Environmental accounts
Households

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Foreword

Statistics Sweden has developed physical environmental accounts since 1993. In the environmental accounts, so far, households have appeared as one of the components of final demand, thus linking it both directly and indirectly to environmental effects through what is consumed and how these goods and services are produced. This has made it possible to compare environmental pressures caused by households with pressures from other economic agents such as industries or the public sector.

This report is a study of possible ways to elaborate the role of households in the environmental accounts, mainly by using household/individual surveys to identify environmental effects generated by expenditure and activity patterns of different household types. The main areas of study are transport, energy, waste and composition of consumption.

The report is prepared on commission from Eurostat, who supports and co-ordinates development of environmental accounts in the EU member states. The European Commission (Directorate- General for Regional Policy and Cohesion) has contributed financially to the project. Elisabeth Bergstedt is responsible for the section on waste, Marianne Eriksson for the section on transport and housing and Anders Wadeskog for the section on consumption of goods and services.

Contents

1 Introduction

So far, the environmental accounts have treated households or consumers as a component of final demand – namely private consumption. This has made it possible to calculate the direct emissions caused by the actions of consumers (they consume energy which causes emissions) as well as indirect emissions (emissions caused in the production of the goods and services consumed). These calculations have been made for private consumption in total and disaggregations have been restricted to straight per capita measures.

In the debate on sustainable development, the role of the consumer has gained increasing interest. Changes in life styles have been seen as necessary to move towards a more sustainable consumption. Increasingly, the discussion has shifted from focusing on the levels of total consumption, to a discussion on the composition of consumption and also of the distributional aspects of a sustainable consumption. Studies of the effects of different fiscal measures to influence consumption of energy have highlighted the possibly negative distributional effects linked to the consumption of environmentally sensitive goods and services.

The households contributes to many of the environmental problems we have today, but can also in many ways contribute to a sustainable development in many ways by i.e. changes in consumption patterns from non-environmentally friendly products to environmentally friendly products, changes in travel habits, changes in energy consumption, treatment of waste etc. Some of these changes will probably be voluntary while others will be in response to changes in taxes, subsidies, regulations or institutions.

The household sector is not homogenous. It consists of individuals and households that are very different in their environmental impact. They will also adopt different strategies for the changes ahead. All according to tastes, beliefs, culture, financial means etc. It is important that the environmental accounts tries to capture these differences and changes to some extent, as they are primary factors for a development towards a sustainable future.

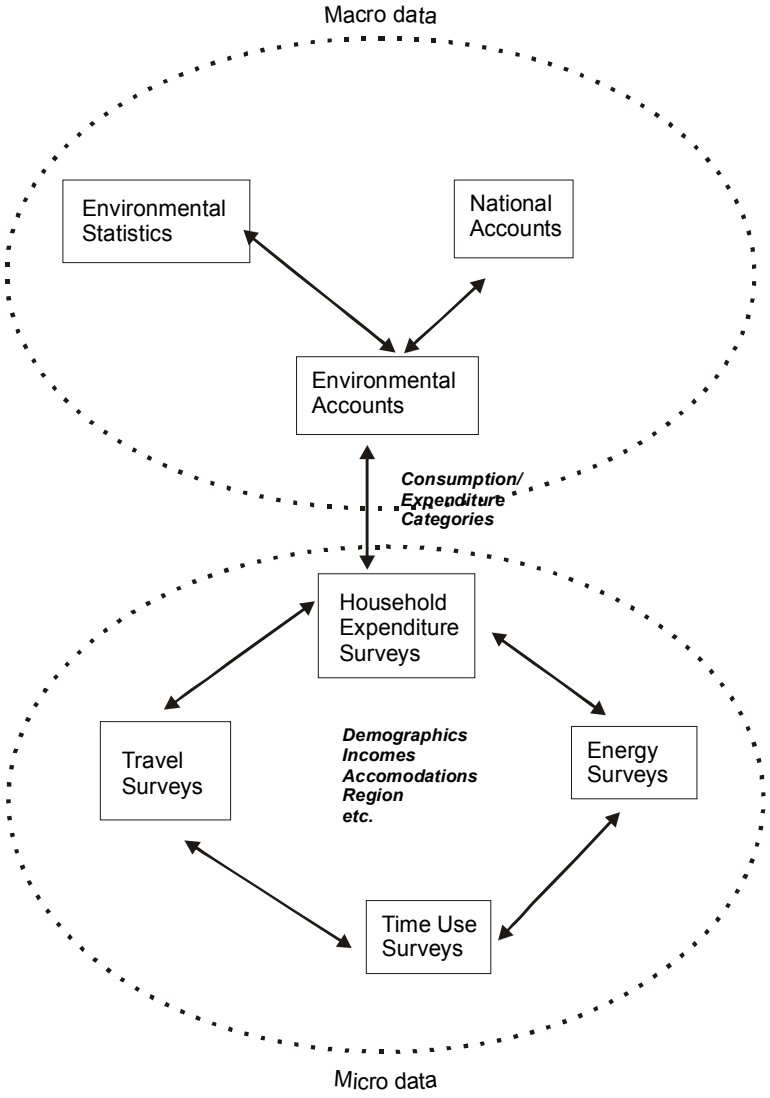
Most of the environmental impacts from households come from consumption of goods and services and an essential part of the environmental impacts from household can be described by

- What (Volume and type of commodity) are consumed
  and
- How things are used (behaviours i.e. waste handling)

However, it is important to remember that environmental impacts from households are not limited to market produced goods and services. Consumption of non market commodities such as land and water also has environmental impacts. So does production in the household for its own consumption.

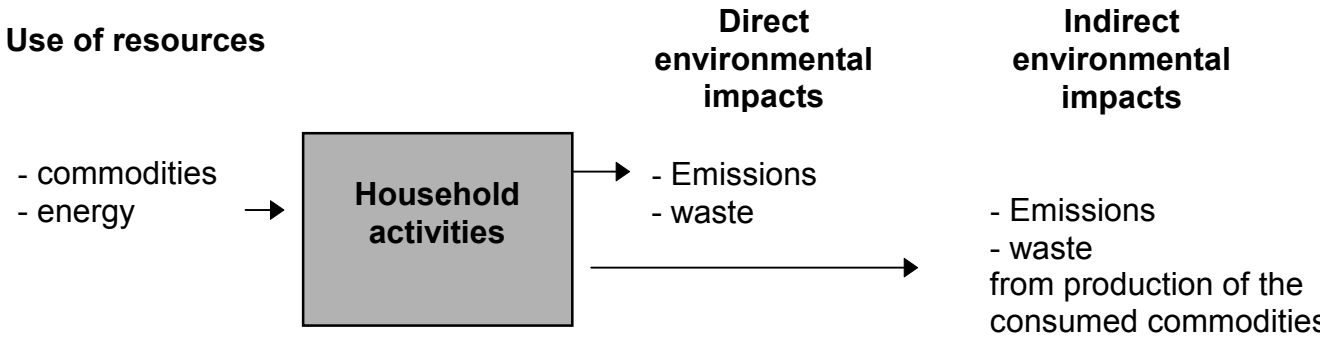
As part of the effort to achieve environmental goals it is important to identify the contribution from households as a group to emissions, waste generation, etc. – *the macro - perspective* In developing instruments and finding measures to influence the behaviour of the households into a more environmental friendly direction, it is important to have more detailed information of the situation for different households (economic situation, consumption pattern, life-style, attitudes etc.) - *the micro-perspective*.

In the environmental accounts there are information about total impacts from the households, *macro-perspective*. The present study is an attempt to introduce a *micro-perspective* by using data from individual/household based surveys on households travel patterns, expenditures and use of time, which gives opportunities to show the statistics for different type of households, geographical regions etc.. By linking surveys on households with the environmental accounts it is possible to take one step closer to a micro-perspective in the environmental accounts. The idea is illustrated in the diagram below.



The general idea is that households contribute to environmental problems mainly by what they consume. Different goods and services have very different environmental impacts when they are produced. Using I/O analysis in the environmental accounting system it is possible to estimate the environmental impacts from production of the goods and services consumed by households classified into different household types.

The focus in this report is on the direct and indirect impacts from use of energy, consumption of goods/services and waste generation. *Direct* impacts mainly come from the consumption/use of energy, i.e. fuel for private cars, or oil for direct heating in private houses. *Indirect* impacts are generated in the production of the goods and services consumed by households.



There is one important difference between the present task and using the same model to analyse environmental impacts from the production side of the economy. The household sector consists of many small units and the environmental impacts are diffuse and to a large extent unmeasured. Analysing the household thus means analysing the input side in order to arrive at an estimate of the output/emission side.

This study consists of three parts:

1. Use of energy and emissions from housing and private transports
   An important part of environmental impacts from household comes from the use of energy for housing and private transports. The impacts differ for different type of households depending on i.g. type of heating system, size of dwelling, travel pattern or use of private car.

2. Consumption of goods and services, indirect emissions from production
   With an I/O analysis it is possible to get information on the total emissions from the production of goods and services. Different types of households have different consumption patterns, which translates into different indirect environmental impacts. The activity pattern of households will influence both the consumption pattern and the direct emissions from households.

3. Waste
   Statistics on waste usually are dived into domestic waste and industrial waste. Domestic waste include not only waste from households, but similar waste from other sectors in the community. In this study methods is shown to estimate the amount of waste generated by households and domestic waste generated in other sectors.

2. Summary of results

Most of this study is based on data from the environmental accounts for 1993, which at the moment is the best available information on use of energy and emissions linked to the national accounts (provisional accounts for 1991). This 1993 NAMEA has been linked to energy accounts for 1993, the National Travel Survey (NTS) for 1994 and The Household Budget Survey (HBS) for 1992. Neither travel nor expenditure patterns change much between single years, so the one or two year offset between the sources should not pose any major problem. If this is to be an integral part of NAMEA for the future, it is of course desirable and also likely that it can be based on more recent and synchronised surveys in terms of the survey period.

As this is a first methodological study to investigate the possibilities to extend information on households in the NAMEA framework, we have concentrated the work to only cover a single year 1993, but instead tried to cover many different aspects of environmental impacts from different types of households.

The classification of households can be done in many ways depending on the purpose of the analyse. Here we present results for one way of classifying households using a demografic approach, which at the moment was the best available, as it made it possible to use the same classification when linking different individual/household surveys to the environmental accounts. Other possible ways, which at present demands considerable more extra compilations, are by income, socio-economic groups, regional distribution etc.. Some of these alternatives are illustrated briefly in chapter 4.

The estimations of the indirect emissions by different type of household should be looked upon only as an example of possible ways to further analyse environmental impacts from households.

Use of energy

Households uses energy mainly for transportation and housing (heating and domestic electricity). In 1993 the total use of petrol and diesel in Sweden was 300 PJ[1] thereof was 141 PJ or 47% used by private consumption or 17 GJ[2] per capita.

For heating and domestic electricity the household used 333 PJ or 38 GJ per capita. Inhabitants in one or two dwelling houses used 40 GJ per capita and inhabitants in multi-dwelling houses 35 GJ per capita.

Emissions of CO_2, SO_2 and NO_x

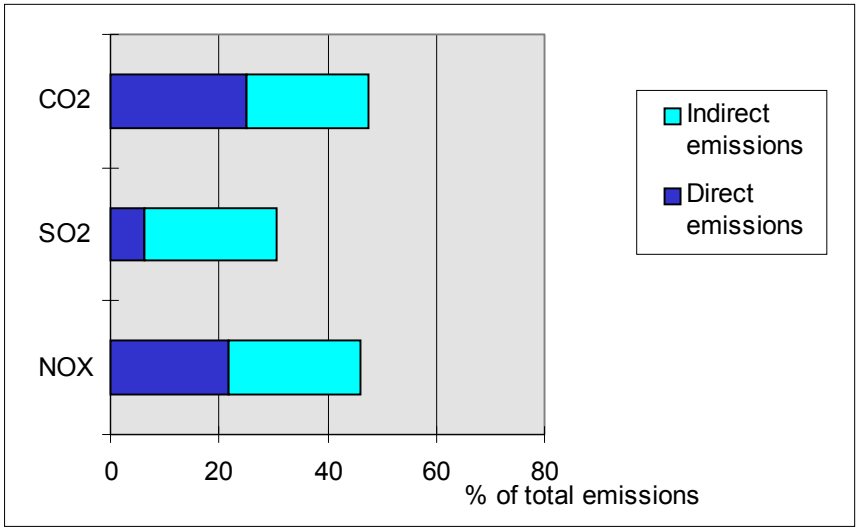
The households cause direct emission of CO_2, SO_2 and NO_X mainly by the use of fuel for transportation or for heating of the dwellings. Emission caused by production of the goods and services consumed by the household make up the indirect emissions.

[1] PJ Petajoule 10^{15} joule

[2] GJ Gigajoules 10^{9} joule

Taken into account both direct and indirect emissions, the total emission of CO_2 amounted to 29900 ktonnes. SO_2 to 31 ktonnes and NOx to 175 ktonnes. That were 48 % of total CO_2 emissions 30 % of total SO_2 emissions and 46 % of total NOx emissions.

Diagram 2.1 Direct and indirect emissions from households 1993



The indirect emissions are an essential part of the total emissions from households. For CO_2 just below 50% of the emissions are indirect emissions, for SO_2, 80% and for NO_X just above 50 %.

The average emissions per capita are shown in the table below.

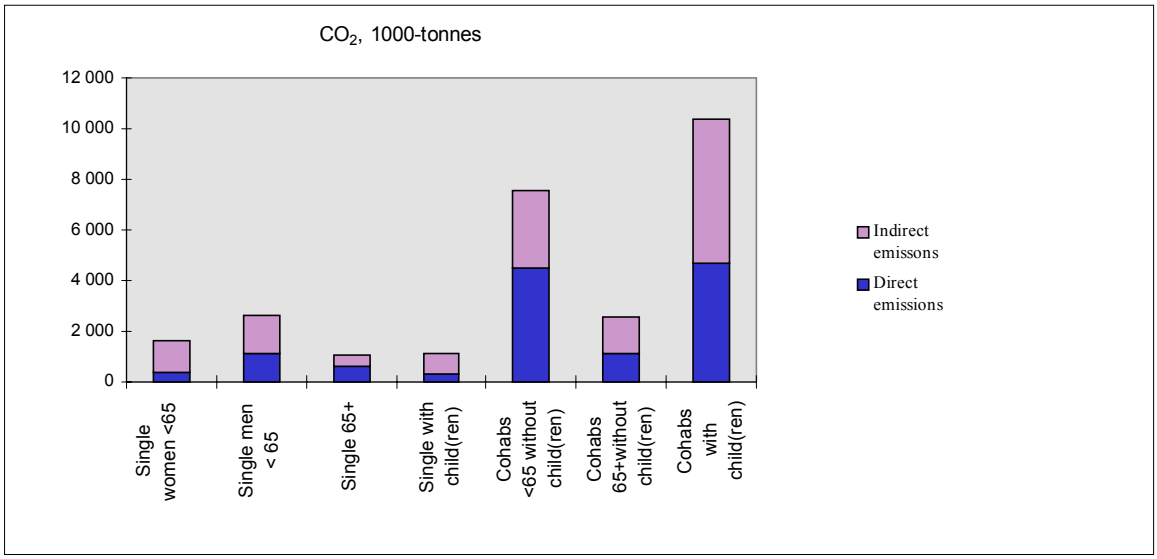
Table 2.1 Direct and indirect emissions per capita 1993

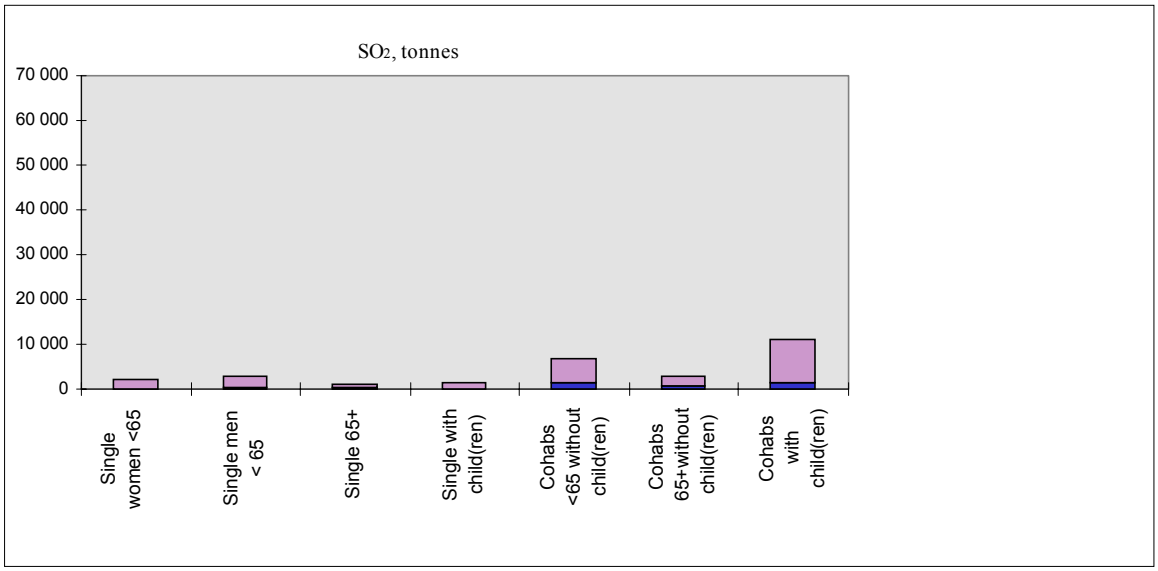
Emission per capita	Direct emissions	Indirect emissions	Total
CO_2 (tonnes)	1,8	1,6	3,4
SO_2 (kg)	0,7	2,8	3,5
NO_x (kg)	9,4	10,6	20,1

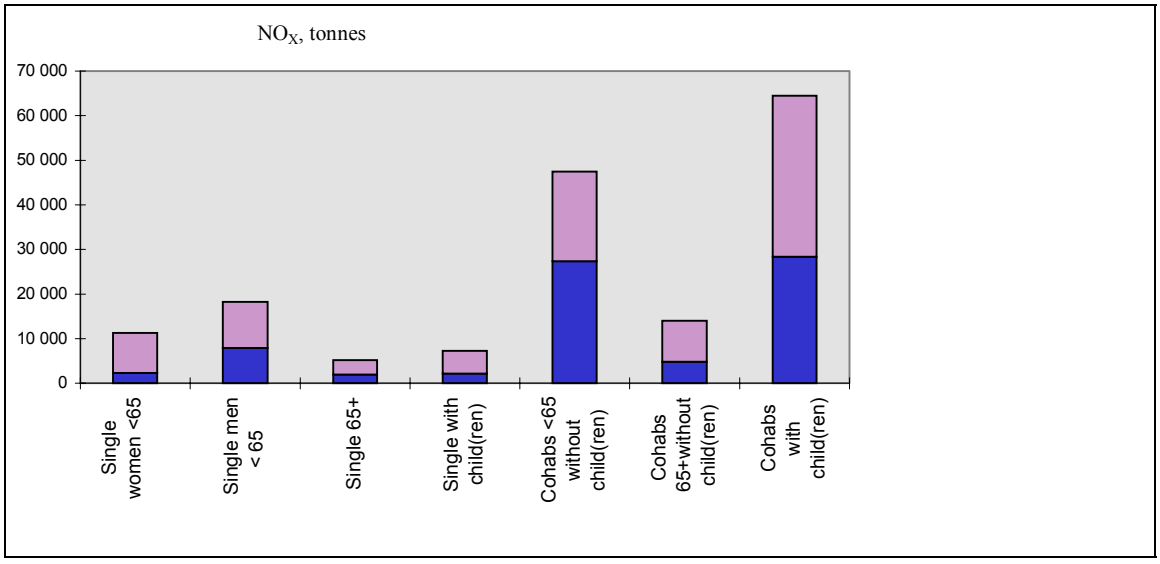
By linking information from the environmental accounts with different household surveys it is possible to distribute the main part of both direct and indirect emissions over different type of households. For CO_2 about 91 % of the emissions can be allocated to different types of household and for SO_2, 94 % and for NO_x, 96 %.

Looking at the household types, the main part of total emissions comes from households consisting of cohabitants with children and cohabitants without children. This, of course, reflects the fact that they are the largest categories.

Diagram 2.2 Total emission from households 1993

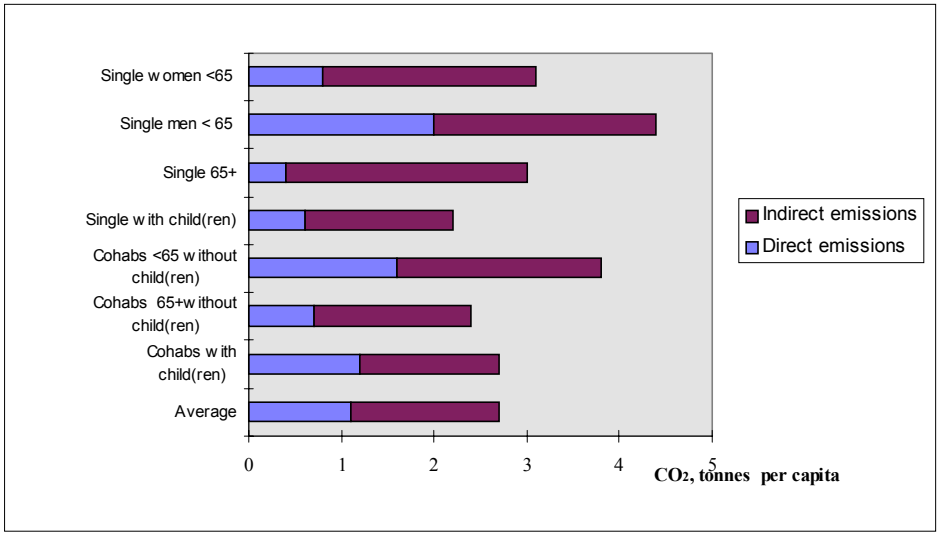


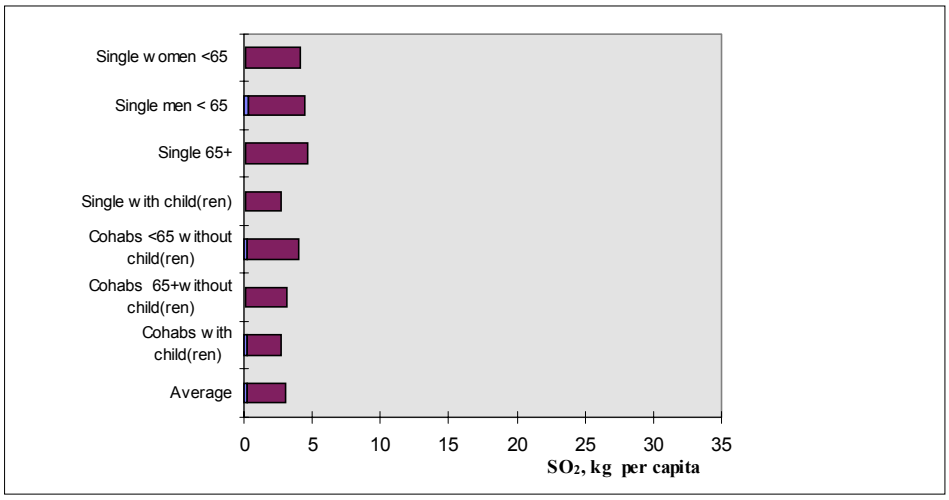


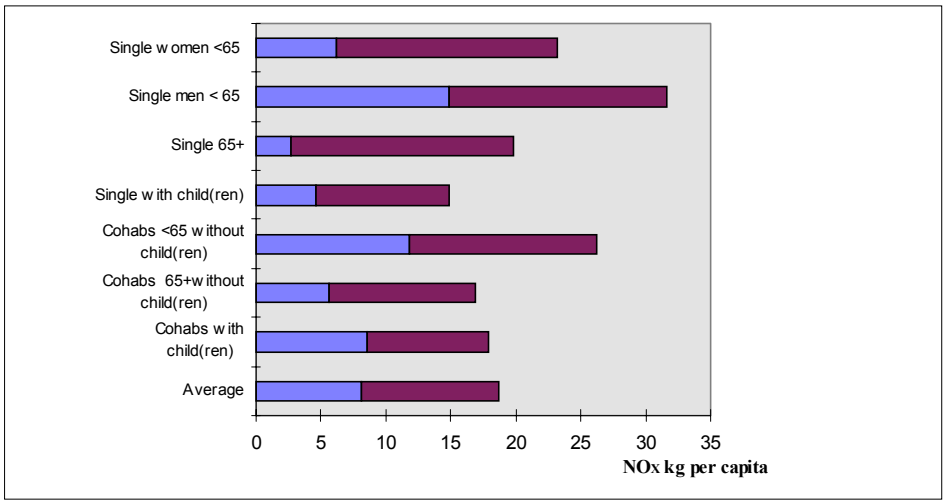


But Looking at the emission per capita for the different categories, a different picture emerges. Single men <65 years of age and cohabitants <65 without children have the highest per capita values.

Diagram 2.3 Emission per capita by type of household







Waste

A substantial and noticeable part of the households influence on the environment is the waste arising from consumption. Today it exists statistics over the household waste for 1994. The municipalities are responsible for the mixed waste of this kind. The definition of household waste in this statistics is ”waste from households and similar waste from other sectors where people stay and therefore produce waste, for example business”. But so far there are no statistics to describe waste from the households excluding similar waste from other parts of the society. In the collection of waste, household waste from different sectors in the society are mixed.

In this report two methods to estimate waste from households are discussed. The total amount of household waste was 306 kg per capita in 1994. After a deduction of an estimation of waste generated in other sectors, the average household waste per capita was 217 kg.

Results

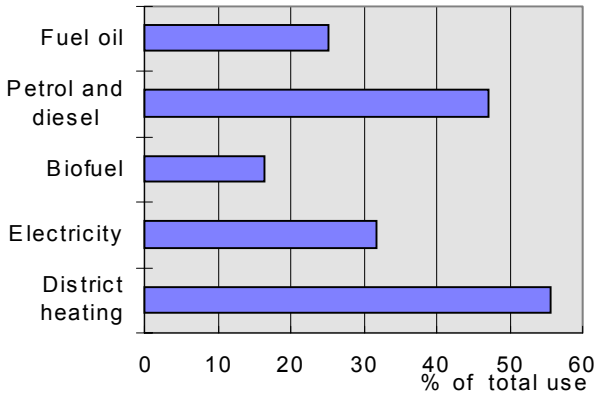
3.Use of energy and emissions from transports and housing

3.1 Introduction

Private consumption of energy is mainly used for housing and transportation and is an important part of the total use of energy in the country.

47 % of the total use of petrol and diesel was used for private consumption. In housing, energy is used for heating and domestic electricity. 25 % of fuel oil was used for private consumption, 56 % of the district heating and 33 % of electricity. (See table 1)

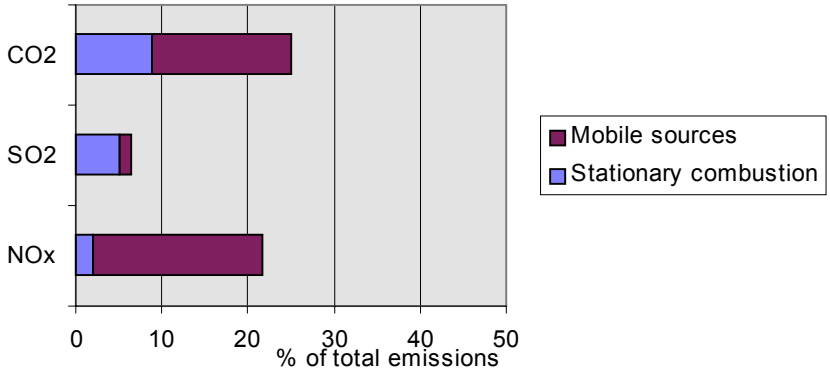
Diagram 3.1 Private consumption of energy 1993



The use of fuel oil, petrol and diesel causes direct emissions to air, while the use of electricity and district heating causes emissions in the production process in the power stations or heating plants.

In 1993 total emissions of CO_2 amounted to 62900 kton, SO_2 amounted to 100 kton and NO_x to 381 kton. Of the total emissions of CO_2, 25 % came from private consumption, for SO_2 the share was 6% and for NO_x 22 %, see table 2. Of these, mobile sources accounted for 90 % of the emissions of NOx, 50% of emissions of CO_2, but only 20 % of SO_2 emissions. (See table 2)

Diagram 3.2 Direct emissions from private consumption 1993



3.2 Environmental impacts from transportation

Petrol and diesel are used by households for private cars, motorbikes, boats, machine tools etc. In the energy-accounts there are information about type of fuel used by industrial sector and private consumption. As for private consumption, there is no further information about the specific use of energy, for cars, boats etc.

Estimation of emissions of CO_2 and SO_2 are based on the amount of used fuel. Emission of NO_X from mobile sources are not directly proportional to the amount of used fuel, but is estimated by a model with information on vehicle population, model years, traffic volume and emission coefficients. Emission coefficients depends on the type of vehicle, traffic environment, climate and like.

From the estimation of NO_X emissions from mobile sources, it is possible to get estimates of what type of vehicle that generated the emissions.

Table 3.1 Emission of NO_X from private consumption, mobile sources 1993

Vehicle	%
Private cars	94 %
Vans and lorries	2 %
Boats etc	2 %
Machine tools	1 %
Others	≈1 %
Total	100 %
Total NOx	75 100 tonnes

The major share of NO_x emissions comes from private cars. We know that access to cars, travelling distance etc. differ between different types of households, regions etc. and that expenditures on petrol constitute a more or less important part of the budget of the household.

The Swedish National Travel Survey (NTS) gives information on the travel volume by private cars, and other means, for different types of households. The NTS collect information on travel distance, purpose of the trip, background information about the household, possession of cars, if the petrol are paid by employer etc.[3] This makes it useful for estimating the use of energy and emissions for different types of households according to their driving pattern.

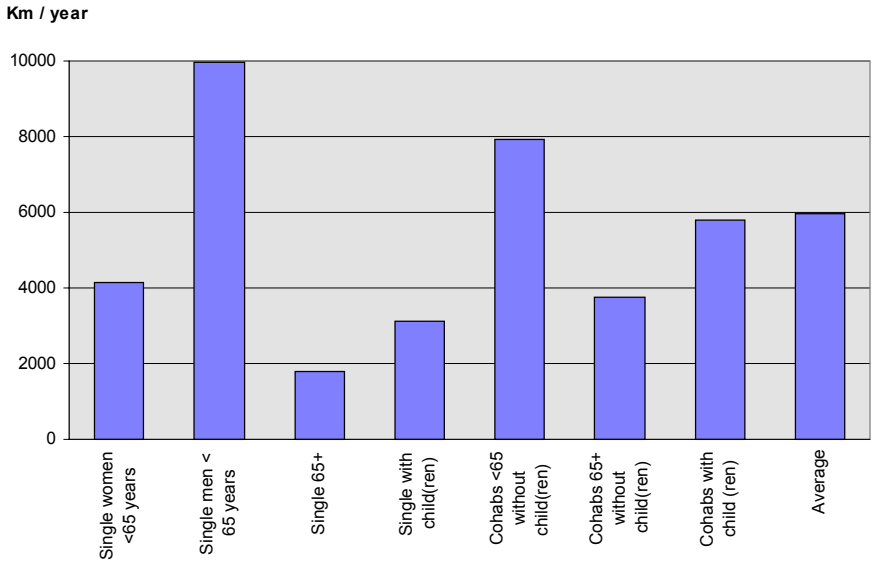
For this study, we decided only to use the total transport volume. Future studies could also consider type of vehicle, urban or rural driving, climate etc. We have focused on the distance travelled by drivers of cars fuelled by privately paid petrol. The assumption is that this will provide the best estimate when linking information from NTS with

3 There is a short description of the Swedish National Travel Survey in the appendix to this chapter

emissions and expenditures for petrol by comparable household type. (for further explanation of household groups see chapter 4.4)

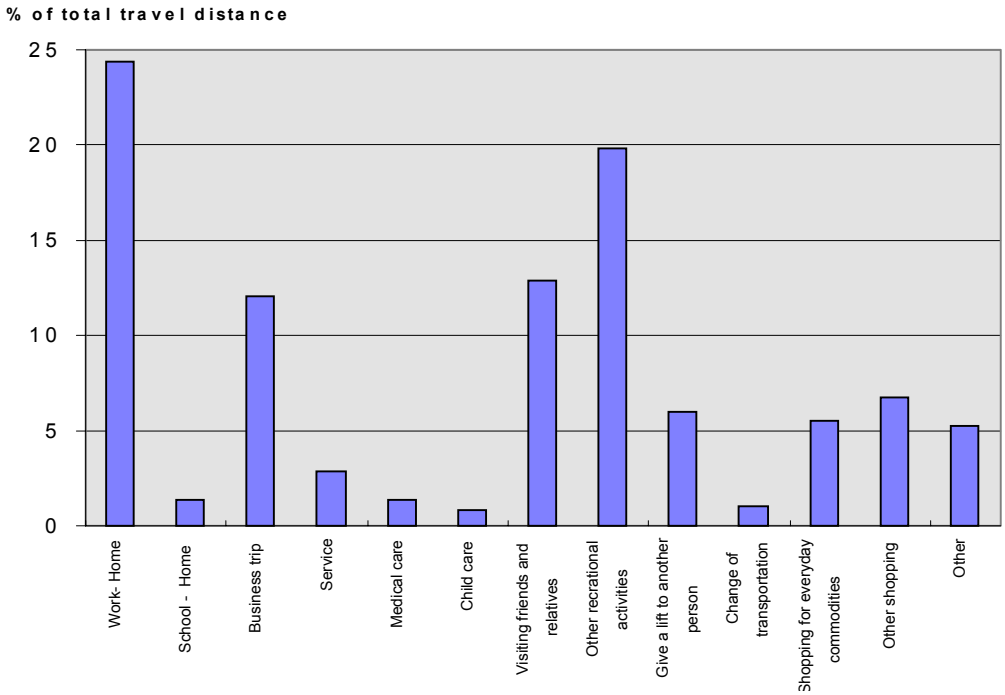
The average travel length differ between different types of households. Single over 65 years of age have the lowest average travel length 1800 km /year and single men under 65 years of age have the highest travel length almost 10 000 km/year. (See also table 3.)

Diagram 3.3 Average driving length per person and year



The purposes of the trips are mainly trips between work and home, 24 % of the trips, and for other recreational purposes, 20% of the trips.

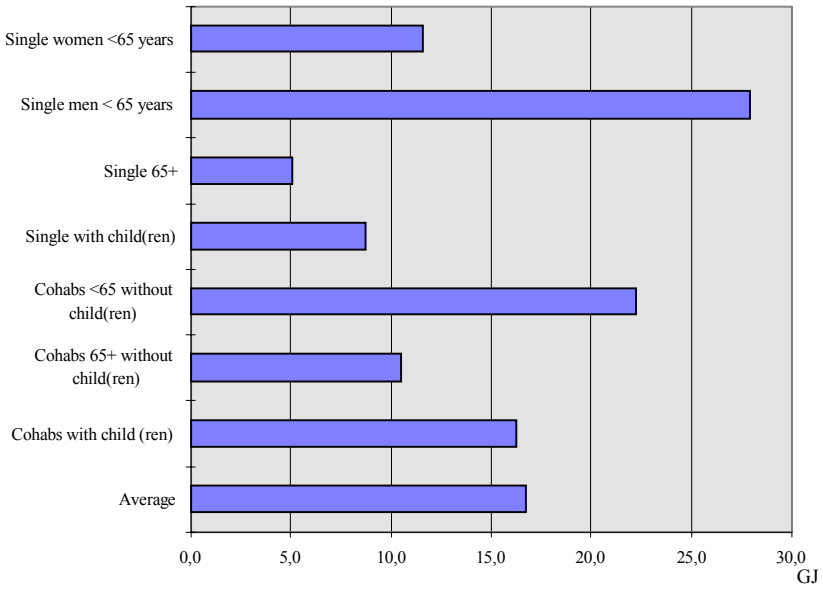
Diagram 3.4 Purpose of the trip



Knowing that 94 % of the emissions of NO_X from mobile sources came from cars, we used that information to estimate the use of energy and emissions from transports by cars.

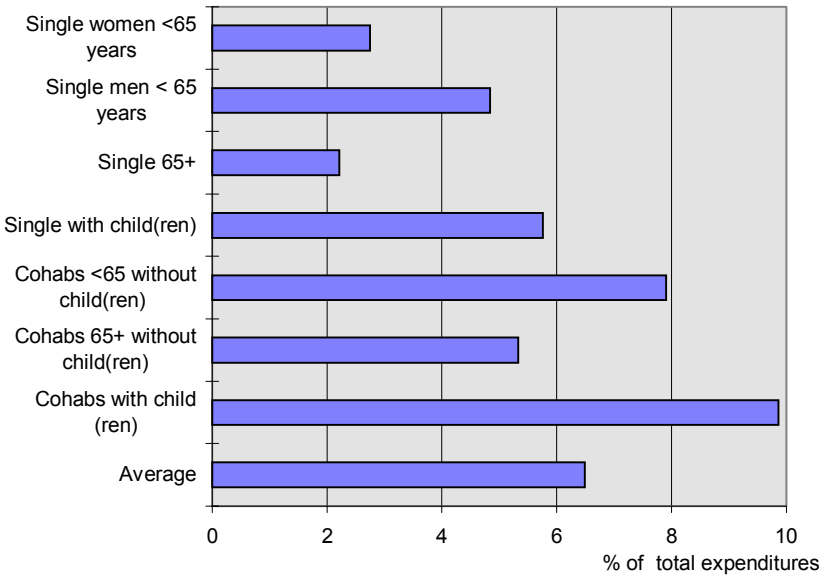
Under the assumption that the use of energy for each type of household are proportional to the travel distance (best available estimation for now), the average use of fuel for private cars will be 17 GJ per person and year . For single men under the age of 65 it will be 28 GJ per person and year and for singles over 65 years of age 5 GJ per person and year.

Diagram 3.5 Average use of energy for cars GJ per year and person



Information on expenditures for fuel (petrol and diesel) is found in the survey on household expenditure. On average, around 7 % of total household expenditures are spent on fuel. For cohabitants with children 10 % of the expenditures are spent on fuel, while singles over 65 years of age only 2 % are spend on fuel.

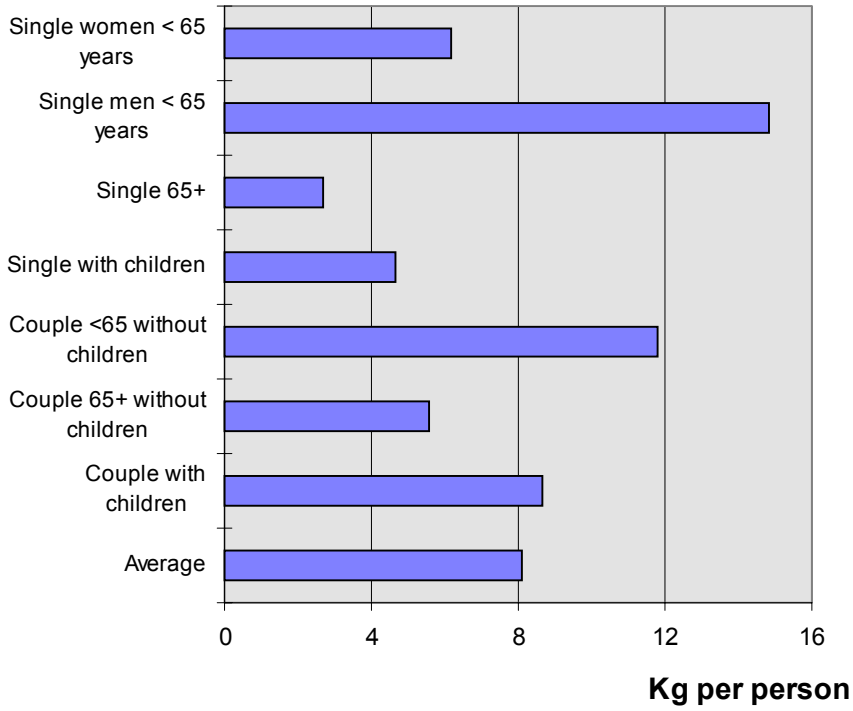
Diagram 3.6 Expenditures for petrol and diesel in relation to total expenditures.



In the same way as the use of energy for different types of households can be estimated by the travel distance, the emissions from the use of energy can be estimated. Knowing that the emission of NO_X depend upon such things as type of vehicle, year model, traffic environment etc. we have yet made an estimation of the distribution of emissions by the travel distance. The assumption is that the type of vehicle, traffic environment etc. not will differ too much between the different types of household. Of course there are great variation within the different types of households concerning possessions and use of the car. That would be very useful information for a more elaborated study of the households.

In average emission of NO_x from private cars was 8 kg per person and year, for SO_2 only 0,2 kg per year and for CO_2 1,1 ton per year.

Diagram 3.7 Average emission of NO_X from private cars



Appendix: Short overview of the Swedish National Travel Survey

Over a period of five years NTS, The National Travel Survey will examine where Swedish people are travelling. The aim is to provide a basis to make travelling easier, increase safety and improve the transport environment. Statistics Sweden has been commissioned to carry out the survey. By the survey it will be possible to study

- the number of kilometres travelled by people using different modes of transport
- different modes of transport and how these are combined and changed during different trips
- travel patterns of individuals
- reason people travel
- differences between individuals in travel patterns
- changes over longer and shorter periods
- effects of changes in terms of fees, frequency of service, routes, taxes price of petrol
- risk of accidents and injuries
- environmental effects of transport

The measurement period is from April 1st 1994 and five years ahead. It cover each day over this period. The sample covers 50 000 persons over the age range 6-84 (proxy interviews with children). The sample is drawn from the population register. Computer assisted telephone interviews are used to carry out the surveys. The survey cover all trips the previous day and long distance trips over the previous months. As regards foreign travel, country and place or area are reported.

Following variables are available

- starting point and destination in form of e.g. addresses
- date and time
- length of trip
- purpose of trip
- types of transport
- accompanying children under six years of age
- fellow passengers during car trip
- cost, use of tickets at reduced rates

The survey have background data such as individual or family situation, gender, age, occupation, possession of driving licence, type of home, income, education, type of business at the work place, resources in terms of transport, number of cars in the household, type of ownership, petrol/diesel, ownership of motorbike, moped or bicycle, access to taxi service for the disabled.

3.3. Environmental impact from housing

The uses of energy in households are, apart from transportation, for heating of dwellings and domestic electricity. The energy statistics contain information on what type of energy used in one-and two -dwelling houses and in multi-dwelling houses. From the survey on use of energy in one or two dwelling houses it is possibilities to distribute that part of the energy consumption according to type of household.

The total amount of energy for housing was 333 PJ or as an average 38 GJ per capita. The energy use per capita was higher for inhabitants in one or two dwelling houses than in multi-dwelling houses.

Table 3.2 Total use of energy for housing 1993

	One or two dwelling houses PJ	Multi - dwelling buildings, PJ	Total, PJ
Fuel oil	46	23	69
Biofuel	40		40
Gas	1	2	3
Electricity	101	39	140 1)
District heating	8	73	81
Total	196	137	333
Per capita (GJ)	40	35	38

1) Above that private consumption of electricity includes electricity for leisure-houses and electricity used by non-profit organisations serving households.

Fuel oil causes emissions direct by use, while electricity and district heating causes emissions in the production process in the electricity and district heating plants. Emissions from stationary combustion, i.e. use of fuel oil, is referred to as direct emissions while emissions from electricity and district heating plants are referred to as indirect emissions.

Table 3.3 Direct and indirect emissions from housing 1993

	CO2, k tonnes			SO2, tonnes			Nox, tonnes		
	One or two dwelling houses	Multi - dwelling buildings	Total	One or two dwelling houses	Multi - dwelling buildings	Total	One or two dwelling houses	Multi - dwelling buildings	Total
Total emissions									
Direct emissions	3671	1835	5506	3350	1675	5025	4935	2468	7403
Indirect emissions	1520	1583	3103	2809	2923	5732	2862	2978	5840
Total	5191	3418	8609	6159	4598	10757	7797	5446	13243

Of the total emissions connected to housing, 64 % of the total emissions of CO_2 were direct emissions, for SO_2 the direct emissions counted for 47 % and for NO_x 56 %.

In Sweden around 56 % of the population lives in one-or two dwelling houses. The direct emissions per capita are much higher in one-or two dwelling houses compared to multi-dwelling houses. This is due to the fact that many houses have their own combustion equipment. If both direct and indirect emissions are taken into account, the emission per capita differ less between the two type of houses, but is still higher in one-or two dwelling houses.

Table 3.4 Average emission from per capita housing

	CO2, ktonnes			SO2, kg			Nox,kg		
	One or two dwelling houses	Multi - dwelling buildings	Total	One or two dwelling houses	Multi - dwelling buildings	Total	One or two dwelling houses	Multi - dwelling buildings	Total
Emissions per capita									
Direct emissions	0,8	0,5	0,6	0,7	0,4	0,6	1,0	0,6	0,8
Indirect emissions	0,3	0,4	0,4	0,6	0,8	0,7	0,6	0,8	0,7
Total	1,1	0,9	1,0	1,3	1,2	1,3	1,6	1,4	1,5

In the ‘regular’ environmental accounts, only direct emissions from stationary combustion are included. In a way, this underestimates emissions connected to heating and domestic electricity of dwellings. With a more elaborated analysis of the household sector and both direct and indirect emissions, it is possible to get a better understanding of the environmental impact from housing.

4 Environmental impact from consumption

4.1 Introduction

Supposedly, "the consumer is king" in the market. Yet, sustainability has, until recently, almost exclusively been considered from a production point of view. The processes by which inputs are transformed into outputs consumed by the consumer have been the focus of concern rather than the choices made by consumers.

The statistical description of what individuals do are often found in surveys that collect data on income, expenditure, time use etc. Few, if any, of these surveys have a more substantial environmental dimension in that they ask specifically for environmentally relevant activities, although this is a possibility that should be explored further.

The bulk of environmental data is collected according to type of emission (e.g. CO_2) or type of environmental problem (e.g. Greenhouse gases). In environmental accounts[4] - NAMEA - emissions and use of natural resources are linked to the production sectors in the economy. Few attempts have been made to allocate the environmental problems over population groups for instance in linking the actual expenditures to their environmental impact. There are of course similarities between this and the analysis made in the area of environmental fiscal reforms. Most of these analyses have focused on estimating demand systems in terms of price and income elasticities. This in order to see how consumption/ expenditures in total, or for different groups of households, alters when environmental taxes are introduced/changed. This can then be used to say something about the assumed change in, e.g., CO_2 emissions given a certain reduction in petrol consumption.

Economic data in the national accounts have counterparts in the individual surveys – for instance in terms of employment, expenditure and incomes. It is tempting to try to establish a direct link between these survey based sources and the national accounts as this opens up the possibilities of disaggregating the macrodata of the NAMEA in different ways. In this project the ambition has been to link the household budget (expenditure) survey (HBS) to private consumption as it appears in the national accounts. Since the 1950, i.e. with the introduction of the modern national accounts, the HBS has been seen as a primary source for measuring private consumption. In the last few years the classification systems have been more or less harmonised in the so-called COICOP[5].

The data used for the linking of the HBS and the NAMEA are: 1992 HBS, a set of provisional tables from the 1991 national accounts (input-output matrices and converters) and the calculated emissions data for 1993. There are well known problems in linking HBS-data with national account data. The two do not produce identical results. The levels of consumption/expenditure in many categories differ widely. It has not been possible to do any deeper analysis/corrections to this in the time frame of this project, so the results

4 We will refer to the environmental accounts as NAMEA, i.e. the integrated national and environmental accounts although only parts of that social/environmental accounting matrix are addressed in this context.

5 Classification of Individual Consumption by Purpose.

have to be viewed as illustrative examples of what type of results a properly worked through linkage between micro and macro data could produce.

4.2 Outline of the chapter

The chapter starts out with a general view of the actions of the individual. This is a somewhat different view than that of the passive consumer who only enters the realm of economic decisions when lining up to pay for the goods in the store. Our view of the individual, in the context of sustainable development, is that of someone making a host of decisions that to a greater or lesser extent influence the transition to a sustainable future.

Ideally we would need to be able to establish links between NAMEA on the one hand, and HBS and time-use surveys (TUS) of the same household, on the other. This is not possible, given the state of these surveys today.

Using the HBS, the NAMEA and a set of matrices from the Swedish national accounts, we try to link the actual consumption patterns of seven household types to the emissions caused in producing the goods and services they purchase - the indirect emissions. The method used is described briefly and some tentative results are shown.

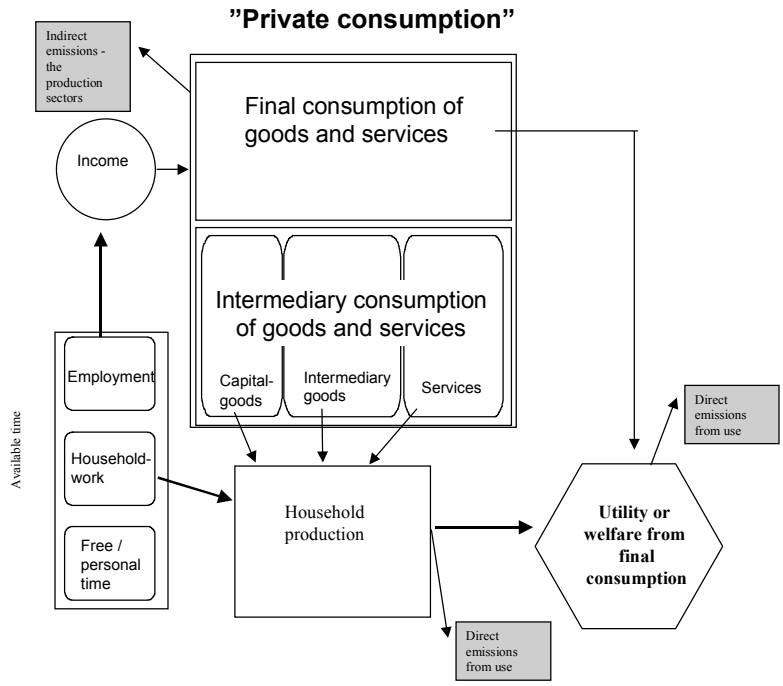
Linking HBS and national account data is far from trivial. The data collected are not consistent. These problems are described and examples from several countries are presented as well as the differences between the, reclassified, data from the HBS (unadjusted) and national accounts data used in the present analysis. This is followed by a more general discussion on linking the NAMEA-HBS further with TUS data and an example of a HBS-TUS link is presented – a so called Household Satellite Account.

Finally we briefly discuss future steps in putting a more complete picture of the household sector into the NAMEA. This would be interesting to pursue in parallel with, the presently dormant, efforts to set up a proper Household Satellite Account, as the two would have many of the HBS-TUS-National Accounts linkages in common.

4.3 A statistical view of the household

Using an activity perspective of the household, the following picture can be used to illustrate the basic reasoning.

Diagram 4.1 The HPK model[6]



The simple idea is that, from a household point of view, every day life forces the household to juggle the resources at their disposal. One of the key resources at the disposal of the household is time. The members of the household can allocate their 24 hours a day in many ways and this will affect the situation for the household and its environmental impact. For most households, much of the time available appears committed in one way or another. The decision to have children, get a dog, taking a course or to take on a certain job, brings with it restrictions on future time use. Decisions at one point in time certainly can place restrictions on the use of time later. We will disregard this dynamic side to the picture – we assume that the allocation of time within the household illustrate its possible trade offs and preferences among the possible choices facing them today[7].

Each member of the household then has the option to use his/her time on different activities[8]. In the picture these alternative uses have been aggregated to three – to work for a

6 HPK is the Swedish acronym for Household Production and Consumption. The model has been described more in detail for instance in Rydenstam & Wadeskog "Hushållen: Producenter eller Konsumenter" (The household: producer or consumer?), Appendix 4 in SOU 1996:10

7 In economists' terminology, they strive to equalise the utility of each unit of time used.

8 This of course depends on the assumptions made about the division of labour within the household and the rules governing this division of labour.

salary, to spend time in household work or to spend time on personal or free time activities.

The wage work category is not problematic, but the distinction between what is household work and free/personal time is probably not as apparent. The most commonly used criteria for deciding how to distinguish between what could be labelled “work” as opposed to “non-work” use of time is the so called Third Person Criteria, originating from Margret Reid[9].

> "If any activity is of such character that it might be delegated to a paid worker, then that activity shall be deemed productive"[10]

The simple idea behind this is that when we perform an activity that we could possibly conceive of paying someone else to perform for us we are in fact doing productive work. We can pay someone else to babysit, wash the car, do the dishes and walk the dog. We cannot pay someone else to eat, sleep or take a shower for us.

Given that activities performed in and around the household can be classified as productive activities, i.e. comparable to the work we do as employed, these activities should ideally also be studied in terms of their environmental effects. There are few, if any, studies that focus on home production in terms of its environmental effects.[11]

The amount of production performed in the household sector, i.e. by all households, can be compared to the amount performed in the formal economy by salaried workers. As household production is not paid, the comparison can mainly be made in terms of hours worked in the different sectors, although we will come back to the value of household production. The following diagram illustrates the number of hours worked in 1990/91 for various market and nonmarket sectors/activities, for men and women. Domestic work, i.e cooking, cleaning, washing etc. uses around 40% more hours of working time than the service sector. The households time used for purchasing goods and services is comparable with the time used in the wholesale and retail sectors.

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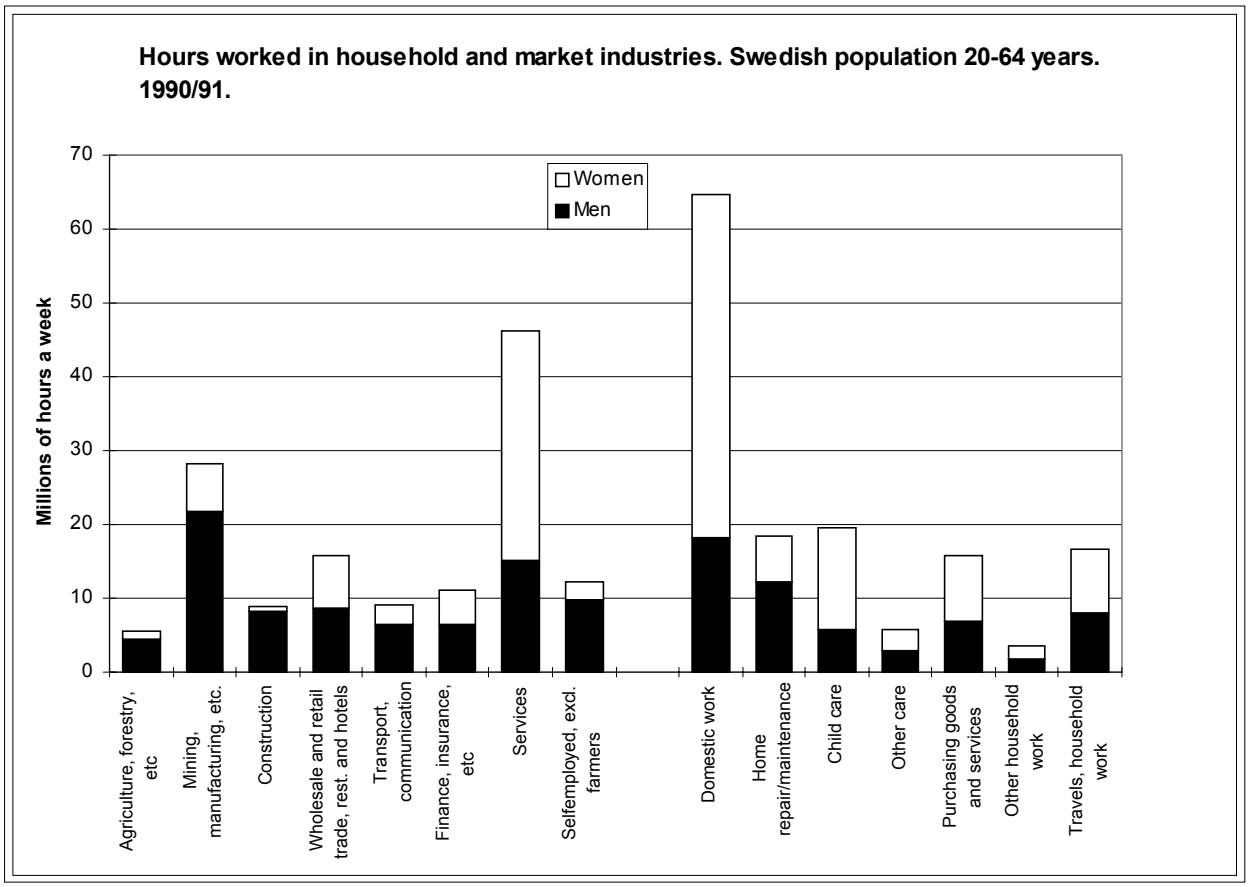
9 Reid, M "Economics of household production", New York, 1934

10 Quoted in Goldschmidt-Clermont "Unpaid work in the household", ILO, 1982

11 There are a lot of sectoral studies that include households, either as an aggregate or in different groupings. But these do not analyse the environmental effects of the household in the framework of the organisation of every day life. Most often they group the households according to income, type of dwelling, access to car etc.

Diagram 4.2 Hours worked in households and market[12]



This production, regardless of how we value it, will of course have an environmental impact just as the formal production of the same goods and services do. It raises interesting questions concerning the relationship between household production and industrial production in terms of environmental effects. As production tasks are reallocated back and forth between the formal and household sector over time - is the over all production processes allocated in the environmentally most efficient way?

We have no way of answering these questions today. The data available do not enable us to analyse and answer them. Further developments of the NAMEA could look into addressing this broader view of the economy, where a substantial amount of production occurs in the household sector.

4.4 Indirect emissions from private consumption

Linking macro and micro data - the general idea

As it stand today, the NAMEA produce statistics on over all emissions etc., by industry and commodity in an aggregated version of the national accounts. It uses these emission data, for instance, to produce a set of indicators such as emission per SEK value added in

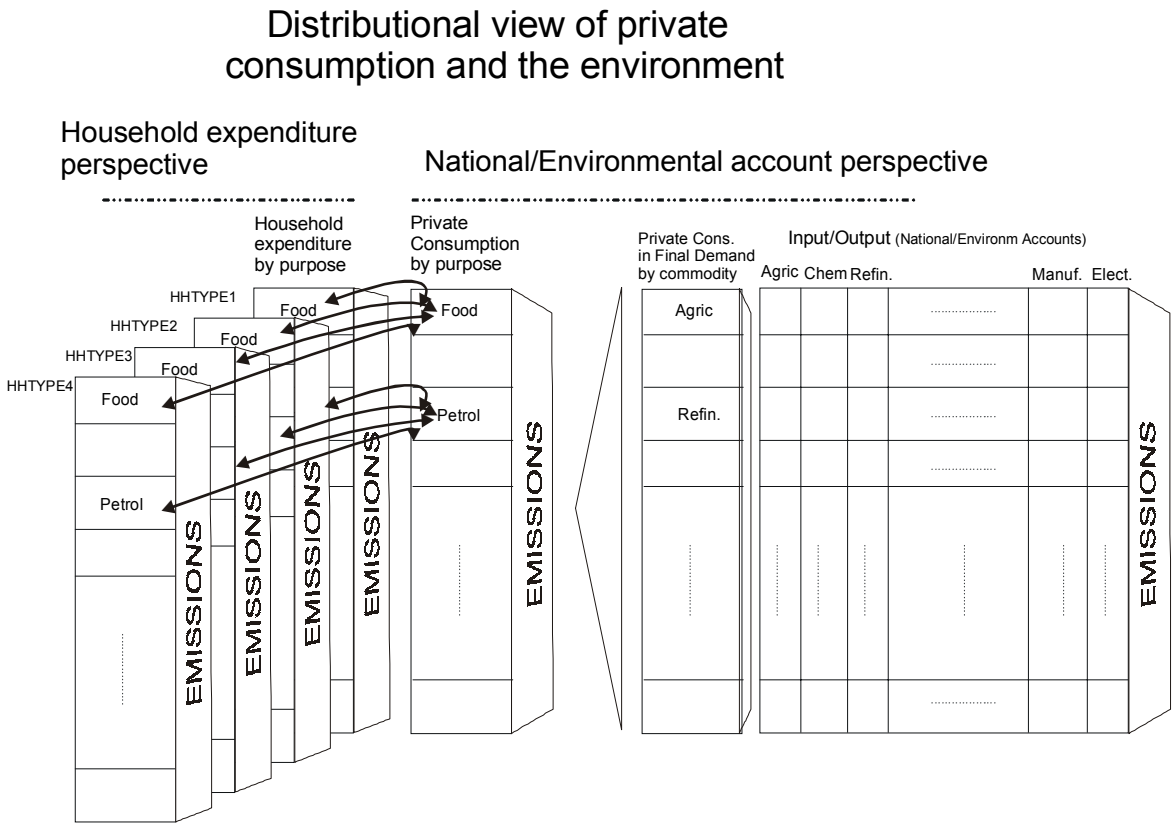
12 Rydenstam & Wadeskog *A Statistical System on Household Production and Consumption*, in Statistics in Transition, Journal of the Polish Statistical Association, Nov 1995.

the different sectors. This is interesting in itself, but the NAMEA could become more interesting from a consumption/household, or distributional, point of view if these emissions also could be allocated over different household types, region or other distributional classifications.

Given that the NAMEA is based on the national accounts and the sectoral classification of these, it would seem possible to convert the emissions from private consumption by sector or commodity to the COICOP categories that classify according to purpose. With this classification it would then seem possible to link the accounts data to the expenditure survey (HBS) where expenditure/consumption can be classified according to the COICOP. With this link between the private consumption of the accounts and the expenditures of the HBS - it would then be possible to allocate the emission in production caused by the consumption choices of different household types that can be constructed through the HBS. We would then introduce a distributional aspect of the NAMEA.

This can be illustrated as in the following diagram.

Diagram 4.3 Linking NAMEA and household budget surveys



The method used

The analysis is based on the 1992 HBS[13]. This survey was based on a sample of 6000 households of which 3806 participated in all moments of the survey. They kept an

13 Statistics Sweden "Hushållens Utgifter 1992"

expenditure log of everything purchased over a 4-week period. In addition to this there is an interview in which background data on the household is collected, as well as data collected from registers, mainly on incomes. In terms of background data, only the demographics of the household, i.e. household composition were used for the micro-analysis in the present study. The effects of using other classifications are briefly shown but not analysed further.

Households were classified into seven categories, or household types. These categories were originally designed to facilitate the further linking with the 1990/91 TUS and the travel surveys. The household types are very different in size, when scaled up to population size, and the different surveys have different survey population, which makes the translation of the macro environmental and economic data to these populations somewhat difficult. It has not been possible to deal with this in the context of this project. Using the HBS, the population classified according to the different household types comes out like this:

Table 4.1 Population in HBS

	House-holds n	Individuals n	Adult equival. n
Single women < 65	525252	525252	525252
Single man < 65	614539	614539	614539
Single 65+	186381	186381	186381
Single with child(-ren)	197547	497071	363879
Cohabs < 65 - no children	693028	1387588	1095781
Cohabs 65+ - no children	404902	809803	639745
Cohabs with children	1005570	3892457	2514541
Other	1096	3697	2490
All	3628316	7916787	5942607

A few households could not be classified into any of the categories in a consistent way across the surveys. These were discarded in the calculations. Future analysis will of course have to be more precise in this respect.

Of the household types, households with couples and children are the dominant, accounting for almost half of all individuals and a quarter of all households. The low share of elderly singles is a reflection of the fact that the HBS has a maximum age of 75.
The method for linking the HBS with the NAMEA can be described in the following steps:

The expenditure categories in the HBS and the consumption by purpose categories in the national accounts were reclassified according to a common classification scheme – 30 categories. A set of 7 household types where then constructed that would act as a least common denominator between the individual/household based surveys. Households in the HBS were then classified according to these 7 categories and total (weighted)

expenditures were calculated for the 30 categories as well as the shares for each household type of these totals.[14]

The distribution of expenditure shares between the household types was then used to allocate the private consumption by purpose in the national accounts to each household type. Differences between the levels of expenditure/consumption between the HBS and the national accounts made it necessary to make this simplification.

Private consumption by purpose for the different household types was then converted into private consumption by commodity in the SNA-classifications by a conversion matrix. This gave the private consumption by commodity for the different household types. This was then translated into shares for the different household types.

Disaggregated emission data by industry was converted into emissions by commodity produced by use of the so-called make matrix, i.e. what commodities are produced by which industries. Total emissions for SO_2, CO_2 and NO_x were then related to the output value of each commodity, thereby giving emission coefficients, e.g. tonnes CO_2 emission per million SEK of pulp.

The consumption shares (by commodity) was then used to allocate the private consumption vector (in producers prices) in the provisional 1991 Commodity-by-Commodity input output table over each household type. This simplification was due to the different price systems in the different sources (producers' prices vs. purchasers prices).

Using the inverse matrix, production levels (by commodity) was calculated for each household type. These production levels were then linked to the emission coefficients and the emissions for each household type could be calculated.

There are many aspects of this process that would need further analysis. One is the difference between the estimates of expenditures/consumption in the HBS and the national accounts private consumption (by purpose). Reallocations and imputations in the national accounts and the energy accounts need to be analysed from an environmental point of view. The same applies to imports, taxes/transfers and trade margins and the use of matrices in producers and purchasers prices that is linked to this.

Results

In table 4.2 the indirect emissions caused by private consumption, i.e. emissions generated in the production/distribution processes leading up to the commodity/service in the shop, is presented. Total emissions caused by the different household types are directly related to their respective shares of total expenditures on the different commodities and the number of households/individuals in the different categories. Total emissions for the different household types are then converted into emissions per household, individual and adult equivalent, using information on the survey populations in Table 4.1.

Looking at the total emissions, the largest household category – Cohabitants with children – account for between a third and half of the total indirect emissions. But translating the

14 See Table 4.9 in the appendix to this chapter

emissions into a per capita or per adult equivalent shows that the individuals in this category are well below the average.

Table 4.2 Calculated indirect emissions caused by private consumption

Household type	Total emissions			Per Household			Per Capita			Per Adult Equivalent		
	CO2 Ton	SO2 Ton	NOx Ton	CO2 Kg	SO2 Kg	NOx Kg	CO2 Kg	SO2 Kg	NOx Kg	CO2 Kg	SO2 Kg	NOx Kg
Single women < 65	1215902	2100	8917	2315	4	17	2315	4	17	2315	4	17
Single man < 65	1472184	2497	10325	2396	4,1	16,8	2396	4,1	16,8	2396	4,1	16,8
Single 65+	488048	854	3188	2619	4,6	17,1	2619	4,6	17,1	2619	4,6	17,1
Single with child(-ren)	770385	1293	5132	3900	6,5	26	1550	2,6	10,3	2117	3,6	14,1
Cohabs < 65 - no children	3051533	5249	20023	4403	7,6	28,9	2199	3,8	14,4	2785	4,8	18,3
Cohabs 65+ - no children	1412011	2421	9179	3487	6	22,7	1744	3	11,3	2207	3,8	14,3
Cohabs with children	5691997	9671	36090	5660	9,6	35,9	1462	2,5	9,3	2264	3,8	14,4
All (total)/Average (rest)	14102060	24085	92854	3887	6,6	25,6	1781	3	11,7	2373	4,1	15,6

The differences between the rankings of the household types in terms of total or per capita emissions illustrate the need for choosing a focus when viewing the environmental impact of consumption. The consumption patterns/levels of individuals in the household category that accounts for the major part of total emissions is more environmentally friendly than the individuals in households that account for a lesser part of total emissions.

The results presented over the household types can be disaggregated further by looking at the different expenditure categories themselves. This is done in table 4.3, where the total emissions, over all household types, above have been allocated over the 30 expenditure by purpose categories. This illustrates the shares of CO_2, SO_2 and NO_x emissions, emanating from each expenditure category.

Table 4.3 Allocation of emissions over expenditure categories

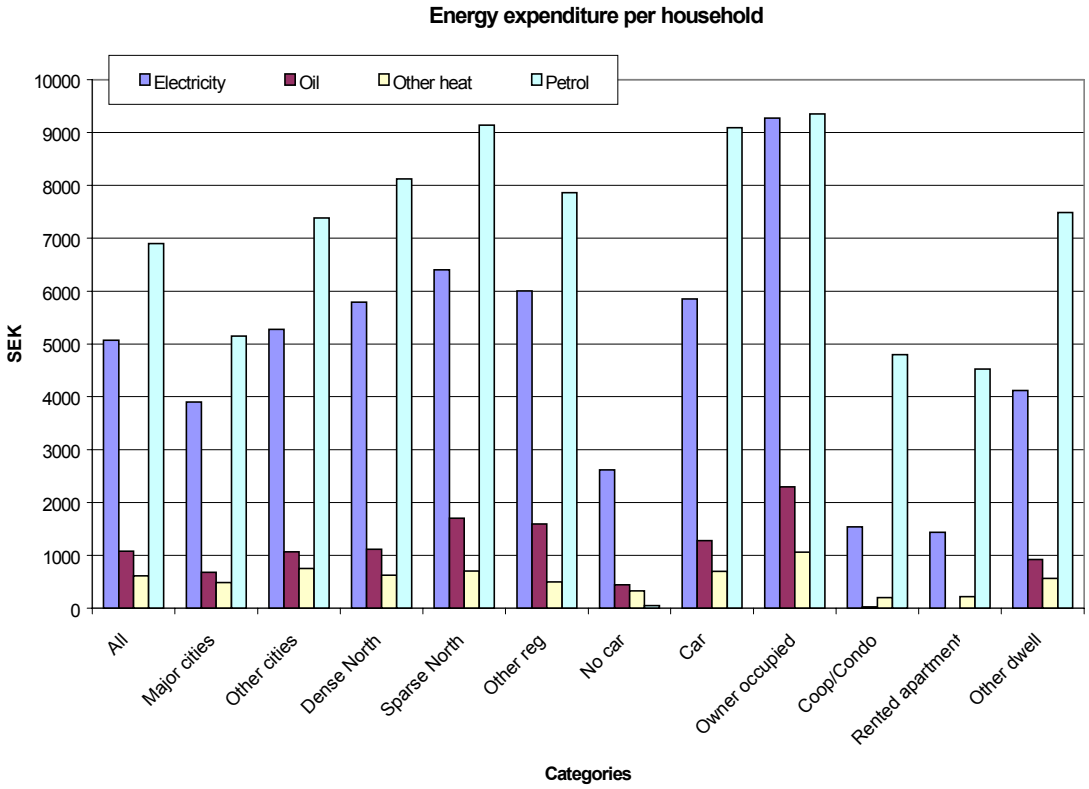
	CO2	SO2	NOx
	%	%	%
Food	18.5	12.4	32.6
Drink	1.0	0.9	1.1
Tobacco	0.7	0.6	0.8
Clothing and footwear	0.7	0.6	0.5
Gross rent and water charges	13.8	12.3	8.0
Electricity	19.6	21.3	6.1
Energy for cottage	0.0	0.0	0.0
Liquid fuel	0.4	0.7	0.1
Other fuels (incl gas)	8.8	9.6	2.7
Furniture & hh textiles	1.8	2.3	1.4
Petrol	1.7	3.4	0.5
Major appliances	0.2	0.2	0.2
Hardware	1.3	2.0	0.8
Household services (priv)	0.1	0.1	0.1
Household services (publ)	0.4	0.3	0.5
Medical care etc	0.7	1.0	0.8
Vehicles etc	1.1	1.0	0.7
Veh maintenance	3.8	3.5	4.6
Rail transport	1.7	2.0	2.9
Buses & local transp	4.4	5.1	7.4
Air transport	5.8	6.7	9.7
Other transport	3.5	4.1	5.9
Communication (post/tele)	1.0	0.9	1.0
Leisure equipment (TV, Stereo etc)	2.2	2.1	3.5
Entertainment etc	1.5	1.2	1.9
Literature	0.9	1.4	1.2
Education	0.1	0.1	0.1
Restaurants and Hotels	2.7	2.2	3.1
Misc pers goods	0.9	1.6	0.9
Banking, insurance, transfers	0.6	0.5	1.1
Total	100	100	100

Expenditure on food accounts for a third of the NO_x-emissions. Expenditure on electricity accounts for over 20% of the SO_2 emissions. In the appendix to this chapter, the multipliers for the different expenditure categories are presented, which shows how this type of analysis can be used to calculate the CO_2 emissions caused by the purchase of 1 SEK of Food, Drink etc.

A set of only seven household types will necessarily conceal variations within the groups. Energy use is the dominant source of emissions for both direct and indirect emissions by consumption. Future analysis of the emissions caused by consumption will have to take account of further dimensions than the demographics used in the household types above.

Diagram 4.4, below, illustrates how some other factors influence expenditures on energy goods. The calculated weighted average expenditure for Electricity, Oil, Other heating and Petrol is presented according the region where the household resides, access to a car and the type of dwelling.

Diagram 4.4 Average expenditures for energy goods



Petrol consumption increases with the distance from the urban regions, as does electricity expenditures. Access to a car is positively related to petrol expenditures, electricity and oil expenditures. Low or none existing average expenditures for oil and other heating in rented and coop apartments is a reflection of the fact that these are included in the rent and seldom paid directly by the tenant.

Another common way of classifying households is, of course, by income. It is natural to assume that there is a regressiveness in consumption of energy goods, i.e. that energy goods accounts for a larger share total expenditure of poorer household than it does for more wealthy households. This would then imply, for instance, that fiscal measures introduced to reduce energy consumption would hit the poorer households more. In table 4.4, the expenditure shares for households classified according to their total expenditure compared to the mean of total expenditure is presented. This measure is used in recent Eurostat compilations of HBS data. The table shows expenditure shares for, what is called domestic energy, i.e. total expenditure on energy for heating, lighting, power and cooking. This is calculated from the EUROSTAT Family Budgets expenditure categories as electricity + gas + other fuels.[15] The calculated shares for Sweden has been added from the Swedish HBS.

15 Sources: EUROSTAT Family Budgets 1992, 1993; EUROSTAT calculations; Statistisches Bundesamt (1994) and EU project PL950582 Environmental Fiscal Reform. The Swedish figures are based on the 1988 Household Expenditure Survey.

Table 4.4 Distribution of total expenditure percentages on domestic energy. Percentages of total household expenditure in 1988[16]

	All households	Expenditure groups						Social transfers	Pensions
		< 0.4	0.4-0.6	0.6-0.8	0.8-1.2	1.2-1.6	> 1.6		
		of mean total expenditure							
Belgium	5,28	9,07	7,09	6,30	5,10	4,15	2,96	6,99	6,18
Denmark	6,41	13,91	9,95	8,58	6,50	5,00	4,36	7,68	11,50
W.Ger	5,44	10,03	9,33	7,96	5,54	3,87	3,18	8,25	7,46
Greece	4,14	12,48	10,10	7,42	6,12	4,91	3,37	4,97	4,97
Spain	2,79	4,11	3,54	3,11	2,74	2,51	2,09	3,15	3,39
France	4,05	6,82	5,48	4,89	4,00	3,18	2,40	4,44	5,18
Ireland	6,20	9,53	8,57	7,64	6,44	5,20	4,16	9,41	7,60
Italy	4,65	6,01	5,35	5,00	4,80	4,63	3,31	6,31	5,61
Lux	5,33	8,93	7,25	6,26	5,19	4,30	3,48	6,26	6,34
Netherland	3,98	8,73	5,70	4,66	3,99	3,35	2,70	5,45	4,29
Portugal	4,17	9,08	6,24	5,30	4,83	3,78	2,63	3,84	3,28
UK	4,65	6,17	7,21	5,52	4,07	3,65	2,21	8,73	4,95
Sweden		*4,8*	*3,5*	*3,3*	*3,4*	*3,2*	*2,9*		

There is some support for regressiveness in the expenditure shares of these energy goods. Policy oriented studies focusing on the distributional aspects of the environmental effects of household consumption will have to address these issues. Future disaggregations of NAMEA over household types will of course also have to incorporate an income dimension into the classifications, given that the samples permit this.

4.5 HBS and private consumption in the National Accounts

Ideally, a HBS would play an important role in calculating private consumption in the national accounts (NAPC). But private consumption and the different GDP components are basically calculated on the changes in the period. This means that the absolute level of total expenditure as it appears in the HBS is not really of any greater interest. Basically, the incremental approach is one way of constructing the accounts in order to achieve consistency in the series. The levels of different private consumption categories in the national accounts will therefore reflect the base levels set at some point in time as well as the skills in establishing the growth rates in the periods since then.

In some countries, the HBS is seen as a source for independent estimates of the levels of private consumption. Differences in the levels predicted from the accounts and from HBS will differ by default and this is probably seen as an argument not to put too much of an emphasis on the totals and levels of the HBS. There is of course no way of concluding that one estimate is more true than the other - although the national accounts figures are consistent with other economic indicators.

16 From Köhler, Luhmann & Wadeskog “Expenditure on environmentally sensitive goods and services: Household spending in Europe”, Working paper 1 in project “Environmental Fiscal Reform” , EC Environment and Climate Research Programme, 1998

The final consumption in the national accounts (NAPC) is based on many sources - of which the HBS is one source, although insignificant in most countries. The last time the HBS was put to any greater use in the national accounts in Sweden, was when the 1978 survey was used to reset the levels of private consumption in the early 80's. Apart from a few exceptions, these are still the base levels used in the national accounts.

It is well known that NAPC and total expenditures as they come out in the HBS differ. According to a survey by Eurostat, the discrepancy for total consumption is around 30%, of which 2/3 comes from differences in population, concepts and definitions and the rest comes from underreporting of different sorts.[17] The differences for some countries are presented in the table below.

Table 4.5 Discrepancies between HBS and national accounts data

Country	HBS data	Popul. Adj.	Def. & concept adj.	Imputed rent adj	NA estimate
	%	%	%	%	%
Austria	77	91	91	99	100
France	64	66	77	86	100
Germany	67	77	79	87	100
Italy	63	67	74	82	100
UK	72	75	81	90	100

The difference in population stems from the fact that HBS survey private households. This means that it does not include persons living in institutions or foreign tourists. Both included in the NAPC. It also comes from the differences in the age groups surveyed in the HBS. In Sweden there is an age limit of 75 in the HBS while the NAPC covers consumption regardless of age.

The differences in definitions and concepts are due to the different treatment of a series of expenditure types. Among these are:

- Consumption of household own production, benefits in kind, insurance, hiring/leasing, gifts and transfers, equipment and clothing needed for work, capital expenditure etc.

- The major part of the difference in concepts and definitions has to do with the imputation of the rent of housing.

An adjustment of the HBS to cater for these differences will bring the totals closer, but there will still be discrepancies in different goods categories.

17 This section is based on "Task force on the use of Household Budget Surveys for National Accounts - Final report", Eurostat, September 1996

It has not been possible to correct for these apparent discrepancies in the HBS and the national accounts within the framework of this project. Table 4.6 below, illustrates the unadjusted differences between the HBS and the NAPC.

Table 4.6 Classification used for consumption by purpose and unadjusted discrepancies between HBS and national accounts

Consumption by purpose categories	HBS % of NAPC	Consumption by purpose categories	HBS % of NAPC
Food	100	Medical care etc	101
Drink	70	Vehicles etc	118
Tobacco	62	Veh maintenance	59
Clothing and footwear	78	Rail transport	51
Gross rent and water charges	92	Buses & local transp	78
Electricity	83	Air transport	9
Energy for cottage		Other transport	33
Liquid fuel	67	Communication (post/tele)	79
Other fuels (incl gas)	22	Leisure equipment (TV, Stereo etc)	87
Furniture & hh textiles	73	Entertainment etc	79
Petrol	88	Literature	90
Major appliances	110	Education	88
Hardware	85	Restaurants and Hotels	75
Household services (priv)	66	Misc pers goods	96
Household services (publ)	70	Banking, insurance, transfers	624

Apart from the problems described here, there are other obstacles inherent in the expenditure survey. One is the difference in energy consumption, e.g. heating, where households in rented apartments seldom pay specifically for their heating whereas households with their own house do. The same applies to petrol expenditures, where households with one or two company cars will have their employer pay for petrol and maintenance. Electricity has also been perceived as somewhat of a problematic area.

Future analysis linking micro and macro data on consumption will have to deal with these differences. A more thorough analysis of the key differences, from an environmental perspective, is necessary.

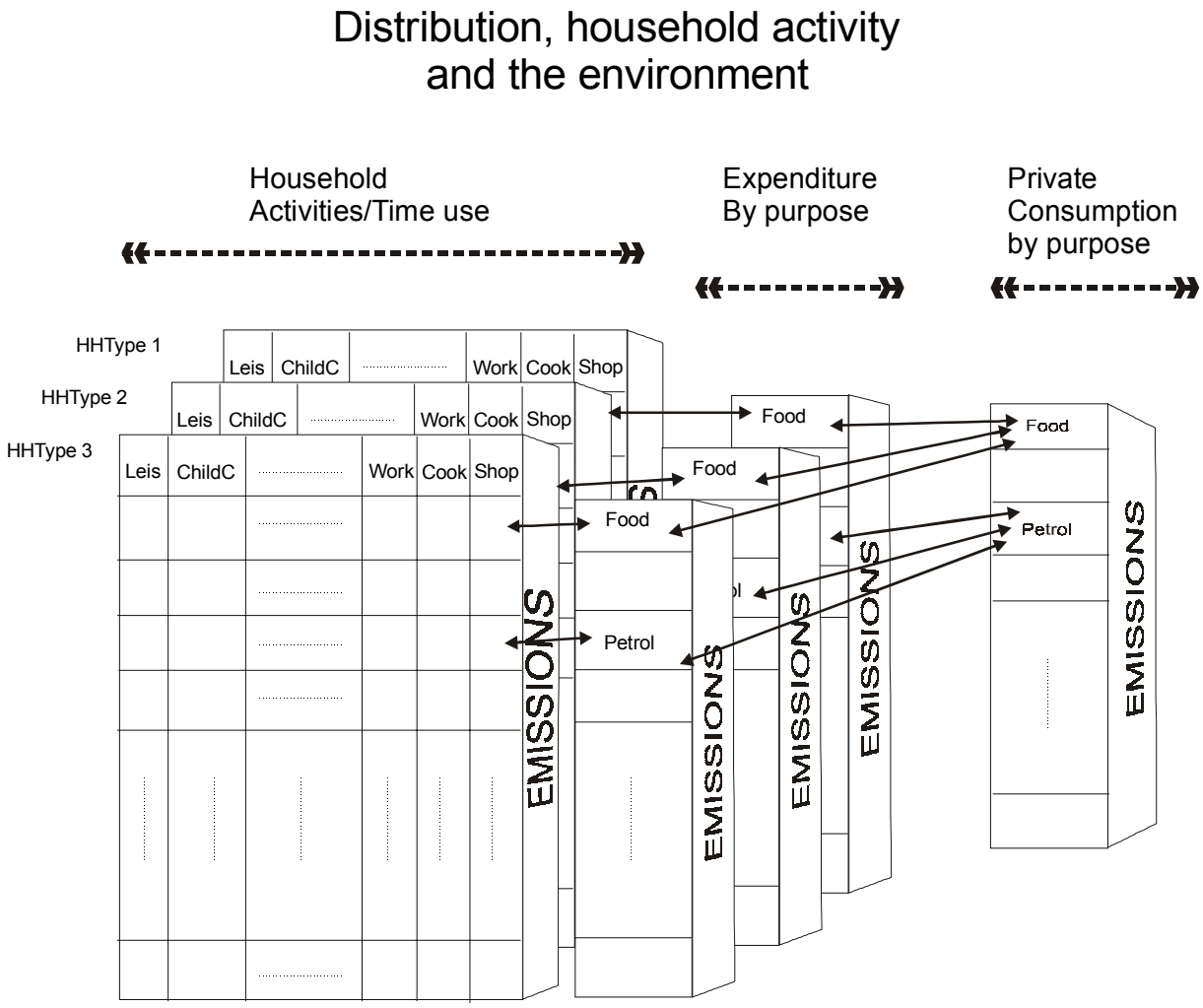
4.6 Households and the activities they perform

Diagram 4.1 displayed the household as consumer and producer, trying to use available resources the best possible way. This means deciding about the use of time and incomes and this in turn will influence the environmental impact of the household. Therefore it would be of great interest to include the activity patterns of households in the NAMEA. Ideally this should be done by doing households surveys that cover both expenditures and time use. This is however not a trivial task as the non-response in these surveys is critical. A full-scale time use survey coupled to a full-scale expenditure survey is probably out of the question. However, a couple of smaller pilot surveys using a reduced time use module attached to a simplified expenditure survey done at Statistics Sweden shows promise. This makes it possible to establish an expenditure-activity relationship on the micro level. Further development along this line will have to wait until there is sufficient interests in

the role of the household in sustainable development to merit this kind of composite survey.

Given that we have to work with existing time use surveys, the general idea is to link expenditures to activities by matching the household types in the HBS and the time use survey on a group level. This would expand the left-hand part of diagram 4.3 in the following way.

Diagram 4.5 Household activities and NAMEA



The critical step in this procedure is of course to allocate the expenditures over activities, e.g. how much of the expenditure on petrol is used on driving to work, day-care, visiting friend, holiday trips etc. For petrol this may be simpler as this can be allocated according to the time travelled by car. Other expenditures are more complicated to allocate. However, this is something that has been done and will be done in the context of so called Household Satellite Accounts.[18]

18 Statistics Finland has produced a report on this for Eurostat - "Proposal for a Satellite Account of Household Production". This was done for the Pilot Study on future harmonised European Time Use Surveys. Statistics Canada, OECD, UN and others have made similar reports.

As one example of what the above can look like in figures, Statistics Sweden has calculated a simple Household Satellite Account using the 1990/91 time use survey and the 1988 Household Budget Survey[19]. The table only details the activities that are seen as household production as the purpose of Household Satellite Accounts generally is to calculate a production value for the household sector.

Table 4.7 Input-Output household production measure for Sweden

Mill SEK	Cooking	Cleaning/ Washing	Mainten.	Shopping	Child care	Gardening	Other	Transport	Input	Cons	Tot Exp
Food	93700	0	0	0	0	0	0	0	93700	0	93700
Kitchen equipm	4770	490	130	0	0	130	0	0	5520	0	5520
Cleaning/Washing equipm.	0	1500	0	0	0	0	0	0	1500	0	1500
Energy	850	600	190	0	470	0	430	0	2540	12350	14890
Transport	0	0	40	0	0	0	0	26610	26650	51210	77860
Clothing/Shoes	2020	1430	450	890	1100	270	1030	940	8130	26570	34700
Furniture	660	460	150	0	490	0	330	0	2090	12260	14350
Househ articles	5870	4170	10120	180	3210	770	2990	190	27500	85840	113340
Personal equipm.	80	2790	20	30	660	10	40	40	3670	21490	25160
Services	320	320	320	320	3230	320	320	320	5470	4080	9550
Misc equipm.	580	430	540	300	2330	940	310	3840	9270	78330	87600
Sum Inputs	108850	12190	11960	1720	11490	2440	5450	31940	186040	292130	478170
Value Added	119630	84910	26600	52990	65310	15750	60970	55510	481670		
Production cost	228480	97100	38560	54710	76800	18190	66420	87450	667710		
Labour input share	52%	87%	69%	97%	85%	87%	92%	63%	72%		
Labour cost (Wage = 70 SEK)	119630	84910	26600	52990	65310	15750	60970	55510			
Time use (Mill hours)	1709	1213	380	757	933	225	871	793			
Men	505	298	325	324	271	127	409	383			
Women	1204	915	55	433	662	98	462	410			

The larger grey area shows the allocation of expenditure over activities. On the right we have a sum for the expenditures on inputs as well as the total expenditure for this category, ”Tot exp”. The difference between these is the consumption part of total expenditures. Summing over all expenditure categories we see that 39% of what we

19 Rydenstam & Wadeskog *A Statistical System on Household Production and Consumption*, in Statistics in Transition, Journal of the Polish Statistical Association, Nov 1995. The table is constructed as a fictitious input-output matrix. This approach has been used in several studies and the inspiration for this approach is Duncan Ironmonger, Cf *National Time Accounts: A Focus for International Comparison, Modelling and Methodology* paper presented at the 14th Annual Meeting of the International Association for Time Use Research, Rome, June 1992 or Ironmonger D (ed), *Households Work*, Sydney 1989.

There are many similar accounts Cf Jackson C *Trends in the Value of Household Work in Canada, 1961-1986* paper presented at the annual meeting of the Canadian Economics Association, Carleton University, Ottawa, June 1993; Australian Bureau of Statistics, *Unpaid Work and the Australian Economy*, Occasional Paper, Cat. No.5240.0, September 1994; Bureau of Economic Analysis, *Measuring Nonmarket Economic Activity*, BEA Working Papers, U.S. Department of Commerce, 1982; Chadeau A, *What is Households' Non-Market Production Worth?* OECD Economic Studies, No.18, Spring 1992; Chadeau A & C Roy "Relating Households' Final Consumption to Household Activities: Substitutability or Complementarity Between Market and Non-Market Production," *Review of Income and Wealth*, Series 32, No.4, December 1986.

usually refer to as private consumption can be seen as inputs into the value adding process in the household.

The lower grey area displays the allocation of time for men and women over the productive activities. The relationship between "Value Added" and "Production cost" can be seen as a measure of labour intensity. This ratio is in the row below the production cost.

The imputed wage is of course essential in the calculations of Value Added. The wage used in the example above is that of a municipal housekeeper or aid that perform all sorts of tasks in the household - mainly for the elderly. For the years in question this wage was appr 70 SEK per hour.[20] This wage has then simply been multiplied with the number of hours that men and women spend cooking, cleaning etc.

Summing up the value added we arrive at a figure of 480 Billion SEK that represents the contribution of the household sector to Swedish economy around 1990. As a comparison, GDP was 1300 Billion SEK in 1990, which means that the household sector produced a value of 37% of that of the formal economy. Comparing single activities, the active child care produced in the household accounted for 2/3 of the value spent in Sweden on, mostly municipal, day-care.

The picture given above of the household and its productive activities suffers from one serious drawback in terms of getting it comparable to the national accounts and to environmental indicators that are linked to economic activities and processes.[21] We do not have market valuations of neither the input nor the output of household production. So although we can impute values on the input side, we can not really say anything about what comes out of the process. In fact, apart from maybe a few exceptions, the activities we describe above are not unique in ways that makes it possible to find market equivalents and use these for imputing values to the output. Activities such as cooking, cleaning, repairing, gardening etc are really sets of activities. Cooking, for instance, can be one of several types of breakfasts, dinners etc for varying number of eaters.[22]

Given these limitations today, it is still desirable to take the expenditure-activity link further. With this kind of information it would be possible to see how the different activities undertaken by households in their everyday life, contribute to the environmental problems, on a group level. This would invite more thorough discussions on changes in

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20 For a further discussion on the relevant wage Cf Goldschmidt-Clermont L "Monetary Valuation of Non-market Productive Time: Methodological Considerations," *Review of Income and Wealth*, Series 39, No.4, December 1993; Gronau R, "The Intrafamily Allocation of Time: The Value of Housewives Time," *American Economic Review*, Vol.63, No.4, September 1973; Heckman J, "Shadow Prices, Market Wages and Labor Supply," *Econometrica*, Vol.42, No.4, July 1974., Waring M, *Counting for Nothing: What Men Value and What Women are Worth*, Wellington, New Zealand, 1988.

21) A more formal analysis of these linkages can be found in Nilsson & Wadeskog “Households and sustainability – possible use of potential data”, Working paper 12 in project “Environmental Fiscal Reform”, EC Environment and Climate Research Programme, 1998

22) It is worth noting that there are examples of data on the amount of goods and services produced by the households. The data that does exist come from single projects with limited samples and based on various techniques. It is apparently possible to get this kind of data. It is however not apparent that it is possible to do this within the framework of an existing time use survey or a coupled time use/expenditure survey.

life styles etc. Much of this discussion has so far been based on hypothetical examples and fragments of what constitutes every day life.

4.7 Further studies

Establishing a household perspective in the NAMEA is possible and desirable. The examples given in this chapter have illustrated some of the sources and techniques that are possible to use in order to do this. There are many deficiencies in the data today that have to be dealt with in order to introduce the household sector into NAMEA more formally.

We have pointed at a series of inconsistencies between the consumption data in the HBS and the national accounts that have to be dealt with. The same goes for the production/final demand matrices used for the input output analysis – the allocation of trade margins, imports, taxes etc. So there is much work to be done to get the basic modelling of the linkages consistent and analytically correct.

Apart from this there are other areas that would be interesting to pursue. One is the possibility of including the activity pattern of household, as it comes out of the time use surveys. If it is not possible to launch surveys that collect expenditure and time use data in the household level, further analysis and possible marginal additions to coming expenditure and time use surveys could probably prove fruitful.

Another interesting area is the possibilities of further disaggregations of expenditure/consumption/production categories to account for more or less environmentally friendly goods and services. This has been one of the key areas in recent years concerning the households and the environment – for instance the introduction of different Eco-labelling systems. It would be interesting to see if the NAMEA could at least produce indicators of reallocations towards more environmentally friendly production/consumption.

With a more solid calculation of the link between expenditure data and emissions it would also be possible to use the NAMEA as a vehicle for environmental indicators on a household level. That is one of the possible uses of the emissions multipliers illustrated in table 4.8 in the appendix to this chapter.

Appendix to Chapter 4

Table 4.7 Indirect emission multipliers from expenditure by purpose

	Per Million SEK			Per SEK		
	CO2 Kg	SO2 Kg	NOx Kg	CO2 Gr	SO2 Gr	NOx Gr
Food	50482	57	629	50.48	0.06	0.63
Drink	32085	48	235	32.09	0.05	0.24
Tobacco	32085	48	235	32.09	0.05	0.24
Clothing and footwear	23665	33	106	23.66	0.03	0.11
Gross rent and water charges	10983	17	42	10.98	0.02	0.04
Electricity	173534	323	354	173.53	0.32	0.35
Energy for cottage	0	0	0	0.00	0.00	0.00
Liquid fuel	73114	244	136	73.11	0.24	0.14
Other fuels (incl gas)	171755	319	350	171.75	0.32	0.35
Furniture & hh textiles	35698	77	170	35.70	0.08	0.17
Petrol	73114	244	136	73.11	0.24	0.14
Major appliances	19864	32	94	19.86	0.03	0.09
Hardware	46978	121	182	46.98	0.12	0.18
Household services (priv)	14970	20	123	14.97	0.02	0.12
Household services (publ)	14970	20	123	14.97	0.02	0.12
Medical care etc	16495	49	114	16.50	0.05	0.11
Vehicles etc	22624	35	90	22.62	0.03	0.09
Veh maintenance	22190	34	166	22.19	0.03	0.17
Rail transport	108370	215	1199	108.37	0.21	1.20
Buses & local transp	108370	215	1199	108.37	0.21	1.20
Air transport	108370	215	1199	108.37	0.21	1.20
Other transport	108370	215	1199	108.37	0.21	1.20
Communication (post/tele)	12052	17	76	12.05	0.02	0.08
Leisure equipment (TV, Stereo etc)	34557	53	375	34.56	0.05	0.38
Entertainment etc	14970	20	123	14.97	0.02	0.12
Literature	17941	47	151	17.94	0.05	0.15
Education	14970	20	123	14.97	0.02	0.12
Restaurants and Hotels	17938	25	134	17.94	0.03	0.13
Misc pers goods	24197	69	132	24.20	0.07	0.13
Banking, insurance, transfers	8745	13	106	8.74	0.01	0.11

Table 4.8 Shares of total expenditures (total expenditure per household group/total expenditure)

	Single women < 65	Single man < 65	Single 65+	Single with child(-ren)	Cohabs < 65 - no childr.	Cohabs 65+ - no childr.	Cohabs with childr.	Total
Food	0.08	0.09	0.03	0.06	0.21	0.12	0.42	1.00
Drink	0.09	0.21	0.01	0.04	0.25	0.09	0.30	1.00
Tobacco	0.13	0.15	0.02	0.07	0.24	0.07	0.33	1.00
Clothing and footwear	0.11	0.07	0.02	0.06	0.22	0.08	0.44	1.00
Gross rent and water charges	0.10	0.12	0.03	0.06	0.20	0.08	0.40	1.00
Electricity	0.06	0.07	0.03	0.05	0.22	0.12	0.45	1.00
Energy for cottage	0.06	0.08	0.05	0.02	0.31	0.21	0.27	1.00
Liquid fuel	0.04	0.06	0.05	0.05	0.23	0.20	0.37	1.00
Other fuels (incl gas)	0.04	0.07	0.06	0.05	0.22	0.10	0.45	1.00
Furniture & hh textiles	0.09	0.07	0.02	0.04	0.26	0.13	0.39	1.00
Petrol	0.06	0.13	0.02	0.05	0.23	0.09	0.42	1.00
Major appliances	0.05	0.06	0.01	0.06	0.27	0.14	0.41	1.00
Hardware	0.10	0.07	0.02	0.05	0.24	0.12	0.40	1.00
Household services (priv)	0.08	0.05	0.07	0.08	0.21	0.10	0.41	1.00
Household services (publ)	0.01	0.01	0.00	0.07	0.00	0.03	0.88	1.00
Medical care etc	0.14	0.07	0.05	0.05	0.21	0.16	0.33	1.00
Vehicles etc	0.05	0.12	0.02	0.04	0.28	0.08	0.42	1.00
Veh maintenance	0.07	0.16	0.02	0.06	0.22	0.10	0.38	1.00
Rail transport	0.19	0.27	0.05	0.06	0.16	0.03	0.24	1.00
Buses & local transp	0.17	0.16	0.03	0.07	0.21	0.06	0.29	1.00
Air transport	0.13	0.12	0.02	0.04	0.28	0.08	0.33	1.00
Other transport	0.09	0.04	0.13	0.05	0.17	0.15	0.37	1.00
Communication (post/tele)	0.12	0.16	0.06	0.05	0.18	0.12	0.31	1.00
Leisure equipment (TV, Stereo etc)	0.07	0.11	0.02	0.06	0.21	0.09	0.44	1.00
Entertainment etc	0.09	0.15	0.02	0.04	0.22	0.11	0.36	1.00
Literature	0.12	0.11	0.04	0.04	0.22	0.13	0.33	1.00
Education	0.17	0.17	0.04	0.02	0.16	0.04	0.39	1.00
Restaurants and Hotels	0.12	0.18	0.01	0.05	0.23	0.04	0.37	1.00
Misc pers goods	0.12	0.06	0.02	0.06	0.21	0.08	0.44	1.00
Banking, insurance, transfers	0.07	0.11	0.02	0.04	0.27	0.08	0.42	1.00

5 Waste

Waste accounts for a substantial, and noticeable, part of the environmental impact of household consumption. Direct waste generation from household consumption appear in two forms. On the one hand there is the waste generated at the household location (the home). On the other, there is all the waste generated from consumption elsewhere, at work, holidays, shopping etc. Combinations of the two is also possible, e.g. food bought by a private person, brought home and cooked in the household, generating some waste, then brought to the office where it is eaten. The waste from the consumption of the house hold member at work is mixed in with the rest of the ”office-waste”. Which part of the waste should be considered as waste belonging to the household sector - just the part thrown in the household or all of it? From a data-gathering point of view, it is not a trivial task to try to capture this chain of waste generation. Below we present statistics for both the examples.

There is statistics on household waste in Sweden. Municipalities are responsible for waste of this kind and Statistics Sweden collected data from the municipalities in 1990 and 1994. The definition of household waste in this statistics is ”waste from households and similar waste from other sectors where people stay and therefore produce waste, for example business”.

Existing data covers private consumption regardless of location. Data on separate fractions (newspaper, packaging of paper, glass etc.) are not included at all since they are lumped together with similar waste from others as well as packaging not similar to household waste, e.g. used in the industry in the production chain. Other types of waste, for example biological waste used for the home compost or waste given to charity (e.g. used furniture) is not recorded at all.

In the table below, the amounts of mixed household waste and similar waste from households and other (business, stores etc.) are presented. Separately collected amounts for recycling are excluded.

Table 5.1 Mixed household waste and similar waste from households and other (business, stores etc.), ton

	1990	1994
Total	2 813 800	2 697 400
of which to		
Landfill	1 376 250	1 229 200
Incineration	1 283 550	1 337 500
Biological treatment	70 950	90 000
Recycling	18 950	14 500
Unknown treatment[23]	64 100	26 200

It is not possible to separate out the waste from households. In order to get a better view of the part emanating from households, we have to make estimates. Either directly, by

23 I.e the treatment has not been specified by the respondents

using other sources to get an idea of the share of the households, or indirectly, by using other sources to try to estimate the part not emanating from households.

Possible data sources for a direct estimate of household waste include:
- Household expenditure data where waste collection is one expenditure category
- Time use surveys, where the activities connected to waste handling/disposal as well as activities generating waste can be analysed
- Interviewing the organisations responsible for the waste collection schemes.

One advantage with first two sources, i.e. household based surveys, is that it gives a link to the kind of household analysis discussed earlier concerning expenditure, emissions, energy use, travel etc. It is also possible that questions on waste generation/disposal could be addressed more directly in future expenditure or time-use surveys. We have not pursued these alternatives in this project, although it is an interesting possibility for future studies.

The third alternative, interviewing organisations, was tried. Seven municipalities in Sweden were contacted, based on their system for waste collection and fee administration. They all charge every individual unit by weight; i.e. the waste collected at each site is weighted. This should, in principle, make it possible to separate the amounts coming from households. Unfortunately, it turned out that the municipalities were still not able to separate the amounts coming from households. Their databases are not designed to be able to report on a single type of customer. Also several representatives from waste handling organisations and companies have given the opinion that it is not possible to get direct information on the waste amount from households.[24]

As for an estimate of the amount of waste not coming from households, i.e. an indirect estimate of the amount coming from households, it is possible to start out with the statistics on household waste from industry although this is a subset of the possible sources not belonging to the household sector. We have used the 1993 data on household waste from industry.

In table 5.2 below the amount of waste per employee in the extraction and manufacturing industries is presented. Apparently, there are major differences between the sectors. The extraction industry (NACE 13-14) generates 5 times as much waste per employee as the average. In the food, beverage and tobacco industry (NACE 15-16) we suspect that some waste have been inaccurate classified by the companies in the survey, producing the large amount per employee. Apart from these two sectors, the amount of household waste per employee lies between 158 and 363 kg. The average is 226 kg.

24 According to one association of waste treatment plants in southern Sweden, it is not possible to divide the statistics into waste from households and similar waste from other parts in the society. The Swedish Association of Waste Management (RVF) is of the same opinion. On the other hand, the association ”Stor-Stockholms Energi AB” reporting on a study on energy recovery from 1982, claimed that only 50 percentage of ”household waste” comes from households.

Table 5.2 Household waste in industrial sectors 1993, ton and kg/employee

Sector of industry, NACE	Household waste, ton	Number of employees[25]	Kg household waste/employee
13-14	8 000	6 800	1176
15-16	28 000	61 900	452
17-19	2 000	12 100	165
20	5 000	27 600	181
21-22	17 000	86 900	196
23-25	10 000	50 600	198
26	4 000	16 300	245
27	12 000	33 100	363
28-35	44 000	279 200	158
36	4 000	17 500	229
Total	**134 000**	**592 000**	**226**

The estimate of waste per employee was then multiplied with the total number of employees to arrive at total waste generated by non-households. According to the Labour Force Survey (LFS) around 3.5 million persons were employed in Sweden in December 1993.

This means that 226 kg household waste/employee would give a total of approximately 790 000 tonnes waste from sources other than households. The amount of household waste should then be around 1 910 000 tonnes. This is of course an uncertain estimate. The average amount per employee in the industry may even be less representative for other sources.

With this estimate we can summarise the statistics of household waste as in table 5.3 below. By excluding the estimated waste emanating from other sources, roughly 70% of the amount presented in table 5.1 are attributed to household consumption.

Table 5.3 Summary of the amounts of household waste in Sweden, totals and per capita

	Mixed household waste, ton	Inhabitants in Sweden 1994	Kg mixed household waste/person
1) Total amount of household waste in 1994, including waste from business etc. (Private consumption wherever it takes place)	2 697 400	8 816 381	306
2) Amount of household waste 1994 from the household, calculated by deducting the estimated amount from business etc. (1993).	1 910 000	8 816 381	217

25 According to the industry statistics, which includes companies with >20 employees. The waste statistics includes local units with more than 20 employees. This may give a small underestimation of kg household waste/employee. (The employment statistics cover a larger part of the industry than the waste statistics.)

It is unclear if it will be possible to get better data on waste from the household sector in the future. It depends on the development of the collection scheme in the municipalities and the data registration/handling, i.e. if there will be interest in showing separate figures for the household sector. There is undoubtedly an increasing demand for this kind of data.

Another aspect of waste from household consumption is of course the indirect waste produced as part of the production process in producing the goods/services that households consume. It would be possible to analyse the part of all waste produced that can be attributed to private consumption, much in the same way that indirect emissions were calculated in previous sections of this report. There are problems in going from the data on waste generated by industrial sectors to waste linked to the production of specific goods. These may be of a bigger order when dealing with waste than when dealing with emissions, but they are nevertheless the same kind of problem.

Sources:
- Waste and recovery in municipalities in Sweden 1990, Na 28 SM 9201, Statistics Sweden
- Waste and returnable raw materials from the industry 1993, Na 28 SM 9501, Statistics Sweden
- Waste and recovery in municipalities in Sweden 1994, Na 28 SM 9502, Statistics Sweden
- Labour Force Survey, Statistics Sweden
- Industry statistics, Statistics Sweden

Verbal sources:
- Stor-Stockholms Energi AB
- The Swedish Association of Waste Management
- Some Swedish municipalities and one association of waste treatment plants in southern Sweden

6 Tables

Table 1 Consumption of energy commodities 1993

PJ [1]	Light heating oil	Heavy fuel oil	Gas	Petrol and diesel	Coke	Hard coal	Peat	Biofuel	Garbage	Elect-ricity	District heating	Other
Agriculture, forestry, fishing	4	1	1	20	0	0	0	0	0	7	0	0
Mining and quarrying	0	2	0	2	0	2	0	0	0	9	0	0
Manufacturing	14	58	11	19	26	18	1	164	0	168	14	55
food, textile, wood & mineral prod.	4	7	5	4	1	9	0	26	0	23	2	6
pulp, paper, printing	2	17	2	1	0	2	1	136	0	70	3	1
chemic and plast (excl. petr prod)	1	3	1	1	1	0	0	1	0	20	4	24
petrolium products	0	23	0	10	0	0	0	0	0	2	0	1
iron and steel	2	5	1	0	23	6	0	0	0	25	1	21
machinery and equipment, other manuf.ind	5	3	1	4	1	0	0	0	0	27	4	2
Elect., gas, distr.heat. water and ww treat.	4	32	16	1	0	28	40	38	16	38	0	14
Construction	5	0	0	14	0	0	0	0	0	3	1	0
Transport	0	60	0	64	0	0	0	0	0	12	1	27
Trade, services, waste treatment	6	1	1	4	0	0	0	0	0	9	19	0
Dwelling and premises	2	0	1	28	0	0	0	0	0	38	4	1
Public sector	11	4	1	6	0	0	0	0	0	32	25	9
Private consumtion	67	3	3	141	0	0	0	40	0	154	81	0
Total	114	161	33	300	26	48	41	243	16	470	146	108
Private consumption %	59%	2%	9%	47%	0%	0%	0%	16%	0%	33%	56%	0%

1) PJ = Petajoules, 10^{15} joules

Table 2 Emissions of CO_2, SO_2 and NO_x 1993

	1000 tonnes CO_2				SO_2				NO_X			
	Total	Stat comb	Mobile sources	Process	Total	Stat comb	Mobile sources	Process	Total	Stat comb	Mobile sources	Process
Agriculture, forestry and fishing	1985	488	1497	0	1	1	0	0	37	1	36	0
Mining and quarrying	479	362	117	0	2	1	0	2	5	0	3	2
Manufacturing	17403	12763	724	3917	49	11	0	38	45	16	5	23
food, textile, wood & mineral prod.	4676	2460	268	1948	12	3	0	9	17	8	3	6
pulp, paper, printing	1953	1840	82	31	18	5	0	13	15	5	0	9
chemic and plast (excl. petr prod)	2076	528	43	1505	4	1	0	3	3	1	0	2
petrolium products	1744	1742	2	0	6	0	0	6	3	0	0	3
iron and steel	5820	5392	31	397	9	1	0	8	5	1	1	4
machinery and equipment, other manu	1135	800	298	36	1	1	0	0	2	1	1	0
Electr., gas , distr,heat, water and waste	8728	8684	44	0	16	16	0	0	16	16	0	0
Construction	1436	370	1066	0	0	0	0	0	6	0	6	0
Transport	11466	59	11407	0	23	0	22	0	133	0	133	0
Trade, services, waste treatment	795	523	273	0	0	0	0	0	1	0	1	0
Dwelling and premises	24680	315	2065	88	1	0	0	0	45	0	44	0
Public sector	2357	1195	1162	0	2	1	0	0	10	1	9	0
Private consumtion	15790	5506	10284	0	6	5	1	0	83	7	75	0
Total	62908	30264	28639	4005	100	35	25	40	381	44	312	26
% private consumtion	25%	18%	36%	0%	6%	14%	6%	0%	22%	17%	24%	0%

Table 3 Total driving lenght 1994 by purpose of the trip and type of household

Purpose of the trip	milj km Single women <65 year	Single men < 65 year	Single 65+	Single with child(ren)	Cohabs <65 without children	Cohabs 65+ without children	Cohabs with child(ren)	Other	Total
Work- Home	364	1136	2	316	4163	78	5474	9	11542
School - Home	6	103	0	43	283	0	200	0	635
Business trip	160	535	4	167	2392	64	2379	0	5701
Service	58	100	34	62	684	30	372	9	1348
Medical care	18	9	1	18	182	126	295	0	648
Child care	0	0	0	24	2	18	344	0	388
Visiting friends and relatives	315	715	197	243	2310	538	1760	3	6080
Other recrational activities	258	1375	297	82	3568	885	2913	10	9389
Give a lift to another person	99	231	48	83	960	196	1210	7	2835
Change of transportation	1	19	30	32	137	2	252	0	472
Shopping for everyday commodities	39	147	201	113	968	310	809	12	2598
Other shopping	65	367	66	181	1089	282	1157	1	3208
Other	98	511	90	28	723	185	858	4	2497
Total	1481	5247	969	1392	17461	2713	18023	56	47342
Average driving lenght/person 1000 km	4135	9949	1792	3108	7919	3737	5791	3880	5969
Use of energy per capita, GJ	12	28	5	9	22	10	16	11	17
Expenditure for petrol and diesel as share of total expenditures	3%	5%	2%	6%	8%	5%	10%	20%	6%

Table 4a, Total emission of CO_2 from private consumption by type of household 1993

	1000 tonnes								
	Total emissions, kton	Thereof Single women <65	Single men < 65	Single 65+	Single with child(ren)	Cohabs <65 without child(ren)	Cohabs 65+without child(ren)	Cohabs with child(ren)	Others
Direct emissions									
From private cars	9467	296	1049	194	278	3492	543	3604	11
Other mobile sources	815								
Emissions from stat.comb.									
Thereof	5506								
One or two dwelling houses	3671	82	97	403	57	997	583	1078	374
Multi-dwelling biuldings	1835								
Indirect emissions									
Indirect emissions from consumption	14102	1216	1472	488	770	3052	1412	5692	
Thereof									
Emission from prod.of el. and dist. heat.	3103								
One or two dwelling houses	1520								
Multi-dwelling buildings	1583								
Total direct and indirect emissions	29890								

Table 4b, Total emission of SO_2 from private consumption by type of household 1993

	Tonnes								
	Total emissions tonnes	Single women <65	Single men < 65	Single 65+	Single with child(ren)	Cohabs <65 without child(ren)	Cohabs 65+without child(ren)	Cohabs with child(ren)	Others
Direct emissions									
From private cars	1331	42	148	27	39	491	76	507	2
Other mobile sources	114								
Emissions from stat.comb.									
thereof	5025								
One or two dwelling houses	3350	75	88	367	52	910	532	984	341
Multi-dwelling buildings	1675								
Indirect emissions									
Indirect emissions from consum	24085	2100	2497	854	1293	5249	2421	9671	
thereof									
Emission from prod.of el. and d	5732								
One or two dwelling houses	2809								
Multi-dwelling buildings	2923								
Total direct and indirect emissions	30555								

Table 4c, Total emission of NO_x from private consumption by type of household 1993

	Total emissions tonnes	Single women <65	Single men < 65	Single 65+	Single with child(ren)	Cohabs <65 without child(ren)	Cohabs 65+without child(ren)	Cohabs with child(ren)	Others
Direct emissions									
From private cars	70640	2209	7829	1445	2077	26054	4048	26893	83
Other mobile sources	4475								
Emissions from stat. comb.	7403								
Thereof									
One or two dwelling houses	4935	111	130	541	77	1341	784	1449	502
Multi-dwelling buildings	2468								
Indirect emissions									
Indirect emissions from consum	92854	8917	10325	3188	5132	20023	9179	36090	
thereof									
Emission from prod.of el. and d	5840								
One or two dwelling houses	2862								
Multi-dwelling buildings	2978								
Total direct and indirect emissions	175372								

Table 5 a Average emission per capita of CO_2 by type of household 1993

	Total emissions, kton	Tonnes Emissions per person	Single women <65	Single men < 65	Single 65+	Single with child(ren)	Cohabs <65 without child(ren)	Cohabs 65+without child(ren)	Cohabs with child(ren)	Others
Direct emissions										
From private cars	9467	1,1	0,8	2,0	0,4	0,6	1,6	0,7	1,2	0,8
Other mobile sources	815	0,1								
Emissions from stationary combustion	5506	0,6								
thereof										
One or two dwelling houses	3671	0,8	1,7	1,7	3,3	0,6	0,9	1,7	0,4	1,3
Multi-dwelling buildings	1835	0,5								
Indirect emissions										
Indirect emissions from consumption	14102	1,6	2,3	2,4	2,6	1,6	2,2	1,7	1,5	
Thereof										
Emission from prod.of el. and dist. heat.	3103	0,4								
One or two dwelling houses	1520	0,3								
Multi-dwelling buildings	1583	0,4								
Total direct and indirect emissions	29890	3,4								

Table 5 b Average emission per capita of SO_2 by type of household 1993

	Total emissions tonnes	Kg Emissions per person	Single women <65	Single men < 65	Single 65+	Single with child(ren)	Cohabs <65 without child(ren)	Cohabs 65+without child(ren)	Cohabs with child(ren)	Others
Direct emissions										
From private cars	1331	0,2	0,1	0,3	0,1	0,1	0,2	0,1	0,2	0,1
Other mobile sources	114	0,0								
Emissions from stationary combustion thereof	5025	0,6								
One or two dwelling houses	3350	0,7	1,6	1,6	3,0	0,6	0,8	1,6	0,4	1,2
Multi-dwelling buildings	1675	0,4								
Indirect emissions										
Indirect emissions from consumption thereof	24085	2,8	4,0	4,1	4,6	2,6	3,8	3,0	2,5	
Emission from prod.of el. and dist. heat.	5732	0,7								
One or two dwelling houses	2809	0,6								
Multi-dwelling buildings	2923	0,8								
Total direct and indirect emissions	30555	3,5								

Table 5 c Average emission per capita of NO_x by type of household 1993

	Total emissions tonnes	Kg Emissions per person	Single women <65	Single men < 65	Single 65+	Single with child(ren)	Cohabs <65 without child(ren)	Cohabs 65+without child(ren)	Cohabs with child(ren)	Others
Direct emissions										
From private cars	70640	8,1	6,2	14,8	2,7	4,6	11,8	5,6	8,6	5,8
Other mobile sources	4475	0,5								
Emissions from stationary combustion thereof	7403	0,8								
One or two dwelling houses	4935	1,0	2,4	2,4	4,4	0,9	1,1	2,3	0,5	1,7
Multi-dwelling buildings	2468	0,6								
Indirect emissions										
Indirect emissions from consumption thereof	92854	10,6	17,0	16,8	17,1	10,3	14,4	11,3	9,3	
Emission from prod.of el. and dist. heat.	5840	0,7								
One or two dwelling houses	2862	0,6								
Multi-dwelling buildings	2978	0,8								
Total direct and indirect emissions	175372	20,1								