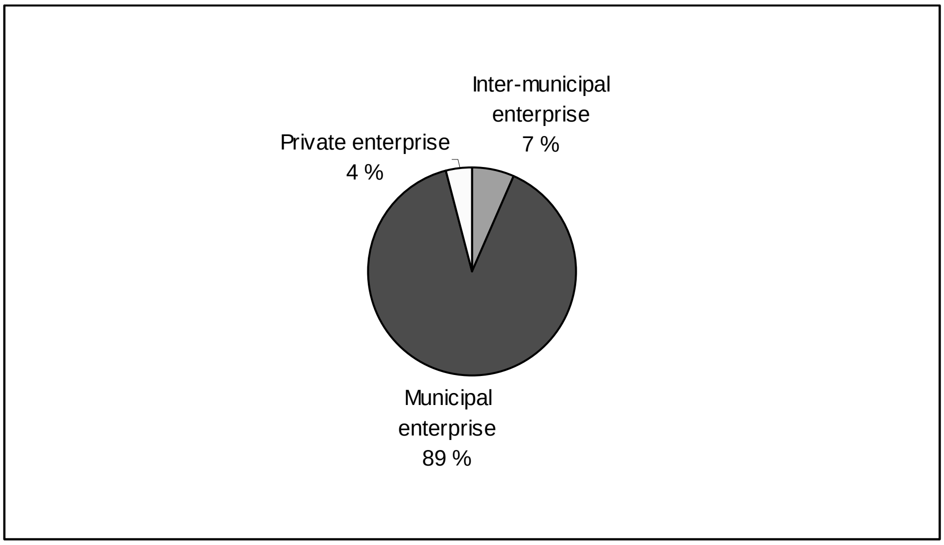
6.1.3 Monetary data

Total annual fees paid to the enterprises are the monetary measurement for production according to ESA 1995. Production is hence calculated as the sum of fees earned for each type of waterworks. Each enterprise also reported the fees that were charged from the households. The pattern generally showed that private enterprises charged higher fees than municipal and inter-municipal waterworks. As an example the annual fee paid by households varied in 1999 from 5170 to 123 NOK per household.

Monetary data is a mirror image of the physical data and confirms the structure outlined in the introduction. The privately owned enterprises received from 3.7 to 5.8 percent per year of all annual fees during the period. Their average share of total fees received is 4.3 per cent. In monetary terms this is equivalent to a variation of 89 to 198 million NOK in current prices, or an average income of 137 million per year.

The Inter-municipal enterprises produce in monetary terms 3.3 to 7 percent of total fees. This variation corresponds to an average income of 183 million NOK per year or 4.8 per cent of total fees earned. Finally, the municipal enterprises received on average a share of 90 percent of the total fee income , or an average of 2 800 million NOK per year.

Figure 6.4 Income from fees by type of waterworks. Per cent. 2004.



6.1.4 Data sources for water works in the municipal accounts system

Each year all of the municipalities in Norway report their municipal accounts via a standardized electronic reporting system (called “KOSTRA”) to Statistics Norway. Starting for 2004, with data reported in 2005, publicly owned enterprises also were required to report via the KOSTRA electronic reporting system and also use the same accounting definitions as the municipal accounts. This means that the quasi-private organization forms of inter-municipal co-operations, inter-municipal corporations, and municipal separate establishments are now all included in the KOSTRA system.

This now means that KOSTRA can provide most of the information for the municipal activity regarding water distribution. The only publicly owned enterprises that are not reporting to the KOSTRA system are municipal owned enterprises organized as joint-stock companies. These companies are not required to report their accounts according to the KOSTRA definitions but are instead required to report their financial accounts according to the regulations relating to joint-stock companies in general.

There are two functional accounts in the municipal accounting system that covers expenditures for water. These are:

Functional account No.	Description
• 340	Production / purifying of water
• 345	Distribution of water

In addition, the accounting system is divided into two parallel accounting systems: one for current expenditures/costs and one for investment expenditure. Both systems use the same set of accounts (posts) although some posts are not valid in both systems. The main groups of accounts are:

- Salaries and social contributions (posts 010-099)
- Purchase of materials and services that are used for the municipality's own production (posts 100-290)
- Purchase of material and services that are substituted for the municipality's own production (posts 300-380)
- Transfers to others - expenses (posts 400-480)
- Financing expenses including interest expenses and depreciation (posts in the 500s)
- Income from sales and from fees for services (posts in the 600s)
- Refunds (posts in the 700s).
- Transfers from others, income including subsidies (usually from the regional or central government) (posts in the 800s)
- Financial income and transactions including sales of stock shares (posts in the 900s).

6.1.5 Waterworks in the National accounts

The economic units reporting through the KOSTRA system are classified as market producers in the general government sector. They are regarded as market producers, as the income from the fees charged is comparable to their costs of production (including capital costs). This level of the fees follows in principle from the public regulation of water fees.

There are mainly historic reasons why the water works are classified in the general government sector. Prior to the implementation of the KOSTRA reporting system (2001), economic data for these units could not always be specified from the Municipal accounts. It must be added that these units do not, as a rule, have autonomy of decision. There is a discussion, however, whether they should be seen as quasi-corporations.

The units that are privately owned are not covered by regular economic statistics. We have used the figures collected by the Norwegian Institute of Public Health. Their aim is, however, not to produce official statistics from their register. For example, one may look at the irregularities in the table for the year 2000. The register should, however, be a good starting point for collection of statistics.

We have considered the possibility that the water fees are collected by the municipalities and, in the case of private suppliers, the fee income is passed on by the municipality to the private waterworks. This is a system that is used with (private) providers of service in NACE 90 and (private) institutions for old age care. Our conclusion has been that this is not the case with private waterworks. So, their production has been neglected in the National accounts. For our ongoing revision (to be presented in December 2006), we plan to introduce to cover this activity separately in the National accounts. The impact shall be small, however, in comparison to the government part of the water industry. The impact on the GDP is negligible. In the future, perhaps our reporting will cover private waterworks as well.

6.1.6 Conclusion

In the period 1998 to 2004 the water industry in Norway is dominated by municipal owned enterprises in terms of the number of individuals supplied and the income received from fees. Inter-municipal enterprises include only a small fraction of the total number of waterworks, only about 1 percent. Nearly 36 percent of all waterworks in Norway belong to the private enterprises. These enterprises supplied about 4 percent of the population, or 300 individuals per waterworks on average. Hence the private enterprises can be described as the portion of the industry with large number of units supplying a small fraction of the population. These private units received 4 percent of total income fees during the period.

In summary the water supply industry can be characterized primarily as municipal and inter-municipal owned. The private sector only provides about 4 percent of the total production leaving 96 percent of the production to the publicly owned sector. The inter-municipal waterworks dominate with respect to number of people supplied, and hence these waterworks are more probable in centralized areas. The two other types of enterprises are more likely to operate in rural areas.

When we are going to fill out the water account tables, the majority of the economic activity will be covered by simply using the data already available in the national accounts for local government production (NACE 41).

6.2 Reporting to the various international questionnaires

There is a variety of different international reporting questionnaire for water (SEEA/Eurostat water accounts, regional questionnaire, water directive), and it is unclear what the future reporting requirements will be. As of the 2004 reporting tables, there are no current reporting requirements to the OECD/Eurostat joint questionnaire for inland waterways.

6.2.1 SEEA Water Tables

We have taken the latest version of the SEEA water tables as trial reporting to see what economic information we have. The SEEA water tables are chosen since these are the reporting tables that Eurostat also has adapted. The sources for the economic data in the tables are the National accounts data for waterworks.

The SEEA Water Tables consist of the following tables:

a) Physical use table
b) Physical supply table
c) Emission accounts
d) Hybrid supply table
e) Hybrid use table
f) Hybrid account for supply and use of water
g) Hybrid account for secondary and ancillary activities of sewerage
h) Economic accounts for collective consumption of government
i) National expenditure on sewerage services and related products
j) Financing of sewerage services and related products
k) Asset accounts
l) Economic accounts supplementary information
m) Matrix of transfers within the economy

Tables d), e), f) and h) are included in this report with the economic data for waterworks to be found in the Norwegian national accounts.

Table 6.2 Hybrid Supply Table

	Output of industries (by ISIC categories)								Imports	Taxes on products	Subsidies on products	Trade and transport margins	Total supply at purchaser's price
			35										
	1	2-33, 41-43	Total	*of which:* Hydro	36	37	38,39, 45-99	Total output, at basic prices					
Total output and supply (monetary units)													
of which : Natural water (CPC 1800)								3 596					
Sewerage services (CPC 941)								8 153					
Total supply of water (physical units)													
S1 - Supply of water to other economic units													
S2 - Total returns													
Total (gross) emissions (physical units)													
Pollutants													

Note: Grey cells indicate zero entries by definition.

Table 6.3 Hybrid use table

	Intermediate consumption of industries (by ISIC categories)								Actual final consumption				Capital formation	Exports	Total uses at purchaser's price
			35						Households			Government			
	1	2-33, 41-43	Total	*of which* : Hydro	36	37	38,39, 45-99	Total industry	Final consumption expenditures	Social transfers in kind from Government and NPISHs	Total				
Total intermediate consumption and use (monetary units)															
of which : Natural water (CPC 1800)								1 233							
Sewerage services (CPC 941)								2 263							
Total value added (monetary units)															
Total use of water (physical units)															
U1 - Total Abstraction															
of which: a.1- Abstraction for own use															
U2 - Use of water received from other economic units															

Note: Grey cells indicate zero entries by definition

Table 6.4 Hybrid account for supply and use of water

	Industries (by ISIC categories)								Households	Rest of the world
			35							
	1	2-33, 41-43	Total	*of which*: Hydro	36	37	38,39, 45-99	Total industry		
1. Total output and supply (monetary units)								11 749		
of which: Natural water (CPC 1800)								3 596		
Sewerage services (CPC 941)								8 153		
2. Total intermediate consumption and use (monetary units)								3 496		
of which: Natural water (CPC 1800)								1 233		
Sewerage services (CPC 941)								2 263		
3. Total value added (gross) (= 1-2) (monetary units)								8 253		
Gross fixed capital formation for water-related infrastructure (monetary units)										
Total use of water (physical units)										
U1 - Total Abstraction										
of which: a.1- Abstraction for own use										
U2 - Use of water received from other economic units										
Total supply of water (physical units)										
S1 - Supply of water to other economic units										
S2 - Total returns										
Total (gross) emissions (physical units)										
Pollutants										

Note: Grey cells indicate zero entries by definition

Table 6.5 Economic account for collective consumption of Government

	Government (ISIC 84) (by COFOG categories)			
	05.2 Wastewater management	05.3 (part) Soil and groundwater protection	05.6 Environmental protection n.e.c.	06.3 Water supply
1. Total output	8 153			3 596
2. Intermediate consumption	2 363			1 233
3. Value added (gross) (= 1-2)	5 790			2 363

6.2.2 Eurostat/OECD Joint Questionnaire on Inland waterways

In the 2004 version of the joint questionnaire on inland waterways, there were no reporting requirements regarding economic variables.

6.2.3 Eurostat Regional Questionnaire

The last time the regional questionnaire was reported was for 2003. For the regional environment statistics joint questionnaire for regional water indicators there were two tables that requested reporting of economic variables. There were two tables in the section IV-Investment in public water supply facilities. These tables were: “total investment in water supply facilities” (table IWS_0) and “of which for the public water supply network” (IWS_NEW). These two tables are broken down according the regional classifications. Data was reported for 2001 and 2002 on the table “of which for the public water supply network” but since there were no statistics covering privately-owned waterworks the total investment in water supply facilities was not able to be filled out. If we are requested to report to this questionnaire in the future, we can obtain estimates for public water supply investment from the municipal accounts which can be assigned to NUTS regions. These investments figures will not necessarily correspond exactly with the totals obtained from the National accounts.

6.2.4 European Water Directive

At this time it is unclear exactly what type of information will be requested from Statistics Norway with respect to the water directive. Given that we have not been directly contacted by the Ministry for the environment and since we do not have full reporting for the water supply industry developing statistics has not yet been addressed. The one thing we do know is that the breakdown will be according to watershed and therefore we need to ensure that the information that is gathered can be geographically located and can be developed in a way that can be reorganized from national statistics to regional statistics and to watershed-based statistics.

6.3 Conclusion

From this work on economic data for waterworks, we identified a “hole” in our water accounts reporting since private waterworks are not included. Physical and monetary data from the Norwegian Institute of Public Health have been examined in order to determine the possibilities of establishing a private waterworks industry in the Norwegian national accounts. The study showed that there are lots of small private waterworks, but they constitute a minor part of the water industry when it comes to amount of people supplied with water and the economic value of the production. However, in order to present the total picture of the waterworks industry in Norway, the Division for national accounts is evaluating the possibilities to establish a private waterworks industry. The National Accounts are used as source to fill out the economic parts of the SEEA water tables. If regional breakdown is needed, investment figures can be obtained from the municipal accounting system (KOSTRA), but these will not necessarily correspond exactly with the totals obtained from the National accounts.

7 Work related to environmental protection expenditure accounts for central government

The work on environmental protection expenditure for the central government has aimed at putting the last pieces together to be able to make this budget analysis statistics official and regular. Currently only COFOG statistics are considered official statistics.

7.1 Improvement of existing budget analysis methodology

Improvement and documentation on non-homogeneous expenditure
The difficult part of the budget analysis involves the items in the budget that are a combination of several different purposes. These budget items are known as non-homogeneous and require that the environmental portion be identified by some method. Extensive work has been carried out to improve the EP share of non-homogeneous expenditure where the percentage could not be found in the Ministries' budgets. We have used several techniques to decide upon which percentage that reflects the environmental protection expenditure part of certain records in the central government accounts:

Step 1: The most correct percentages are probably found where the ministries have given exact budget numbers for environmental protection activities. In these cases the percentages have been calculated using the actual outlay in the budget. The EP budget expenditure is divided by the actual outlay for this record in the central government accounts.

Step 2: Some EP activities are easily identified in the text-part of the budget, but without any specific budget-numbers. For these activities we have done a very approximate evaluation, consisting of identifying whether each activity within a record in the account seems quite similar in size. If so, the calculation is simple: if one out of five activities is identified as an EP activity, then EP percentage of this record is set to 20 per cent. In some cases where the activities are not considered of similar size, the percentage is even more roughly set.

Step 3: In identifying the EP part of regular current expenditure of ministries or different public institutes, the percentage of employees working with environmentally related issues have been used. Documentation of employees is usually not found in the budget, but rather in separate annual reports or from information on the website. For the ministries, the internal telephone book has been used. This percentage (ratio of the number of employees working with the environment to the total number of employees) is then used to estimate the EP part of specific institutions' and Ministries' current costs.

Step 2 and 3 are improvements in the methodology compared to the first preliminary calculations made in 2002 and 2003.

Improvement in the Classification of Environmental Protection Activity (CEPA) coding
In addition to improvements in the identification of non-homogeneous expenditure, we spent some time on improving the CEPA coding. This work consisted in giving almost all EP records in the central government accounts a 4-digit code, while in earlier calculation we had been more rough in our identification of the environmental domains, and assigned only 2-digit CEPA codes to several records.

For some records this is still not done or not possible (with the information sources considered so far), which means we cannot present the EPE statistics broken down by 4-digit CEPA yet and will continue to present information at CEPA 2-digit level.

Transfers to net-budgeting units
We had to look more specifically into some of the expenditures that are recorded as transfers to other central government net-budgeting units, i.e. transfers through extra budgetary accounts. These entities

should be included with their detailed basic data. Since this is not the case, we had to change the type of transaction for some records, especially transfers relating to research and development. Some transactions are re-coded as subsidies. This means that the environmental subsidies calculated in the budget analysis are higher than the environmental SNA-subsidies identified in chapter 8 in this report (on environmental subsidies). The transfers defined as subsidies in the extra budgetary accounts have to be studied in more detail in order to identify environmental subsidies.

Improved calculation for 2001

We implemented all the improvements described above and made new calculations for 2001. These calculations are considered to be of good enough quality to be presented as official statistics. The results are shown in chapter 4 appendix table 7.5. The results are quite different from previous calculations, since more non-homogeneous EPE are identified. Total EPE amounts to NOK 4 985 million. This level is 36 per cent higher that previous calculations.

Most of the changes can be found in CEPA category 9 "Other environmental protection activities" which has almost doubled. This is mostly due to the identification of the EP share of administration in the Ministries and State Directorates. However, it is also due to changes in the EP-coding on the activities in the Ministry of Foreign Affairs. In previous calculations we were too cautious in the identification of the Ministry's EPE, because we could not find much accurate information to identify the EP-parts of non-homogeneous records. In spite of this lack of information, the revised method has resulted in figures more in line with the Ministry's own reporting. Therefore the figures have increased considerably compared to previous calculations.

Further work

There are several further possibilities for improvement in both percentages of non-homogenous expenditure and CEPA-coding. However, it has to be evaluated how much more information we will gain from the resources we put into it. Maybe one should concentrate on securing good quality on the records with the highest value/expenditure. On the other hand, some of the less important records, measured in expenditure, can be quite important for some environmental domains.

Another source of information that we have not used or checked is details about records in the central government account that exist within Statistics Norway (sub-chapters of the accounts). In the budget analysis we have only used information available in the central government budgets. Apparently there exist, however, more information on certain records, within the division for national accounts and the division for public finances, which they gather in the processing of their respective accounts. This could be a valuable information source.

There is also some more work to be done in the area of CEPA coding. These kinds of improvements will not effect the overall level of EPE, but only the structure of them according to environmental domain. Some records are only assigned 2- and 3 digit CEPA, and still lack 4-digit CEPA coding. What is probably more important to work on is the split of some CEPA categories, especially CEPA 9 "Other", but also some of CEPA 8 "R&D". For quite a lot of the records assigned CEPA 9, we know that they consist of several activities related to other more specific CEPA categories. What should be done, is simply splitting records in the accounts into several records, assigning different percentages of the original record to the relevant CEPA categories. This is a technique we have not yet used, we have only assigned existing records or parts of them to one CEPA - category.

7.2 Methodology for establishing time-series

In 2003 we made tentative calculations for central government's EPE for the year 2001. The EP percentages of each record in the central government accounts were then used directly as input for calculating the EPE for the year 2002. This kind of methodology could maybe work if the changes from one year to another were not too extensive, which again might be the case especially between years within one period of government (4 years normally).

However, we found that there were considerable changes in the organisation of some Ministries from 2001 to 2002. This was the case especially for the Ministry of Foreign Affairs, which had changed their whole budget system and the structure of programs. The analysis for this Ministry therefore had to be done from the beginning. We also found that some records in other Ministries had changed content, which makes it quite risky to simply use one year's budget analysis results (percentages and CEPA) on another calculation year. We therefore decided that it is necessary to carry out a new budget analysis every year. Even if this requires some work (estimated to 2 weeks work), most of the foundation is laid by the thorough work done in the basis year 2001. Instead, such thorough analyses should be carried out on a regular basis (i.e. every 4th year) and especially when there is a change of Government.

In carrying out the budget analysis for 2002, we implemented step 1 and 2 in the methodology described in chapter 7.1. We did not, however, carry out step 3. The reason for this is that the information gained from step 3 is not necessarily related to the accounting year anyway, as we might have used more recent information about employees (i.e. information about employees found on the web, are only updated information, which is then used to calculate earlier years). In addition to the 3 steps specified in chapter 7.1, another step is added to the process when dealing with the changes from one year to the next:

There might also be a need to update the information gained from step 3 from time to time. But it is expected that the changes are not that big.

Step 4: When the central government budgets don't provide any new information about non-homogeneous expenditure, the percentage from last year is used in the calculation for the following year.

7.3 Comparing COFOG-based statistics and the EPEA statistics

The statistics we developed using a budget analysis are not consistent with Statistics Norway's official statistics on Central government's total expenditure by function (based on COFOG). While some countries base their EPE statistics on the COFOG, we have not yet done that in Norway. There are two reasons for this.

One is that the COFOG is not detailed enough. It uses environmental COFOG codes mainly or only for activities carried out by the Ministry of Environment. This is however an area we hope to improve by the work we have done through our budget analysis work. We can easily identify and make a list of the records within other Ministries, which are definitely 100 per cent environmental protection activities. We have also seen that the COFOG codes assigned to environmental protection functions are not always correctly chosen. Therefore, we will also give feedback to the Division for Public Finances on this issue.

Another, and more important reason, is that records in the central government account that are only partly EPE, are not included in the COFOG. As long as the COFOG coding can not be split on sub-activities with different motives, we will not be able to include all EPE based on COFOG, since over 50 per cent of the EPE stems from non-homogeneous expenditure.

There is however a large new project called STATRES, initiated by the Ministry of Government Administration and Reform, to produce efficiency measures for the various functions of the central government. There may be an initiative in the STATRES process for changing the COFOG coding options in a way that enables us to make splits on sub-activities in the future.

The following tables show central governments and the municipalities' EPE calculated by the Division for environmental statistics for the JQ-reporting, and compares them to the official statistics on Central government's total expenditure by function. Surprisingly, the differences are even bigger for the municipal sector that for central government. The reasons for the differences for this sector have not been analysed.

Table 7.1 Central government. Comparison of COFOG and EPEA statistics. 2001. Mill NOK.

COFOG categories	CEPA categories	COFOG	CEPA
TOTAL EXPENDITURE*		**490 627**	**493 786**
Of which			
05. Environment protection		2 043	4 985
Of which			
051 Waste management	03 Waste	153	292
052 Wastewater management	02 Wastewater	130	130
053 Pollution abatement	01 Air climate, 04 Soil and groundwater, 05 Noise, 07 Radiation	660	856
054 Protection of biodiversity and landscape	06 Biodiversity and landscape	771	551
055 R&D Environment protection	08 Research and development	154	714
056 Environment protection n.e.c	09 Other EPE	175	2 442

*Definition of Total expenditure: The sum of current expenditure and capital expenditure (fixed capital formation and transfers linked to real or financial investments by the recipient). Total expenditure is to a certain degree a net amount since administrative fees and charges, disposals of fixed capital and disposals of property, according to the National Accounts guidelines, are not included.

Table 7.2 Local government. Comparison of COFOG and EPEA statistics. 2001. Mill NOK.

COFOG categories	CEPA categories	COFOG	CEPA
TOTAL EXPENDITURE*		**232 631**	
Of which			
05. Environment protection		2 128	8 053
Of which			
051 Waste management	03 Waste	597	2 761
052 Wastewater management	02 Wastewater	957	4 087
053 Pollution abatement	01 Air climate, 04 Soil and groundwater, 05 Noise	0	0
054 Protection of biodiversity and landscape	06 Biodiversity and landscape	0	389
055 R&D Environment protection	08 Research and development	0	0
056 Environment protection n.e.c	09 Other EPE	574	816

Table 7.3 Central government. Total expenditure by function (COFOG). 1998-2004*. Mill NOK.

	1998	1999	2000	2001	2002	2003*	2004*
TOTAL EXPENDITURE	**412 293**	**434 357**	**465 218**	**490 627**	**570 558**	**588 290**	**611 048**
Of which							
05. Environment protection	1 845	1 942	2 040	2 043	2 049	1 969	1 973
Of which							
051 Waste management	225	127	232	153	173	125	147
052 Wastewater management	18	2	80	130	63	6	1
053 Pollution abatement	443	626	379	660	629	597	558
054 Protection of biodiversity and landscape	501	610	658	771	631	664	712
055 R&D Environment protection	250	207	227	154	156	196	204
056 Environment protection n.e.c	408	369	464	175	398	381	351

Table 7.4 Local government. Total expenditure by function (COFOG). 1998-2004*. Mill NOK

	1998	1999	2000	2001	2002	2003*	2004*
TOTAL EXPENDITURE	**183 648**	**197 827**	**207 149**	**232 631**	**198 271**	**211 184**	**210 836**
Of which							
05. Environment protection	3 447	3 557	3 016	2 128	2 306	2 601	3 374
Of which							
051 Waste management	-170	-189	-117	597	693	675	976
052 Wastewater management	1 355	1 312	1 036	957	962	1 063	1 436
056 Environment protection n.e.c	2 262	2 434	2 097	574	651	863	962

7.4 Conclusions

It would be ideal if in the future the COFOG statistics would provide the EPEA statistics for the local, regional and central governments. This will require the cooperation between the Division for environmental statistics and the Division for public finances. The Division for environmental statistics will need to provide annual budget analysis results made in cooperation with the Ministries. The Division for public finances will need to implement these annual updates which involves changing their present COFOG routines and databases.

Chapter 7 Appendix 1: Extended CEPA

CLASSIFICATION OF ENVIRONMENTAL PROTECTION ACTIVITIES AND EXPENDITURES (CEPA 2000) INCLUDING SPECIFIC NORWEGIAN CODES

1 PROTECTION OF AMBIENT AIR AND CLIMATE
1.1 PREVENTION OF POLLUTION THROUGH IN-PROCESS MODIFICATIONS
    1.1.1 for the protection of ambient air
    1.1.2 for the protection of climate and ozone layer
1.2 TREATMENT OF EXHAUST GASES AND VENTILATION AIR
    1.2.1 for the protection of ambient air
    1.2.2 for the protection of climate and ozone layer
1.3 MEASUREMENT, CONTROL, LABORATORIES AND THE LIKE
1.4 OTHER ACTIVITIES
    NO141 international cooperation
    NO142 other

2 WASTEWATER MANAGEMENT
2.1 PREVENTION OF POLLUTION THROUGH IN-PROCESS MODIFICATIONS
2.2 SEWERAGE NETWORKS
2.3 WASTEWATER TREATMENT
2.4 TREATMENT OF COOLING WATER
2.5 MEASUREMENT, CONTROL, LABORATORIES AND THE LIKE
2.6 OTHER ACTIVITIES

3 WASTE MANAGEMENT
3.1 PREVENTION OF POLLUTION THROUGH IN-PROCESS MODIFICATIONS
3.2 COLLECTION AND TRANSPORT
3.3 TREATMENT AND DISPOSAL OF HAZARDOUS WASTE
    3.3.1 Thermal treatment
    3.3.2 Landfill
    3.3.3 Other treatment and disposal
3.4 TREATMENT AND DISPOSAL OF NON-HAZARDOUS WASTE
    3.4.1 Incineration
    3.4.2 Landfill
    3.4.3 Other treatment and disposal
3.5 MEASUREMENT, CONTROL, LABORATORIES AND THE LIKE
3.6 OTHER ACTIVITIES
    NO361 international cooperation
    NO362 other

4 PROTECTION AND REMEDIATION OF SOIL, GROUNDWATER AND SURFACE WATER
4.1 PREVENTION OF POLLUTANT INFILTRATION
4.2 CLEANING UP OF SOIL AND WATER BODIES
4.3 PROTECTION OF SOIL FROM EROSION AND OTHER PHYSICAL DEGRADATION
4.4 PREVENTION AND REMEDIATION OF SOIL SALINITY
4.5 MEASUREMENT, CONTROL, LABORATORIES AND THE LIKE
4.6 OTHER ACTIVITIES

5 NOISE AND VIBRATION ABATEMENT

5.1 PREVENTIVE IN-PROCESS MODIFICATIONS AT THE SOURCE

- 5.1.1 Road and rail traffic
- 5.1.2 Air traffic
- 5.1.3 Industrial and other noise

5.2 CONSTRUCTION OF ANTI NOISE/VIBRATION FACILITIES

- 5.2.1 Road and rail traffic
- 5.2.2 Air traffic
- 5.2.3 Industrial and other noise

5.3 MEASUREMENT, CONTROL, LABORATORIES AND THE LIKE

5.4 OTHER ACTIVITIES

6 PROTECTION OF BIODIVERSITY AND LANDSCAPES

6.1 PROTECTION AND REHABILITATION OF SPECIES AND HABITATS

6.2 PROTECTION OF NATURAL AND SEMI-NATURAL LANDSCAPES

6.3 MEASUREMENT, CONTROL, LABORATORIES AND THE LIKE

6.4 OTHER ACTIVITIES

- NO641 international cooperation
- NO642 other

7 PROTECTION AGAINST RADIATION

7.1 PROTECTION OF AMBIENT MEDIA

7.2 TRANSPORT AND TREATMENT OF HIGH LEVEL RADIOACTIVE WASTE

7.3 MEASUREMENT, CONTROL, LABORATORIES AND THE LIKE

7.4 OTHER ACTIVITIES

8 RESEARCH AND DEVELOPMENT

8.1 PROTECTION OF AMBIENT AIR AND CLIMATE

- 8.1.1 Protection of ambient air
- 8.1.2 Protection of atmosphere and climate

8.2 PROTECTION OF WATER

8.3 WASTE

8.4 PROTECTION OF SOIL AND GROUNDWATER

8.5 ABATEMENT OF NOISE AND VIBRATION

8.6 PROTECTION OF SPECIES AND HABITATS

8.7 PROTECTION AGAINST RADIATION

8.8 OTHER RESEARCH ON THE ENVIRONMENT

9 OTHER ENVIRONMENTAL PROTECTION ACTIVITIES

9.1 GENERAL ENVIRONMENTAL ADMINISTRATION AND MANAGEMENT

- 9.1.1 General administration, regulation and the like
- 9.1.2 Environmental management

9.2 EDUCATION, TRAINING AND INFORMATION

9.3 ACTIVITIES LEADING TO INDIVISIBLE EXPENDITURE

9.4 ACTIVITIES NOT ELSEWHERE CLASSIFIED

- NO941 international cooperation
- NO942 other

Chapter 7 Appendix 2: Environmental protection expenditures, central government 2001

Table 7.5 EPEA and total national account figures, broken down by CEPA-categories. 2001. Mill NOK.

Environmental Domains (CEPA)			01	02	03	04	05	06	07	08	09
2001	Total, Central government	Of this, Environmental protection expenditure	Protection of ambient air and climate	Wastewater management	Waste management	Protection and remediation of soil and water	Noise and vibration abatement	Protection of biodiversity and landscapes	Protection against radiation	Research and development	Other environmental protection activities
Total expenditures, Central government	**493 786**	**4 984.7**	267.4	129.6	292.0	538.2	0.0	551.3	50.5	714.2	2 441.5
Total current expenditures	*485 754*	*4 676.4*	256.9	129.6	292.0	496.4	0.0	482.9	47.1	705.1	2 266.4
Central government final consumption expenditures	122 218	1 661.3	146.5	0.0	0.0	146.5	0.0	261.3	46.1	307.6	753.3
Final consumption expenditures, unknown sub-item		103.1								63.9	39.2
Compensation of employees	55 082	772.3	106.0	0.0	0.0	18.1	0.0	109.6	34.7	94.7	409.2
Intermediate consumption expend.	55 113	920.1	41.9	0.0	0.0	128.4	0.0	162.9	52.2	178.6	356.1
Consumption of fixed capital	12 518	0.0									
Taxes on production	6	0.0									
-Sales	-19 537	-134.2	-1.4	0.0	0.0	0.0	0.0	-11.2	-40.8	-29.6	-51.2
Direct purchases from market producers that are supplied to households	19 036	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Property income payable	18 839	0.0									
Subsidies on production	28 753	1 218.7	26.2	0.0	291.9	242.8	0.0	23.2	1.0	387.6	246.0
Social transfers	201 212	0.0									
Current transfers	114 732	1 796.4	84.2	129.6	0.1	107.1	0.0	198.4	0.0	9.9	1 267.1
Transfers to other central government units		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transfers to local government	96 519	194.0	0.0	129.6	0.1	3.2	0.0	53.8	0.0	0.0	7.3
Transfers to other private units and rest of the world	18 213	1 602.4	84.2	0.0	0.0	103.9	0.0	144.6	0.0	9.9	1 259.8
Capital expenditures	*8 032*	*308.3*	10.5	0.0	0.0	41.8	0.0	68.4	3.4	9.1	175.1
Gross fixed capital formation	14 648	242.4	10.5	0.0	0.0	41.8	0.0	21.5	3.4	9.1	156.1
Acquisition less disposal of land	-424	46.9	0.0	0.0	0.0	0.0	0.0	46.9	0.0	0.0	0.0
Adjustment item: Consumption of fixed capital	-12 518										
Capital transfers	6 326	19.0	*0.0*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.0

Environmental Domains (CEPA)			01	02	03	04	05	06	07	08	09
2001	Total, Central government	Of this, Environmental protection expenditure	Protection of ambient air and climate	Wastewater management	Waste management	Protection and remediation of soil and water	Noise and vibration abatement	Protection of biodiversity and landscapes	Protection against radiation	Research and development	Other environmental protection activities
Total incomes, Central government	710 635	0.0	0.0								
Current incomes	709 307	0.0	0.0								
Property income receivable	65 717										
Social contributions	141 679										
Taxes, receivable	412 084										
Environmental taxes	48 859										
Other taxes receivable	365 225										
Other current transfers receivable	13 175	0.0	0.0								
Transfers within central government								0.0		0.0	0.0
Transfers from local government	1 084										
Other transfers	12 091										
Withdrawals of income from central government enterprises	76 652										
Capital transfers receivable	1 328										
Capital taxes	1 328	0.0									
Net lending	216 847	-4 984.7	-267.4	-129.6	-292.0	-538.2	0.0	-551.3	-50.5	-714.2	-2 441.5
Other financial transactions etc											

Chapter 7 Appendix 3: Environmental protection expenditures, central government 2002

Table 7.6 EPEA and total national account figures, broken down by CEPA-categories. 2002. Mill NOK.

Environmental Domains (CEPA)			01	02	03	04	05	06	07	08	09
2002	Total, Central government	Of this, Environ-mental protection expenditure	Protection of Ambient air and climate	Wastewater management	Waste management	Protection and remediation of soil and water	Noise and vibration abatement	Protection of biodiversity and landscapes	Protection against radiation	Research and development	Other environ-mental protection activities
Total expenditures, Central government	**573 761**	**4 993.8**	416.9	62.5	350.0	351.0	0.0	522.5	53.9	832.8	2 404.2
Total current expenditures	*564 067*	*4 656.9*	416.9	62.5	350.0	297.2	0.0	457.9	50.0	822.5	2 199.9
Central government final consumption expenditures	180 691	1 667.0	45.9	0.0	0.0	69.1	0.0	272.0	45.9	438.2	795.9
Final consumption expenditures, unknown sub-item		199.6	42.0							157.6	
Compensation of employees	91 149	727.6	0.2	0.0	0.0	22.4	0.0	117.8	36.5	96.8	453.9
Intermediate consumption expend.	70 571	789.3	3.7	0.0	0.0	46.7	0.0	154.2	57.8	183.8	343.1
Consumption of fixed capital	15 227										
Taxes on production	5										
-Sales	-20793	-49.5	0.0	0.0	0.0	0.0	0.0	0.0	-48.4	0.0	-1.1
Direct purchases from market producers that are supplied to households	24532										
Property income payable	18 197										
Subsidies on production	30 705	1 372.1	307.3	0.0	324.7	128.7	0.0	19.2	4.1	367.1	221.0
Social transfers	216 860	0.0									
Current transfers	117 614	1 617.8	63.7	62.5	25.3	99.4	0.0	166.7	0.0	17.2	1 183.0
Transfers to other central government units		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transfers to local government	95 034	101.8	0.0	62.5	0.0	0.0	0.0	32.0	0.0	0.0	7.3
Transfers to other private units and rest of the world	22 580	1 516.0	63.7	0.0	25.3	99.4	0.0	134.7	0.0	17.2	1 175.7
Capital expenditures	*9694*	*336.9*	0.0	0.0	0.0	53.8	0.0	64.6	3.9	10.3	204.3
Gross fixed capital formation	17 999	268.5	0.0	0.0	0.0	53.8	0.0	25.1	3.9	10.3	175.4
Acquisition less disposal of land	761	39.5	0.0	0.0	0.0	0.0	0.0	39.5	0.0	0.0	0.0
Adjustment item: Consumption of fixed capital	-15 227										
Capital transfers	6161	28.9	*0.0*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	28.9

Environmental Domains (CEPA)			01	02	03	04	05	06	07	08	09
2002	Total, Central government	Of this, Environ-mental protection expenditure	Protection of Ambient air and climate	Wastewater management	Waste management	Protection and remediation of soil and water	Noise and vibration abatement	Protection of biodiversity and landscapes	Protection against radiation	Research and development	Other environ-mental protection activities
Total incomes of Central government	713 720	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Current incomes	712 477	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Property income receivable	72 696										
Social contributions	151 098										
Taxes, receivable	426 772										
Environmental taxes	46 829										
Other taxes receivable	379 943										
Other current transfers receivable	3 158	0.0									
Transfers within central government											
Transfers from local government	502										
Other transfers	2656 [a)]										
Withdrawals of income from central government enterprises	58 753										
Capital transfers receivable	1 243										
Capital taxes	1 243	0.0									
Net lending	139 959	-4 993.8	-416.9	-62.5	-350.0	-351.0	0.0	-522.5	-53.9	-832.8	-2 404.2
Other financial transactions etc		2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5

a) No transfers from the Norwegian Central Bank in 2002

8 Work related to environmental expenditure accounts regarding environmental subsidies

In the central government budget analysis we made a first attempt at coding the subsidies and other transfers according to CEPA categories, to be able to fill in the Expenditure II-part of the Joint Questionnaire (public sector). Since the coding had already been done as part of the budget analysis work, we expected that the work to identify the transfers and compile a statistics on environment related subsidies could be done without too much additional effort. However, there is still some unclear areas regarding definitions of environment related subsidies. In this work we have looked at the two main different ways of defining environment related subsidies and have seen that it can make very big difference whether subsidies to transport is included or not. There is need for further harmonisation of definitions before this area can be established as official statistics.

8.1 Developing consistent definitions

The starting point for this work was the national accounts definition of a subsidy, which excluded fees, deposits systems, taxes and grants. But, as the work proceeded, we understood that the scope of this analysis possibly had to move beyond this first assumption on what to include in a study covering environmental related subsidies.

Then, when having decide what transfers to include, the next step was to identify which of these transfers is an environmental related subsidy (in the rest of this discussion, we will use the term environmental subsidy instead of environment related subsidy).

The calculations in this report are based on data only from the central government accounts. Transfers from the local governments have not been taken into account. When comparing results between countries, it is important to be aware of what kind of transfers that have been included in the calculations.

8.1.1 The concept of environmental subsidy

We started out with the theoretical perspective that the definition of environmental subsidies has to fit into the EPEA in a consistent way, both regarding definition of economic concepts and environmental domain. However, in the existing literature on environmental subsidies, and the related literature on environmentally harmful subsidies and environmental taxes, this perspective is not always prevalent.

One approach is to use the definition of environmental protection expenditure, and define an environmental subsidy as a subsidy or transfer having environmental protection as its main *motivation*.

Another approach is to use a definition similar to that of environmental taxes, and define an environmental subsidy as a subsidy or transfer having a (proven) positive environmental *effect.*

Not many countries have done any work on this subject, but looking to Sweden and Denmark, we actually find both definitions used: the motivation-approach in Sweden and the effect-approach in Denmark.

Since we identified environmental expenditures in the government accounts using budget analysis, we have also identified environmental subsidies using the motivation as the selection criteria. If effect is taken as the selection criteria, a different analysis of the all the transfers defined as subsidies in the government accounts must be re-evaluated.

If an effect approach is taken to classify all subsidies it is necessary to categorise them depending on their effect on the environment (for example environmentally positive, neutral or negative). This is the way environmentally harmful subsidies are defined. Harmful subsidies necessarily have to be defined according to effect and not according to motivation. Since harmful subsidies are defined according to effect, one could argue that it would be most consistent to categorise the environmental subsidies according to the same base. The effect-approach is also more consistent with the definition used in environmental taxes. Some argue, however, that it is more difficult to measure or decide what is a positive effect (of a subsidy) than identify a negative effect, and use this as an argument for sticking to the motivation-approach for defining an environmental subsidy.

The effect-approach would also mean that we have to break with the definition already used in the EPEA, and base this statistics on another kind of economic information about the environment. This might not necessarily be a problem, if it supplements the EPEA statistics. On the other hand it is also possible to take the whole "population" of subsidies and assign an environmental subsidy label to some subsidies, based on the motivation perspective, and assign an environmentally harmful subsidy label to other subsidies, based on the effect perspective.

8.1.2 Consistency in environmental domain categorisation - CEPA

When deciding what approach to choose when categorising environmental subsidies, it is natural both to look at the categorising of environmental taxes, as well as the classifying of EPEA statistics. But, environmental taxes and EPEA statistics are not categorised by the same standards. EPEA statistics are classified using CEPA codes, while environmental taxes are divided into four categories called energy taxes, transport taxes, pollution taxes and resource taxes.

There seems to be an understanding from the Swedish and Danish studies that environmental subsidies should be categorised in the same way as environmental taxes and not by CEPA codes. It would perhaps be preferable to use the same environmental domain categorisation for both environmental subsidies and EPEA statistics if both are based on the motivation criterion approach.

The four main categories that environmental taxes are divided into, was specially designed for this purpose and effect criterion was used for selection. When classifying environmental subsidies by the environmental tax categories, the majority of the environmental subsidies for Norway falls outside the four categories (see table 8.1).

If CEPA was to be the classification categories to use, at least one extra category has to be included for subsidies and taxes. The CEPA codes only covers environmental protection activities, and subsidies (and taxes) related to resources therefore fall outside this classification system. In principle, there is no difficulty against classifying environmental taxes by CEPA codes. Presumably there will be some environmental taxes that might fit into several CEPA codes, but this is a problem also when making the EPEA statistics.

8.2 Preliminary calculations and estimates

Environmentally motivated subsidies amounted to NOK 1 133 million in 2001, which accounted for 3.9 per cent of the total SNA-subsidies that year. The environmentally motivated grants amounted to only NOK 19 million, which equals 0.3 per cent of the total grants.

8.2.1 Subsidies by environmental domain

In table 8.1 the different environmentally motivated subsidies on products are sorted into the 4-categories used for environmental taxes, which have also been used for categorising subsidies in the Swedish and Danish publications. However, several of the environmentally motivated subsidies on products in Norway do not fit into these categories, either because they are too general by nature, or because we do not have enough information about them to categorise them. Therefore, we have added a fifth category called "other environmentally motivated subsidies". We have used these categories in order to compare these data to the Swedish and Danish data. However, perhaps using CEPA categories would be a better classification approach (the CEPA coding is included in table 8.1 to illustrate how this table could be reorganised according to CEPA).

Table 8.1 Environmentally motivated subsidies in Norway, by environmental domain. 2001. Mill NOK

	CEPA	NOK million
TOTAL ENVIRONMENTALLY MOTIVATED SUBSIDIES		**776.4**
Total environmentally motivated SNA-subsidies		**757.3**
Resources		***28.6***
Measures for improving the environment in forestry	0610	21.2
Subsidies for inspection of National parks etc	0630	0.7
Subsidies for conservation of cultural landscapes	0620	1.3
Subsidies for information centres on nature	0920	5.4
Energy		***249.4***
Introduction of new energy technologies	0142	247.7
Production support for wind power	0142	1.7
Pollution		***6.5***
Preventing radiation in houses (radon)	0710	1.0
Preventing pollution of NOx from shipping	0122	3.4
Prevention of runoff pollution from iron mines	0420	2.1
Transport		***136.2***
Subsidies for collection systems for used cars	0320	98.3
Reimbursement measures	0333	37.9
Other environmentally motivated subsidies		***336.7***
Environmental competence building in development aid	0920	25.4
Subsidies on environmental issues in built up areas	0930	50.3
Subsidies for information on environmentally friendly construction	0930	8.8
Subsidies for development of environmental housing policies	0930	19.1
Environmental labelling	0920	3.6
R&D on environmental technology	0930	14.9
Environmental projects in agriculture	0942	15.2
Organic agriculture	0940	51.3
General subsidies for environmental research institutes	0880	85.9
Information on environmentally friendly production and consumption	0920	51.9
Use of guarantee funds for environmental protection loans	0361	2.3
Environmental measures in the Northern and Polar areas	0880	8.0
Total environmentally motivated grants		**19.0**
Other environmentally motivated subsidies		
Environmental projects in agriculture - capital subsidies	0942	19.0

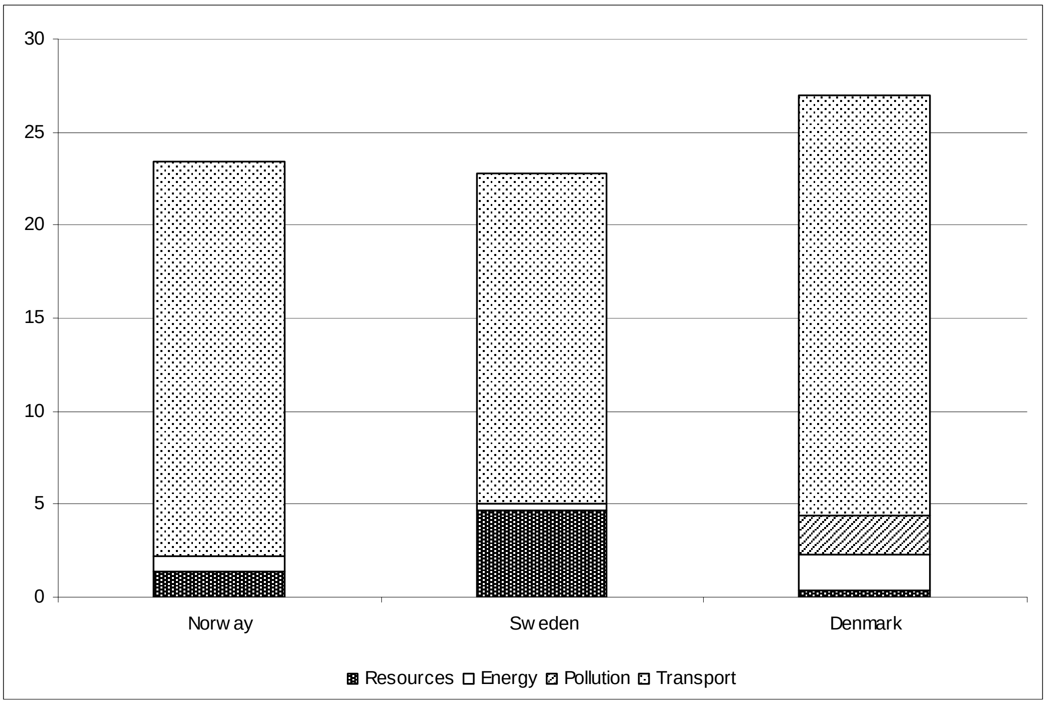
Table 8.2 Environmentally relevant transport subsidies and transfers in Norway. 2001. Mill NOK

ENVIRONMENTALLY RELEVANT TRANSPORT SUBSIDIES AND TRANSFERS	NOK million
TOTAL ENVIRONMENTALLY RELEVANT SUBSIDIES/TRANSFERS	**5 957.2**
Railways (ch. 1350, 1351 and 1354)	5 106.6
- of which SNA-subsidies (ch 1351/70 support to passenger transport)	*1 215.0*
- of which other net expenditure for railway	*3 891.6*
Long distance ferry transport along coast (ch. 1330, p70) SNA-subsidy	195.8
Long distance bus transport (ch. 1330/71) SNA-subsidy	40.8
Public transportation (part of ch. 1320/30)	150.0
Compensation for auto diesel tax for public bus transport	464.0
() identifies chapters in the central government budget	

To be able to compare the Norwegian figures with the Swedish and Danish figures, we have included some other transfers and expenditure related to railway and public transportation by land and sea. The main difference between the motivation approach and the effect approach is related to transportation subsidies. Using the effect approach like Denmark, the transportation subsidies and other transfers to railways are included. Table 8.2 shows these figures separately. Total SNA-subsidies for railway and public transport in 2001 were NOK 1 452 million.

In figure 8.1 we have included the category "Other environmentally motivated subsidies" into the Resource-category, to compare the Norwegian results with the results from Sweden and Denmark.

Figure 8.1 Environmentally motivated and relevant subsidies in Denmark, Sweden and Norway, as percentage of total SNA-subsidies in each country. Inclusive subsidies and transfers for public transportation and railways. 2000 (for Sweden and Denmark) and 2001 (for Norway).



8.2.2 Other subsidies on production

In a long-term perspective we would like to show the interrelations between environmental taxes, subsidies and emissions, by presenting them by different industry groups. Table 8.3 shows the other environmental subsidies on production.

Table 8.3 Environmentally motivated other subsidies on production. 2001. Mill NOK

Other subsidies on production	NOK million
Total	**375.8**
Agriculture and forestry	74.5
Mining and quarrying	4.2
Manufacturing industry	144.7
Transportation	3.4
Wholesale and retail trade	37.9
Other personal services	11.1
Electricity production	1.7
Research and development	25.4
Dwellings (households)	69.3
Business services	3.6

The largest receivers of environmental subsidies are the manufacturing industry, agriculture and forestry and dwellings (households). About half of the SNA-subsidies in table 8.1 are subsidies on products, and the other half are other subsidies on production. Normally only the other subsidies on production would be divided and presented by industry. However, all environmental subsidies on products are related to research and development products, and hence also to the R&D industry. In this perspective R&D is the largest receiver of environmental subsidies.

Another way to present the environmental subsidies could be as part of the industry's total subsidies. In that case some of the industries that receive few subsidies would come out with all received subsidies being environmental subsidies.

Another possible analysis could be to present the industries that receive the most of subsidies in general, and show the share of environmental subsidies among the total subsidies received. For example, agriculture in Norway receives large subsidies (NOK 7 902 million in 2001), but only 1 per cent of these subsidies were environmentally motivated subsidies. This is of course a topic to be analysed further in dealing also with the case of environmentally harmful subsidies, since quite a lot of the agricultural subsidies could be considered environmentally harmful (see for example OECD 2005).

In considering environmentally harmful subsidies, several other issues could also be discussed further. One example could be the "Compensation for auto diesel tax for public bus transport" (Eurostat, 2001) which is included in table 8.2 as environmentally relevant transportation expenditure. In promoting public transportation this kind of price reducing means could lead to less use of private cars, which would then be considered a good for the environment. However, the auto diesel tax is in itself an environmental tax, because the use of it "has a proven specific negative impact on the environment". It is therefore meant to have a cost for the user, and compensating this cost could of course be considered the opposite of environmental policy.

8.3 Conclusions

In this project we have discussed the pros and cons regarding each method, and made some estimations based on each method. These figures are then compared with the figures from the Swedish (2003) and Danish (2003 and 2005) studies.

This analysis has shown that before further work can be done in establishing this as an official statistical area, it is necessary to decide on the definitions regarding which subsidies are included and excluded according to consistent criterion, i.e. effect or motivation. There are large differences between these two approaches due largely to transportation subsidies.

It would seem logical that consistency with EPEA definitions using motivation as the inclusion criterion and CEPA classification expanded to include the natural resource management area as the environmental domain categorizations would be worth considering when developing this new area for environmental statistics.

8.4 References

Eurostat (2001): *Environmental taxes - A statistical guide*. Methods and nomenclatures, Theme 2 - Economy and Finance, Eurostat.

OECD (2005): *Environmentally harmful subsidies. Challenges for reform.*

Statistics Sweden (2003): *Environmental subsidies - a review of subsidies in Sweden between 1993 and 2000.* Statistics Sweden, Miljöräkenskaper, Rapport 2003:4.

Statistics Denmark (2005): *Offentlige miljøudgifter og - indtægter 1994-2004.* Danmarks statistikk, Statistiske efterretninger 2005:, Miljø og energi.

Statistics Denmark (2003): *Miljøskatter og -subsidier 2002.* Danmarks statistikk, Statistiske efterretninger 2003:12, Miljø og energi.

9 Work related to environmental expenditure accounts regarding environmental taxes

The work done in order to develop official statistics on environmental related taxes divided by industry has shown that the way towards establishing official statistics in this area is more complex and extensive than first assumed.

In the Norwegian national accounts, it is not possible to directly find the different environmental taxes by industry and product. The input data to the national accounts regarding taxes on products consists of the total tax sum divided by products. As part of the balancing process of the national accounts, the total tax on each product is automatically distributed proportionally among the users of the product. Users exempted from paying various taxes are handled specially, so they are not included in the automatic distribution routines.

The first attempts to calculate statistics on environmental related taxes divided by industry was undertaken in 2001, as part of an Eurostat funded Nordic project including participants from Sweden, Denmark, Finland and Norway (See "Energy taxes in the Nordic countries - does the polluter pay?", Grant Agreement nr. 200141200022). The "Eurostat manual on Environmental taxes" (2001) was used as the starting point for the work within the project. In addition to the overall goals of the project, the main focus of the Norwegian participation in this project was to see if Statistics Norway had data to conduct statistics on environmental related taxes on such a detailed level required in this project.

The work with the Nordic project only covered energy taxes. It still revealed that, based on the input data in the Norwegian national accounts, it was possible to calculate environmental related taxes divided by industry. Within the scope of the Nordic framework, there was not enough resources and time to expand the work to include other environmental related taxes or to assure the quality of the results.

When defining environmental related taxes in Norway, all taxes (excise duties) received by the central government and defined as a tax in the Norwegian national accounts have been taken into consideration. In order to get the total picture of environmental related taxes, taxes received by the local government as well as through extra budgetary accounts also have to be examined. However, the taxes received by others than the central government only amount to a small share of total taxes paid. In addition to taxes, including additional information on environmental related fees and charges will add valuable information when examine environmental related expenditures.

Although the method for conducting environmental related taxes is developed, there is still considerable work to do in order to realise the ambition of establishing official statistics within this area. Three different divisions within Statistics Norway (the Division for National Accounts, the Division for Environmental Statistics and the Division for Public finances) have to cooperate in order to secure the quality of the data and to secure that the published data on environmental taxes are in accordance with the rest of the statistics published by these divisions. The division for IT – Economic Statistics also have to be involved when developing an appropriate system for the calculations. Hopefully, the new system will be a part of the existing SAS system for balancing the national accounts.

As developing official statistics on environmental related taxes involves extensive resources, the work in this area has not been given high priority as long as no official reporting/demand from users have been present. With the recent enquiry from Eurostat for statistics covering environmental related taxes by industry, higher priority has been given this work. A working group will hopefully be established this fall with the ambition of establishing official statistics on environmental related taxes by industry.

This year, Statistics Norway was only able to report to Eurostat total environmental taxes divided into pollution taxes, energy taxes and transport taxes. The environmental taxes divided by industry reported in the Nordic report should be considered only as preliminary figures.

Based on the work undertaken in Statistics Norway on environmental related taxes in Norway, an article about this theme was published in November 2005 (see annex A or http://www.ssb.no/english/magazine/.). Also the 2001 final NOREEA Report to Eurostat (Contract N°. 200041200016 and the 2003 final NOREEA Report to Eurostat (Contract N°. 200241200013) includes articles on the about Norwegian environmental related taxes.

Appendix chapter 9 - Article about Environmental taxes in Norway

Environmental taxes

Environmental taxes in Norway 1991-2004

The proportion of tax revenues arising from environmental taxes has been on a downward trend in recent years, despite the fact that such taxes have been on a steady increase since 1991. In 2004, revenues from environmental taxes amounted to NOK 52 billion and accounted for 6.9 per cent of total tax revenues. However, various exemptions mean that it is not always the polluter who bears the brunt of environmental taxes.

By Tone Smith

In addition to environmental legislation, environmental taxes can be an important environmental policy tool. Environmental taxes are market-based instruments aimed at internalising external environmental costs, thereby stimulating both producers and consumers towards limiting environmental pressure and towards responsible use of natural resources (Eurostat, 2003). In the real world, however, such taxes are weighted against other political priorities such as the competitiveness of industries, employment and regional interests. This leads to various types of exemptions, which means that it is not always the polluter who pays the most.

Definition of environmental tax

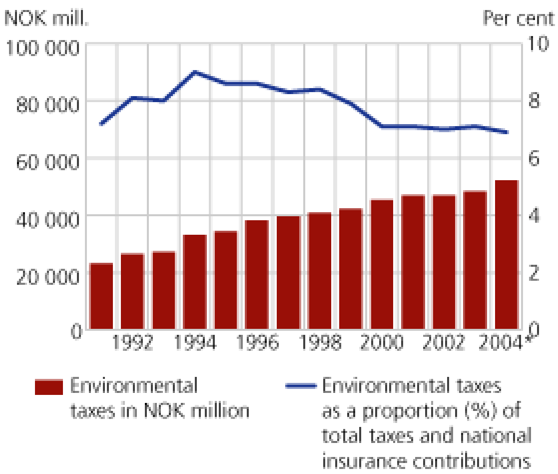
Statistics Norway uses the OECD/Eurostat definition of environmental tax: "A tax whose tax base is a physical unit (or a proxy of it) of something that has a proven, specific negative impact on the environment." (Eurostat, 2001).

In other words, what is being taxed and not the explicit motivation for the tax, determines whether the tax is considered an environmental tax or not. This means that the purpose of the tax can be something other than environmental protection, yet it can still be classified as an environmental tax (for example, the annual vehicle tax). The figures presented here only include environmental taxes defined as "taxes" in the national accounts. They do not include charges that are fees or part of deposit schemes.

Decrease from 1994

During the period 1991-2004 revenues from environmental taxes increased by 125 per cent (measured in current prices). When measured as a proportion of total tax revenues, environmental taxes were approximately the same level in 2004 as in 1991 - about 7 per cent. In 1994, the proportion of environmental taxes had risen to 9 per cent, which is the highest level in this period. In 1996, the Green Tax Commission in Norway (see box below for further details) presented its proposals for changing the tax system to the advantage of consumers and businesses that are environmentally friendly (NOU, 1996). Since then, the proportion of revenues from environmental taxes has slowly fallen, and in the past few years, been stable around 7 per cent.

Total environmental taxes and environmental taxes as a proportion of total taxes[1]. 1991-2004*. NOK million and per cent



[1] Tax revenues include production taxes, taxes on revenues, property etc, national insurance contributions and capital income

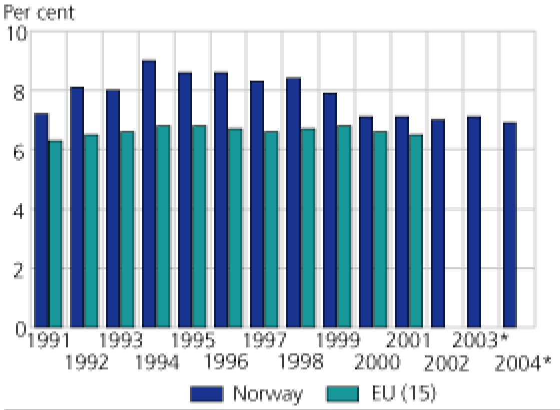
Green Tax Commission

The government's task for the Green Tax Commission was to outline how economic instruments could be used to redirect the economy in a more environmentally friendly direction. A white paper was presented in 1996. The Commission proposed that the tax system be changed so that the tax burden on employment was reduced and the taxes on environmental damaging activities/consumption increased. This should take place without changing the total pressure of taxes and charges. The principle that the polluter should pay was made explicit.

No longer higher proportion of environmental taxes than the EU

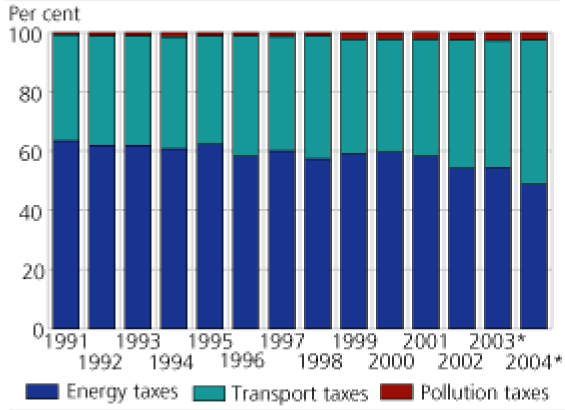
A comparison of Norway and the EU15 in the period 1991-2001 shows that Norway's proportion of environmental taxes was well above the EU15 average during the majority of the period. In 2000 and 2001, the difference was only 0.5 per cent. The EU15 average remained around 6 and 7 per cent during the whole period. For Norway, on the other hand, the figure was around 7 per cent in the last years of the period, but reached 9 per cent at the beginning of the period.

Environmental taxes as a proportion of total taxes[1], Norway and the EU (15). 1991-2004*. Per cent



[1] Tax revenues include production taxes, taxes on revenues, property etc, national insurance contributions and capital income.

Types of enviromental taxes, as a proportion of total environmental taxes. 1991-2004*. Per cent



Energy and transport taxes dominate

Energy and transportation taxes are the most important environmental taxes in terms of raising revenue. In 2004, each of these two tax categories accounted for more than 48 per cent of total environmental taxes. Energy taxes include taxes on energy products used for transportation and stationary purposes. Transportation taxes include taxes on ownership and use of motor vehicles, transportation equipment and related transportation services.

The remaining environmental taxes accounted for almost 3 per cent of total environmental tax revenues, and thus only play a marginal role in terms of total tax revenues. However, these taxes can be an important tool when it comes to limiting various types of environmental pressure (for example beverage containers). Pollution taxes include taxes on measured or estimated amounts of emissions to air and water, solid waste treatment and noise. Resource taxes include taxes on natural resources. Taxes on the extraction of minerals, oil and natural gas, whose purpose is to capture resource rents, are excluded here. Using this classification definition, there are currently no resource taxes in Norway.

As the figure shows, there has been a small but consistent change in the distribution of different types of environmental taxes since 1991. The proportion of energy taxes has fallen (from 63 to 49 per cent), while at the same time the proportion of transportation taxes has increased (from 36 to 49 per cent). The proportion of pollution taxes has more than doubled, but still contribute little to the total revenues.

Not the polluter who pays

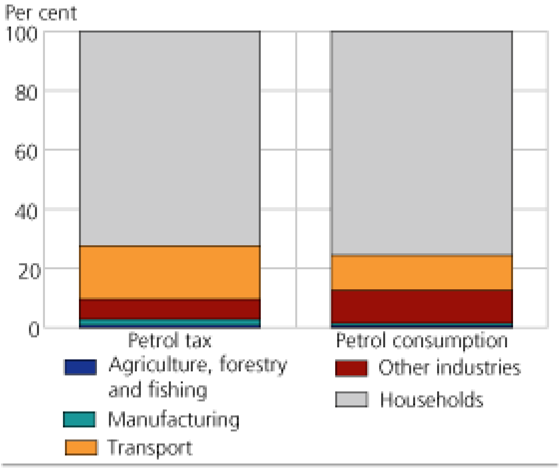
A Nordic report on energy taxes (DST, 2003), shows that the tax burden is not evenly distributed between different energy consumers. This phenomenon is observed in all the Nordic (1) countries and is attributable to various types of exemptions and refund schemes for specific industries. The most extreme example is the manufacturing industry, which accounts for 50 per cent of the energy use in the Nordic countries, but only pays about 5 per cent of the energy taxes. The opposite is true for households, which use about 20 per cent of the energy, but pay 50 per cent of the energy taxes.

Below, we present two examples from 2001. The CO_2 example shows the large disparity between the polluters and those who pay environmental taxes, while the petrol example shows an area with consistency between the consumers/polluters and those who pay the environmental taxes.

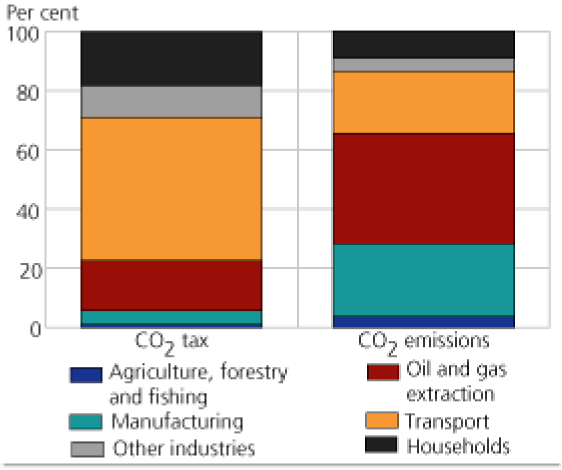
Heavy polluters benefit from exemptions

The figure clearly shows that the oil and natural gas industry's proportion of total CO_2 taxes is considerably higher than the industry's proportion of total CO_2 emissions. This industry accounted for about 25 per cent of CO_2 emissions, but paid 50 per cent of the CO_2 taxes. The difference is explained both by the fact that a number of industries are exempt from paying the tax or have a lower CO_2 tax rate, while the oil and natural gas industry pays a relatively higher tax rate. Exemptions from this tax are not as widespread as exemptions from energy taxes as a whole.

Petrol tax and petrol consumption, by industry. 2001. Per cent



CO_2 tax and CO_2 emissions, by industry. 2001. Per cent



Another aspect that is highlighted in the Nordic report is the fact that it is often the pollution intensive industries (industries that have high levels of pollution in relation to their value added) that are exempt from paying environmental taxes. This strengthens the mismatch between the industries that pollute and those who pay environmental taxes.

An analysis of petrol consumption and petrol tax payments show that the "polluter pays" principle is true to a much larger extent for this tax. This is due to the fact that there are few exemptions and refund mechanisms for petrol.

(1) The report does not cover Iceland.

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References*:*

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Tables:

- Table 1 Environmental taxes in Norway. 1991-2004*. NOK million

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Table 8.1 Environmental taxes in Norway. 1991-2004*. NOK million

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003*	2004*
Sum environmental taxes	**23 167**	**26 597**	**27 319**	**33 211**	**34 413**	**38 182**	**39 555**	**40 675**	**42 185**	**45 268**	**46 857**	**46 829**	**48 287**	**52 219**
Energy taxes	***14 665***	***16 424***	***16 904***	***20 133***	***21 410***	***22 199***	***23 741***	***23 303***	***24 888***	***26 935***	***27 212***	***25 321***	***26 178***	***25 387***
CO2 tax on the petroleum activity on the continental shelf	810	1 916	2 271	2 557	2 559	2 787	3 034	3 229	3 261	3 047	2 861	3 012	3 056	3 309
Tax on mineral products, total	2 172	1 851	1 623	2 001	1 330	1 798	1 514	1 631	0	0	0	0	0	0
CO2 tax on mineral products	0	0	0	0	0	0	0	0	3 644	3 815	3 575	3 587	3 853	3 809
Sulphur tax	0	0	0	0	0	0	0	0	343	138	119	84	94	84
Basic tax on fuel oil	0	0	0	0	0	0	0	0	0	372	754	482	716	655
Excise on petrol	8 345	9 122	9 126	9 581	9 935	10 042	10 883	11 367	9 623	9 756	8 821	8 548	8 651	8 729
Auto fuel tax	0	0	142	1 746	2 804	2 928	3 489	3 679	4 533	4 814	4 067	3 977	4 305	4 675
Tax on coal and coke	0	0	4	7	9	11	6	2	0	0	0	0	0	0
Tax on production of electrisity	3 338	3 535	1 132	1 286	1 519	1 533	1 471	2	2	0	0	0	0	0
Tax on consumption of electricity	0	0	2 606	2 955	3 254	3 100	3 344	3 393	3 482	4 993	7 015	5 631	5 503	4 126
Pollution taxes	***216***	***357***	***365***	***533***	***458***	***491***	***548***	***529***	***1 058***	***1 145***	***1 150***	***1 260***	***1 346***	***1 368***
Basic tax on non-refillable beverage containers	0	0	0	52	100	129	166	162	259	325	363	433	483	462
Tax on beer containers	13	19	11	91	14	13	13	11	31	3	0	0	0	0
Tax on wine/spirit containers	45	45	49	41	55	51	66	59	63	8	0	0	0	0
Tax on non-alcoholic lemonade containers	59	35	23	30	15	10	11	9	22	1	0	0	0	0
Tax on non-alcoholic non-fizzy lemonade containers	59	48	66	71	28	32	37	32	29	1	0	0	0	0

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003*	2004*
Tax on plastic beverage containers	0	0	0	0	0	0	0	0	0	15	22	39	58	57
Tax on metal beverage containers	0	0	0	0	0	0	0	0	0	100	102	86	77	63
Tax on glass beverage containers	0	0	0	0	0	0	0	0	0	48	45	45	58	39
Tax on paper beverage containers	0	0	0	0	0	0	0	0	0	13	15	17	17	18
Tax on final treatment of waste	0	0	0	0	0	0	0	0	442	483	473	498	501	554
Tax on artificial fertiliser	0	156	166	171	167	172	171	165	108	2	0	0	0	0
Tax on pesticides	0	23	22	21	19	22	21	24	35	53	35	56	65	85
Tax on lubricating oil	28	30	28	56	60	62	63	67	69	88	86	80	81	84
Tax on batteries	12	1	0	0	0	0	0	0	0	0	0	0	0	0
Tax on trichloroethane	0	0	0	0	0	0	0	0	0	4	7	4	4	4
Tax on tetrachloroethane	0	0	0	0	0	0	0	0	0	1	2	2	2	2
Tax on hydrofluorocarbons (HFCs) og perfluorocarbons (PFCs)	0	0	0	0	0	0	0	0	0	0	0	0	61	123
Transport taxes	***8 286***	***9 816***	***10 050***	***12 545***	***12 545***	***15 492***	***15 266***	***16 843***	***16 239***	***17 188***	***18 495***	***20 248***	***20 763***	***25 464***
Tax on car ownership	3 300	4 092	4 005	7 365	7 484	9 900	9 345	9 976	8 889	9 557	9 821	12 319	12 888	16 387
Tax on heavy vehicles	0	0	0	293	293	315	271	214	226	273	342	314	299	293
Car re-registration tax	887	892	981	1 049	1 100	1 229	1 307	1 348	1 402	1 410	1 595	1 598	1 796	1 820
Annual vehicle tax	2 240	2 731	2 978	3 134	3 225	3 403	3 688	4 247	4 442	4 626	5 348	5 583	5 780	6 964
Tax per driven km by diesel vehicles	1 745	1 968	1 966	560	2	14	4	2	8	1	0	0	0	0
Tax on aircrafts	114	133	120	144	441	631	651	1 056	1 272	1 321	1 389	434	0	0
Resource taxes	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***

10 Conclusion

With any type of development related project, some flexibility and creativity is needed especially since the reporting requirements to international questionnaires continue to evolve. Developing statistical reporting systems that are flexible enough to keep up with the changing demands from those asking for the data are a major challenge. The development of the NAMEA reporting systems continue to change at the European level and therefore it is difficult to anticipate in which direction the reporting requirements will develop so that we can report our data in the correct format often given short reporting deadlines. Our work with the Norwegian NAMEA database, biofuels and energy table will provide some insights into our NAMEA data and will help us report to the next NAMEA questionnaires.

The decomposition analysis work provided us with additional insights into the causes behind the changes observed in air emissions in Norway and also in different industries. The work on decomposition analysis has only just started to provide us with a tool that can be used in the future. Some refinements need to be made but hopefully this will become part of our annual NAMEA analysis and publications.

The budget analysis work focusing on environmental protection expenditures in central government has shown that there needs to be some coordination and refinements especially to the COFOG statistics and databases. The limitations of these databases may prove to be substantial and may hinder the establishment of consistent statistics based on the budget analysis and COFOG approaches. The budget analysis methodology has been refined and expanded to be able to handle annual changes. We concluded that it would be necessary to do at least a rough budget analysis annually in order to update the changes.

The work regarding environmental subsidies provided preliminary results for 2001 and compared the two different ways of defining "environmental subsidies." There is a big difference between these two approaches and before further work can be done it will be necessary to harmonize these definitions. The work relating to environmental taxes also progressed slowly but results were published and future work developing these statistics at the industry level is continuing as a cooperation between the Division for National accounts and the Division for Environmental statistics.

All of the different small actions included in this project have helped improve the current statistical systems and have provided the opportunity to explore especially our NAMEA data in more detail and use an analytical methodology to gain more insights into this rich data set. We expect that the work we have done will lead to improved statistical production in the long term.

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