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The Dutch environmental accounts: present status and future developments

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Abstract

Environmental accounting relates environmental data to the national accounts. This enables consistent comparison of environmental and economic indicators. Work areas range from accounts for natural resources such as the extraction of oil and gas to material use and emissions data such as CO_2 and waste. The environmental accounts are internationally comparable through common frameworks, concepts and methods.

Statistics Netherlands has a long history in environmental accounting at the national accounts department. This culminated in the introduction of the National Accounting Matrix including Environmental Accounts (NAMEA) in 1991. In this paper the history of the Dutch environmental accounts is discussed, the current status, as well as the future extensions which are currently envisaged.

The core set of the Dutch environmental accounts, which is published annually, consist of seven parts, namely the NAMEA-matrix, detailed air emission accounts, the water accounts (NAMWA), energy accounts, waste accounts, subsoil accounts for oil and gas and environmental tax accounts. The NAMEA consists of a conventional National Accounts Matrix (NAM), extended with two accounts on the environment: a substance account and an account for environmental themes. NAMWA is a further specification of NAMEA for water, using the same accounting structure.

At present, Statistics Netherlands is improving and extending the system of environmental accounts based on the System of Environmental and Economic Accounting (SEEA). This extension includes projects on physical accounts (material flow accounts), environmental industry accounts, environmental subsidy accounts, environmental permits, climate change accounts as well as macro-economic analysis.

Contents

1. Introduction

Environmental accounting integrates environmental data with the national accounts. Accordingly, environmental data can be directly compared with macro-economic indicators such as GDP. Work areas range from accounts for natural resources such as the extraction of oil and gas to material use and emissions data such as CO_2 and waste. The environmental accounts are internationally comparable through common frameworks, concepts and methods.

Environmental accounting has a long history of international coordination culminating in the System of Integrated Environmental and Economic Accounting (SEEA, 2003). The SEEA handbook was produced to provide an overview of a variety of environmental accounts. In 2005 the *UN Committee of Experts on Environmental-Economic Accounting* (UNCEEA) was established. The main objectives of this committee are to elevate the system of environmental accounts to an international statistical standard and to advance the implementation of SEEA in all countries. In Europe, Eurostat has indicated to give high priority to the further development of the environmental accounts (Eurostat, 2005). On the national level there is also much interest in the environmental accounts, as environmental institutes and ministries use this data for environmental-economic analysis and policy development.

Since initial work in the early 1990s, Statistics Netherlands has gradually extended the Dutch system of environmental accounts. This paper provides an overview of the current status of the environmental accounts in the Netherlands and new developments in this area. This paper proceeds as follows. In Chapter 2 the history of environmental accounting in the Netherlands is discussed. Chapter 3 further elaborates on the current status of the Dutch environmental accounts. In Chapter 4 a summary is presented of new projects that are currently under way. Finally, conclusions are drawn in Chapter 5.

2. History of the Dutch environmental accounts

In 1991 an illustrative NAMEA (National accounting matrix including environmental accounts) was presented for the first time (De Boo, Bosch, Gorter and Keuning, 1993), according to the conceptual design by Keuning (1993). The original design contained a complete system of national flow accounts, including a full set of income distribution and use accounts, accumulation accounts and changes in balance sheet accounts. At a conceptual level, not only emissions of pollutants and extraction of natural resources are represented, but also their effects.

A distinction was made between effects of current emissions that are absorbed in the current period (noise, stench, etc.), current effects of emissions in the past (e.g. leakage from a garbage dump), net capital losses due to natural causes (e.g. a severe drought), referable damage - to economic assets and to other, natural assets - due to environmental effects, and non-referable degradation to non-economic, natural assets. All these transactions were summarized in additional balancing items, culminating in a new total for the changes in net worth.

Soon, it became clear that insufficient data were available for an immediate operationalization of this conceptual framework. For that reason, it was decided to compile a more modest pilot-NAMEA, making use of the work done at the Dutch Ministry of Housing, Spatial planning and the Environment (1989). This Ministry had developed a so-called national environment policy plan, in which a number of environmental themes were distinguished. For each of these themes a single indicator had been designed, by weighing together the emissions that contributed to each theme (Adriaanse, 1993). The conversion of emissions into theme equivalents was based on the expected contribution of each polluting substance to a particular environmental theme. By the time the first NAMEA was compiled, this environment policy plan had been approved by Dutch Parliament. In 1993, the first NAMEA became available (De Haan, Keuning and Bosch, 1994), and the present NAMEAs largely maintained this format (see for example De Haan and Keuning, 1996).

Statistics Netherlands has published detailed NAMEAs for the years 1990 to 2005 (for the most recent NAMEA see CBS, 2008a). In these NAMEAs, the following themes are considered: the greenhouse effect, ozone layer depletion, acidification, eutrophication, solid waste, wastewater and the exploration of crude oil and natural gas.

During the 1990s and the early 2000s, a number of pilot projects were performed to extend the system of environmental accounts. Following a pilot project in 1997, the Dutch system of environmental accounts was extended in 2002 with the National Accounting Matrix including Water Accounts (NAMWA). Other pilot projects have focussed on energy (Verduin, 2000), land use (Leurs and van Dalen, 1998), subsoil accounts (Van den Berg and van de Ven, 2001), dispersion of toxic substances (Segers et al., 2000), material flow accounts (Konijn et al., 1995, 1997) and environmental taxes (De Haan, 2004).

In 2004 new resources became available at Statistics Netherlands to further expand the environmental accounts. Between 2004 and 2007 energy accounts, environmental tax accounts, subsoil accounts for oil

and gas, physical water accounts en waste accounts were developed and implemented, while the air emission accounts and the water emission accounts were further extended. In 2006 the first electronic publication for the environmental accounts was published, which now appears annually. In 2010 the publication will appear for the fist time in English. In 2007 the first modules of the environmental accounts were published on Stat Line, the electronic database for Statistics Netherlands that is available to the public.

In 2009 a programme for the advance of new statistics with regard to sustainable development was initiated. In cooperation with the institutes for economic, social and environmental development and policy makers, new statistics will be developed to answer all kind of relevant social, economic and environmental questions. Within this scope also new projects in de area of environmental accounting were started. These projects are discussed in chapter 4.

3. Present status of the Dutch environmental accounts

3.1 Introduction

Table 3.1 gives an overview of the different environmental accounts developed at Statistics Netherlands. Some of these components are already implemented, others are still being developed. They are discussed in more detail below.

Table 1: Overview of the different environmental accounts in the Netherlands, implemented and under development.

	Implemented	Work in progress
Physical flow accounts		
Energy acounts	x	
Physical water accounts	x	
Material flow accounts	x	
Air emission accounts	x	
Water emission acounts	x	
Waste accounts	x	
Nutrient (N and P) accounts	x	
Asset accounts		
Subsoil accounts for oil and gas	x	
Monetary accounts		
Environmental tax accounts	x	
Environmental protection expenditure accounts	x	x
Environmental subsidy accounts		x
Environmental industry accounts	x	
Emission permits	x	x
Other		
Climate change accounts		x
Short term CO2 emissions accounts		x
Environmental accounts for households		x
Time series		x
Accounts for adaptation expenditure		x
Analyses	x	x

3.2 Energy accounts

Traditionally, most countries compile two kinds of statistics for energy. First of all, *energy balances* provide, in the form of energy flow tables, a complete overview of the physical production and consumption of energy on a national level. On a detailed level the receipts, the aim of use and the total deliverance of the energy source is recorded by industry and by energy source. Secondly, countries compile *National accounts*, which among others record all monetary flows associated with energy (production of energy, intermediate use by industries, final use by households, imports, exports, etc.). Ideally, data from the physical energy statistics (energy balances) should be consistent with the monetary data from the National accounts. However, there are two main reasons why this is not the case. First of all, differences in classifications and definitions make a direct comparison between the two data sets impossible. The most important difference is that the energy balances record all energy flows for the national territory, whereas the national accounts provide information for all energy flows related to the national economy. Secondly, the source information for these two statistics usually originate from two different and separate data flows. This causes all kinds of inconsistencies, for example because of differences in the sample size of the underlying survey, up scaling factors, consistency procedures etc.

In order to circumvent these problems the so-called *energy accounts* have been developed. The energy accounts represent a consistent framework in which energy data, both in monetary and physical terms, have been integrated into the national accounting framework. The supply and use tables, part of the system of National Accounts, provide an overall accounting structure for the energy accounts in values and quantities. The energy accounts provide a complete overview of the supply and use of energy commodities in the Dutch economy. Data are presented for 58 industries, households, stock changes and imports and exports.

At Statistics Netherlands, two types of physical energy accounts are compiled, namely the gross en net energy accounts (Schenau, 2008). The gross energy flow accounts show all energy flows that occur within the economy and between the economy and the rest of the world. The gross energy flow accounts, however, have an important disadvantage. When you want to aggregate data by industry or by energy carrier the totals will be subject to double counting. When primary energy sources are converted into secondary energy sources, for example the conversion of coal into electricity, some energy products are double counted with respect to the total energy use or total energy production of industries or the whole economy.

One way of solving the problem of double counting is to compile net accounts where only energy "entering" the economy (imports and extraction) and energy "leaving" the economy (exports, energy used for final purposes and energy losses upon conversion processes) are recorded. The supply table of the net energy flow accounts shows by row the different energy products that are extracted within a country, are supplied from the rest of the world (imports) and the inventory changes. The use table shows by row the different energy products that is actually consumed for final purposes (final use of energy plus energy losses due to conversions) and supplied to the rest of the world (exports). The net energy flow accounts are most suitable for analytical purposes. They can easily be combined with monetary data from the National accounts to determine the energy intensity or the energy productivity of the economy or an industry. In addition, the data from net energy can be used for IO-analyses and decomposition analyses.

3.3 Physical water flow accounts

The physical water flow accounts show the quantitative economic production and use of ground, surface and tap water. In previous years the water accounts were compiled using data from the National Water Survey conducted by Statistics Netherlands once every five years. The most recent survey was conducted over 2001. This survey comprised business level data on water use by industry, mining and electricity companies. However, this survey has been stopped and therefore it was necessary to investigate alternative data sources and their potential for the compilation of the water balance.

For 2004 and onwards the annual environmental reports by enterprises have been used for compiling the water balances (CBS, 2006a). These reports include a brief section on used water quantities divided into tap water, ground water and surface water. In combination with other data sources (water use by agriculture, monetary data from national accounts, information from the water producers) complete water accounts are made annually. In addition, a distinction is made between ground and surface water for cooling purposes and non-cooling purposes. In 2010 also water use for different rivers basins will be calculated.

3.4 Material flow accounts

The SEEA introduces three physical accounts that cover all material flows in the economy: Physical Supply and Use Tables (PSUT), Physical Input-Output Tables (PIOT) and Material Flows Accounts (MFA). The former two are similar to the monetary supply and use tables (SUT) and input-output tables

except that the tables adhere to physical balances rather than monetary balances. They therefore contain all materials that are extracted or emitted from/to the environment. They also include the physical flows of products in the economy, including recycling and packaging products (Konijn et al., 1995; Konijn et al., 1997; Hoekstra, 2005; and Hoekstra and van den Bergh, 2006).

The economic production and consumption activities that are related to material flows may negatively effect on the environment. Negative environmental effects can occur at the time of extraction, processing, consumption and final disposal of materials. Material flow accounts give a coherent overview of how materials flow through an economy. Economy-wide MFAcc record the physical (in tonnes) material input and output of an economy, including input from the national environment, output to the environment and the physical amounts of import and export. The environmental pressure caused by material flows differs according to the type of material. In order to show links between material flows and environmental problems it is essential to monitor a differentiation of types of materials. Also, although absolute levels of material flows can be interesting, especially changes over time provide useful information. Changes in time of material flows in relation to economic developments can be an important input to a strategy on sustainable development. Other policy relevant applications of the materials flow accounts are in the area of dematerialization and material substitution. Material flow accounts are one of the priority areas recommended for harmonised reporting in the EU.

In 2008 Statistics Netherlands conducted a pilot study on MFAcc (CBS, 2008c). At the end of 2008, Dutch material flow accounts for 2004 were compiled. These MFAcc are set up according to the Eurostat guidelines (in the format of the Eurostat questionnaire) and the environmental accounting framework. However, the information on a single year will not answer many questions with regard to environmental problems related to material use. To answer questions on dematerialisation and material substitution it is necessary to consider a MFAcc time series. Therefore, in 2009 time series were compiled for 1996-2006.

A MFAcc time series can be the basis for many analytical applications. To increase the scope of analytical applications an estimate could be made of the material flows within an economy. Data on flows within the economy would open up the possibility to perform different kinds of IO analyses. With an IO analyses environmental impacts can be attributed to the consumption of different materials. In this way the environmental impacts of materials can be determined. Also, IO analyses make it possible to estimate foreign hidden flows that are involved by the production of imported products. Taking also the export into account the total domestic material requirement for consumption can be estimated. These and other

applications of the MFAcc are very important to show policy makers the opportunities of MFA in decision making.

3.5 Air emission accounts

As yet, the most developed environmental accounts in the Netherlands are the air emission accounts. The air emission accounts show the origin and destination of air emissions of CO_2, CH_4, N_2O, CFKs, HFKs, NO_3, SO_2, NH_3, NMVOS, CO and fine dust.

In the Netherlands air emissions are centrally recorded in a database called the Dutch Pollutant Emission Registration. Several institutes take part in the gathering of emission data and the composition of the database. A number of statistical sources are used to compute the emissions and to add more detail by specifying the data by branch of industry. Air emissions caused by stationary and mobile sources are recorded separately as for both sources a different methodology is followed. Physical data on the use of energy play a crucial role in the final estimations of the air emissions. In the case of stationary sources, Statistics Netherlands is responsible for the estimation of emission totals specified by industry classification. As the major part of air emissions are related to the combustion of fossil energy sources, the statistic on energy supply in the Netherlands is used to gross up the data which were originally measured at the polluting location.

There is an important difference in definition between the data from the emission inventory and the air emission accounts. The registration of emissions and energy is restricted to the area within the Dutch borders. However due to international transport activity part of emissions aboard are caused by Dutch residents. These emissions have to be taken into account following the rules of the National Accounts. Using several statistical sources on the purchase of fuels abroad, the distances travelled abroad, these emissions are composed and attributed to the responsible economic activity. From the results it turns out that 10 % of the CO_2 emissions caused by Dutch residents are produced abroad. The difference between the emissions in the Netherlands and the emissions caused by the residents are made visible in a bridge table (Table 2).

Air emissions related to mobile sources are mainly based on transport statistics. For example in the case of road vehicles the emissions are modelled from data on the annual distance travelled by type of vehicle combined with specific use and technical data on the related amount of emissions. Still there is a strong

relation with the energy statistics as the overall use of transport fuels is a result of the Dutch energy balance sheet.

A transport module was developed for the environmental accounts to allocate the air emissions from mobile sources to the different kind of industries and households. Mobile sources represent the different transport modes that generate emissions of a number of air emissions. In the transport module the energy use from mobile sources (road transport, water transport, air transport) is determined by distributing the total energy use over the industries and households. The emission factors for the different gasses are applied to the energy subdivision in order to be able to calculate the emissions from mobile sources. In the transport module, the emissions are calculated according to the definitions of the National Accounts. Therefore both the emissions produced within the national territory as emissions produced outside the national territory will be determined.

Table 2: Bridge table for CO_2 emissions in the Netherlands

		2006	2007	2008	2009*
Emissions by residents	1	202050	204281	207436	202925
Residents in the rest of the world	2=3+4+5	24292	25761	25003	23639
Transport by road	3	6530	6867	6615	6466
Air transport (incl. defence activities)	4	13121	13377	12970	12241
Water transport	5	4642	5517	5418	4932
Non-residents in the Netherlands	6=7+8+9	6983	6276	6811	5805
Transport by road	7	1230	1315	1235	1212
Air transport	8	320	327	315	291
Water transport	9	5433	4634	5261	4302
Emissions in the Netherlands	10=1–2+6	184741	184796	189245	185091

3.6 Water accounts (NAMWA)

Since a number of years, the demand for information about the economic value of water and the wider economic consequences of water policy and management has increased rapidly. In Europe, the introduction of the European Water Framework Directive (WFD) has given this demand an important impulse. The Water Framework Directive is one of the first European directives in the domain of water, which explicitly acknowledges the important role of economics in water policy and management. In order

to meet this growing demand, Statistics Netherlands has developed an integrated water economics information system called the National Accounting Matrix including Water Accounts (NAMWA).

Following a pilot project in 1997 (De Haan, 1997), the Dutch system of environmental accounts was extended in 2002 with the water accounts. Statistics Netherlands and the National Institute for Integrated Water Management and Wastewater Treatment (RIZA) are working together on the development of a new integrated river basin information system. NAMWA is a further specification of NAMEA for water, using the same accounting structure (Van der Veeren et al., 2004; Brouwer et al., 2005). The Dutch water accounts present information at the level of the four main river basin districts in the Netherlands: Meuse, Scheldt, Ems, Rhine-North, Rhine-West, Rhine-East and Rhine-Centre. The Dutch water accounts are published annually by Statistics Netherlands. RIZA uses the water accounts for making reports for the Water Framework Directive.

The NAMWA-matrix consists of 10 monetary accounts and 4 physical accounts. The first two physical accounts for the emission of substances and water extraction and discharge represent the flows. The third physical account for water extraction and discharge describes changes in stocks, while the fourth physical account for emissions describes the contribution of various substances to 'environmental themes' such as eutrophication or the dispersion of heavy metals in water.

By linking water and substance flows to economic flows and doing this systematically for a number of years, insight is gained into the (nature of the) relationship between our physical water systems and the economy. The integration of physical and economic information also allows the construction of integrated indicators. For instance, water use by various economic sectors can be related to the economic interests involved. It is this integration of water and economy at river basin level, which makes NAMWA an important information tool to support policy and decision-making in the field of integrated water management as advocated by the WFD. By linking information about the physical pressures exerted on the water system by economic agents and the associated economic interests, NAMWA enables policy makers and water managers at national and river basin scale in a consistent way to assess the necessary measures to reduce these pressures and meet the environmental objectives in the WFD in an integrated way. NAMWA offers opportunities to analyse the trade-offs between environmental goals and the economic interests involved at the relevant level of analysis, i.e. river basins.

3.7 Waste accounts

Solid waste contributes to a range of environmental problems and therefore the composition of waste accounts is relevant. In 2004 Statistics Netherlands extended and improved the waste accounts (Delahaye, 2004). Several improvements in the coverage of waste flows were made. Firstly, the number of reported NACE categories increase from about 40 to about 60. Secondly, about 70 different waste types, divided in hazardous and non-hazardous waste, are distinguished. The categorization of waste types is according to the recently implemented European Waste Statistic Regulation. This harmonized waste categorization facilitates comparisons between countries. Thirdly, another main extension to the current waste accounts is the implementation of cross-boundary waste flows, i.e. the import and export of waste. Fourthly, a distinction between waste without (waste residuals) and waste with an economic value for the generator (waste products) is made. Finally, recycled waste is considered. As a result complete supply and use tables, thus including recycled waste, are presented in the environmental accounts.

3.8 Subsoil accounts

According to the 1995 ESA, subsoil assets (AN.212) are defined as proven reserves of mineral deposits located on or below the earth's surface that are economically exploitable given current technology and relative prices. In the absence of market prices, the value of the reserves usually has to be determined by the present value of expected net returns resulting from the commercial exploitation of those assets.

Statistics Netherlands annually compiles the physical and monetary balance sheets for oil and gas reserves in the Netherlands (Veldhuizen et al,, 2008). Physical balance sheets were compiled based on the yearly reports 'Oil and gas in the Netherlands' by the Netherlands Ministry of Economic Affairs. Furthermore a physical scenario was developed to estimate future extractions from oil and gas reserves. This extraction scenario was used to calculate the monetary values for the monetary balance sheets.

The monetary values of oil and gas reserves in the Netherlands were calculated by using the net present value method to discount expected future income of oil and gas. The real discount rate was set at 4 percent. Future income was estimated based on a 3-years average resource rent and the physical scenario of future extractions. The resource rent was calculated by subtracting the user cost of produced capital from the gross operating surplus in the industry branch 'extraction of crude petroleum and natural gas'.

The lifelength of the remaining gas reserves in the Netherlands is around 20 years at the current rate of extraction of around 70 billion Sm^3 each year, assuming no new discoveries. The lifelength of oil reserves in 2005 has been estimated at around 24 years. The results also showed that the monetary value of natural gas reserves in the Netherlands has increased with nearly 60 percent (or 36 billion euro) due to price changes in the period between 1990 and 2005, whereas the physical reserves have decreased with nearly 43 percent (or 1169 billion Sm^3). This finding demonstrates the importance of presenting physical and monetary balance sheets at the same time.

3.9 Environmental tax accounts

The environmental taxes accounts identify taxes in the National Accounts that are related to the environment, using the definition and criteria set by the OECD and Eurostat. The tax revenues are classified by category (energy, transport, pollution and resource taxes) and also by industry/final use and environmental domain. In the Netherlands, environmental taxes can be directly obtained from the National Accounts.

3.10 Environmental industry accounts (EGSS)

In order to reduce environmental pressure, environmental measures become more and more stringent. The consequences of environmental measures and environmental concerns for the economy show a large interest by policymakers. On the one hand this interest focuses on the financial burden on the polluting sectors which have to invest in pollution abatement control. On the other hand they want information on the new growth sector consisting of enterprises which produce goods and services to measure, prevent, limit, minimise or correct environmental damage – the so called Environmental Goods and Services Sector (EGSS). These two aspects are often referred to as the *demand and supply side* of the 'environmental market'.

On the *demand side* Statistics Netherlands already collects extensive (but not complete) data on environmental protection expenditure. However, no clear picture exists of the *supply side* of the Environmental Goods and Services Sector. In order to draw such a picture data are needed on the size (in terms of employment, production and value added), the structure and the competitiveness of EGSS. These data would describe the economic significance of the sector.

In 2006 Statistics Netherlands finalised a pilot study on the EGSS (CBS, 2006b). In this pilot study Statistics Netherlands only focused on activities belonging to the group Environmental Protection. The first results showed that the environmental goods and services industry in the Netherlands accounts for 1,4 percent of total employment. In 2008, a second project was done where the activities belonging to the group Resource Management were explored (CBS, 2008b). In this pilot study, Statistics Netherlands collected data and constructed the best available methods to gather information on resource management activities. These two pilot studies together form the basic tools for filling in the standard tables on EGSS.

In these two pilot studies the methods and concept of the EGSS statistic were determined. To answer the research question if and to what extent "the Environmental Goods and Services Sector is booming", one needs a time series of the statistic. This time series has been constructed in 2009. The experience in the field of EGSS has learned that constructing the EGSS statistic is very labour intensive. Reliable statistics are very much dependent on labour input. Statistics Netherlands intends to explore the EGSS market in depth at micro-level. More time should be devoted in finding companies falling within the definition of the EGSS market. Simultaneously constructing time series and study the EGSS market at company level will result in a consistent framework that will be suitable to answer the research questions.

3.11 The NAMEA

The NAMEA consists of a conventional National Accounts Matrix (NAM), extended with two accounts on the environment: a substance account and an account for environmental themes (De Haan, 2004). These accounts do not express transactions in monetary terms but include information on the environmental pressures as they are observed in reality: that is, in physical units. The pollution caused by producers and consumers is shown, as well as the balance of cross-border pollution from and to the rest of the world. For the greenhouse effect and the ozone layer depletion only the pressure on the global environment is shown.

In addition to the environmental accounts, the other accounts in the NAMEA contain, in an aggregated form, the usual transactions of the NAM. However, in a number of cases, the receipts and outlays with a typical 'environmental character' have been singled out and reported separately, e.g. the environmental cleansing services in the goods and services account. Like in the NAM, in the NAMEA the receipts are registered on the row and the outlays in the column. The accounts are balanced: the balancing item being the totals of the receipts minus the outlays. This item has been shaded in the column of the account

concerned. In this way the totals for the rows and columns are equal for all accounts and a consistent system emerges. In Figure 1 an overview is shown of the structure of the NAMEA as published in the Netherlands.

The so-called 'environmental themes' are represented in a separate account. The concept of the themes has been adopted from the (second) Netherlands' 'National Environmental Policy Plan' (Netherlands Ministry of Housing, Spatial Planning and the Environment) where they are used as an integrating framework of current environmental problems in the Netherlands. The weights reflect for each theme the potential relative stress of each substance on the environment. The substance units are converted into theme-related stress equivalents and are largely based on international research on the effects of different substances on the quality of the environment.

Figure 1: The NAMEA matrix (shaded areas are physical accounts)

ACCOUNT (classification)	Goods and services (product-groups)	Consumption of households (purposes)	Production (industry)	Generation of of income (value added categories)	Distribution of income and consumption (sectors)	Capital	Taxes (types)	Rest of the world, current	Rest of the world, capital	Substances	Environmental themes	TOTAL
Goods and services (product groups)		Consumption of households	Intermediate consumption		Consumption of government	Gross capital formation		Exports (fob)				Use at purchasers' prices
Consumption of households					Consumption of households					Emission of pollutants by consumers		Consump-tion of households
Production	Output at basic prices									Emission of pollutants by producers		Output at basic prices
Generation of income (value added categories)			Net value added				VAT not handed over to the government	Compensation of employees from r.o.w.				Origin of generated income
Distribution of income and consumption				Net national generated income	Property income and current transfers		Taxes less subsidies	Property income and current transfers from r.o.w.				Current receipts
Capital			Consumption of fixed capital		Net national savings				Capital transfers from r.o.w.	Other domestic emission of pollutants and changes in natural resources		Capital receipts
Financial balance						National net lending (+) or net borrowing (-)			Net lending from the rest of the world			
Taxes (types)	Taxes less subsidies on products		Other taxes less subsidies on production		Current taxes on income and wealth			Current taxes on income and wealth from r.o.w.				Tax payments (less subsidies)
Rest of the world, current	Imports (cif)			Compen-sation of employees to r.o.w.	Property income and current transfers to r.o.w		Current taxes on income and wealth to r.o.w.		Surplus of the nation on current transactions	Cross border pollution from r.o.w.		Current payments to the rest of the world
Rest of the world, capital						Capital transfers to r.o.w.						Capital payments to the rest of the world
Substances			Absorption by producers					Cross border pollution to r.o.w.			Contribution to environmental themes	Destination Of substances
Environmental themes						Environmental indicators						Theme-equivalents
TOTAL	Supply at purchasers' prices	Consumption of households	Input at basic prices	Destination of generated income	Current expenditures	Capital expenditures	Tax receipts (less subsidies)	Current receipts from the rest of the world	Capital receipts from the rest of the world	Origin of substances	Theme-equivalents	

4. New developments

4.1 Introduction

Statistics Netherlands is at present expanding the depth and breath of the environmental accounts by developing a number of accounts that are also described in the SEEA. This section gives an overview of the new projects that are currently under way.

4.2 Environmental subsidy accounts

Other economic instruments, besides environmental taxes, cover environmental subsidies, emissions permits and environmental liabilities. Contrary to the environmental tax account, environmental subsidies cannot be directly obtained from the National Accounts as no subdivision for the subsidies is made. Therefore, the environmental subsidies have to be obtained from additional data sources like registers. Additional problems occur when classifying certain subsidies as environmental or not.

In 2008 a new project has started to compile environmental subsidy accounts for the Netherlands. These accounts show the total subsidies distributed to the different industries and households. The subsidies will be classified according to the different environmental themes (energy saving, air pollution, water pollution etc.).

4.3 Emission permits

Emission trading is a relative new policy instrument for governments to support mitigation strategies. In 2005 emission trading for CO_2 was introduced for Europe. Emission trading has both a physical (number of trade permits) and a monetary dimension. The most important source, to the description of flows of the CO_2 permits, is the CO_2 emission permit registry, which can be thought of as an internet bank in which, the deals that take place are registered. In the Netherlands, the register is administered by the Ministry of Housing, Spatial planning and the Environment. The information in the allowance register creates an opportunity for compiling a large amount of statistics, which are relevant for the environmental accounts as well as the national accounts.

In a pilot project physical emission trade balances will be constructed for the Netherlands. These balances will provide an overview of the amount of permits allocated, purchased, sold and surrendered by different industrial sectors. In addition, an attempt will be made to also establish monetary balances.

4.4 Quarterly air emission accounts for carbon dioxide

The aim of this study is to investigate if it is possible to calculate structural CO_2 air emission accounts for the Netherlands on a quarterly basis. For this objective a new methodology will be developed in which old quarterly data (energy statistics and national accounts) will be used. Results will be compared and checked with the yearly air emission accounting data. The study will also investigate if it is feasible to publish quarterly carbon dioxide emission data together with the quarterly economic indicators within 90 days after the end of each quarter. The sum of four quarters as well could be used to make a provisional estimate of a year.

The general added value of air emission accounts for carbon dioxide on a quarterly basis is the advanced availability of data for the most important greenhouse gas. Quarterly based CO_2 emission data will help to timely detect breaking points in currently estimated trends for emitted greenhouse gasses. As the data are compatible with national accounts, CO_2 emissions directly can be linked to economic output allowing the comparison of different industries' environmental performance. This new information would support national policy and if necessary policymakers could respond more timely to detected changes. In addition, the reporting of data to Eurostat could be advanced in time.

4.5 Time series

Overall, for the different environmental accounts in the Netherlands time series have been compiled for the period 1990-2007. However, for sustainability analyses longer time series are required. Therefore, for some of the environmental accounts longer time series (1950-2007) will be compiled. As a first step these longer time series will be made for the energy accounts, air emission accounts, and the import of raw materials (part of the MFA).

4.6 Climate change accounts

Climate change is high on the political agenda at all levels. In the scientific world there is general consensus that economic and social pressures are contributing to climate change. Climate change will in the future have a strong impact on society, the economy and the environment. There is thus a high demand for good statistics that can support the measurement and analysis of the drivers behind and the social and economic consequences of climate change and the related mitigation and adaptation measures.

The system of integrated environmental accounts (SEEA) may serve as a useful tool for monitoring, measuring and analyzing the relationship between climate change policies and the economy by providing consistent time series of data, tables and accounts. In a pilot study Statistics Netherlands will try to answer the question what climate change accounts are and how they could look like. The main goal is to identify the parts of SEEA that are related to climate change. As climate change will affect each country in a different way, the climate change accounts may look different for each country. In this study we will also identify which accounts have already been developed in the Netherlands and priority areas that may be developed in the near future.

4.7 Analyses

The environmental accounts have two advantages which make them very useful for analysis. Firstly, the data is collected in a consistent manner with the National Accounts and time series of both the monetary or labour accounts can therefore be depicted alongside the environmental indicators. Secondly, the environmental data can easily be linked to the input-output data for the Netherlands. This allows for a number of input-output modelling techniques to be used for analysis of the relationship between the economy and environment. These applications include:

1. Imputation to final demand categories. This application allows for the attribution of environmental indicators to final demand categories such as consumption and exports. The method does not only attribute the direct emissions but also the indirect emissions that were created as a result of feedback effect of the production process.
2. Impact analysis. In this type of model a “what if” question can be answered. For example, it could answer the question: “what would happen to waste generation if consumption increased by 10%”.
3. Structural decomposition analysis. In this type of analysis input-output tables from 2 years are used to identify the underlying sources of changes in emissions or waste flows.

Through this method, growth of environmentally damaging emissions can be attributed to growth in technology or final demand categories.

Below we present two examples of economic environmental analyses that are published annually in the Dutch environmental accounts, namely decomposition analyses and the emission balance of trade.

Decomposition analyses

A widely used analysis is the so-called structural decomposition analysis (SDA) (see de Haan (2001, 2004), Wilting *et al.* (2006) and Statistics Netherlands (2008a) for applications in the case of the Netherlands). The method uses the input-output model to decompose changes in the target variable (in this case, CO_2-emissions). In figure 4, the development of the CO_2-emissions has been decomposed into an efficiency effect (the effect of the improvement of the emissions per unit output), a structural effect (the effect of shifts in the structure of the economy) and the final demand effect (the effect of economic growth). As the figure shows, the effects of economic growth are the largest driving forces of emissions which are only partially negated by an increase in the efficiency. The figure basically shows that emissions would have been about 35% higher, if there had been no changes in efficiency and structure. Note that far more detailed SDA-specifications can be produced in which final demand and technological effects are decomposed into sub-components.

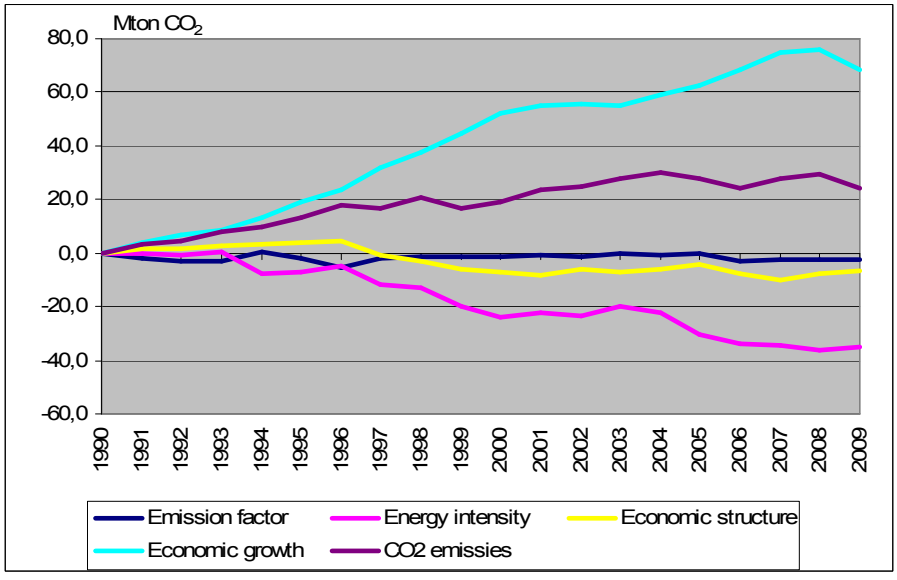

Figure 2: Structural decomposition analysis for CO_2.

The environmental balance of trade

The international transfer of environmental burdens by a country can be addressed by considering its environmental balance of trade. This indicator is defined as the pollution imported via the export of goods and services minus the pollution exported via the import of goods and services. The emissions that can be attributed to domestic consumption are subsequently given by deducting the environmental trade balance from the emissions by residents. We call this measure environmental consumption. Table 3 presents the Dutch environmental balance of trade and environmental consumption for greenhouse gases. The preliminary GHG balance of trade for the Netherlands with the rest of the world was slightly positive in 2009. A positive balance indicates that greenhouse gases emitted domestically during the production of export products are higher than the greenhouse gases emitted abroad during the production of goods and services imported by the Netherlands. As a result of this positive balance, the carbon footprint, i.e. the global emissions as a result of Dutch consumption needs, was equal to 228 Mton GHG emissions, which is slightly less than the emission by Dutch residents.

The emission trade balance can also be compiled separately for the three most important greenhouse gases: CO_2, CH_4 (methane) en N_2O (nitrous oxide). The CO_2 balance is positive. In 2009, the exports of CO_2-intensive products from glasshouse horticulture, the chemical industry and refineries exceeded the imports of CO_2-intensive products like electronics. The balances for nitrous oxide and, especially, methane are negative. The negative trade balance for methane is due to large imports of crude oil and natural gas whose production is frequently accompanied by venting and flaring in which large amounts of methane are released.

Table 3: The environmental balance of trade and environmental consumption for greenhouse gases

	Total GHG	CO_2	CH_4	N_2O
	Mton CO_2-equivalents			
1. Emissions attributed to imports	99	70	20	10
2. Emissions attributed to exports	103	86	9	8
3. Emission balance of trade = 2-1	**3**	**16**	**- 11**	**- 2**
4. Emissions by residents	232	203	17	12
5. Global emissions from Dutch consumption needs = 4-3	**228**	**187**	**28**	**14**

5. Conclusions

Environmental accounting is a satellite system of the System of National accounts. It brings together economic and environmental information in a comprehensive framework to measure the contribution of the environment to the economy and the impact of the economy on the environment. Work areas range from accounts for natural resources such as the extraction of oil and gas to material use and emissions data such as CO_2 and waste. The environmental accounts provide a tool to analyse to what extent our current production and consumption patterns are depleting natural resources or are polluting the environment. In addition, the system includes information about policy measures such as environmentally related taxes or subsidies.

Statistics Netherlands has a long history in environmental accounting at the National Accounts department. This culminated in the introduction of the National Accounting Matrix including Environmental Accounts (NAMEA) in 1991. In this paper the history and theory of the environemntal accounts are discussed, as well as the future extensions which are currently envisaged.

At present, the core publication of the Dutch environmental accounts consist of seven parts, namely the NAMEA-matrix, detailed emission accounts for NAMEA, the water accounts (NAMWA), energy accounts, waste accounts, subsoil accounts for oil and gas and environmental tax accounts. The NAMEA consists of a conventional National Accounts Matrix (NAM), extended with two accounts on the

environment: a substance account and an account for environmental themes. NAMWA is a further specification of NAMEA for water, using the same accounting structure.

Statistics Netherlands is extending the system of environmental accounts based on the System of Environmental and Economic Accounting (SEEA). New work will be undertaken with regard to material flow accounts (MFA). The monetary accounts will be extended with the inclusion of environmental subsidies, emission trade and the environmental goods and services sector.

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