Statistics Estonia

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Final report

Economy Wide Material Flow Account

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1. Introduction

As environmental accounting is field of growing importance in environmental statistics and Economy Wide Material Flow Account (EW-MFA) is one of the modules of the first priority in Europe Statistics Estonia carried out pilot project on compiling Economy Wide Material Flow Account.

In Estonia environmental accounting is new and, not yet highly developed branch of environmental statistics, which up to now has been limited to few pilot projects done by Statistics Estonia. Up to now no activity was done in Estonia in area of EW-MFA. Keeping in mind the high priority of MFA and upcoming regulation of European Commission obliging all Member States to present on regular bases the data of MFA from one side and lack of any experience in compiling MFA in Estonia from other side, the

This project will help to implement a first collection of data in the EW-MFA module in conformity with the EU methodology. The first attempt for compiling the economic wide MFA standard tables of Eurostat of was done. Guidelines of Eurostat's material flow accounts methodology based on published methodological and compilation guides "Economy-wide material flow accounts and derived indicators - A methodological guide"; "Economy-wide Material Flow Accounting — guide for beginners" and "Economy Wide Material Flow Accounts: Compilation Guidelines for reporting to the 2009 Eurostat's questionnaire" were followed.

The main goals of the project were:

1) verify all existing data sources, available data and possible estimation methods for missing data which are needed for compilation of EW-MFA;
2) Fill in the Eurostat's MFA questionnaire 2009 as far as possible.
3) Make the starting point for future development of EW-MFA and write down some guidelines for next data collection for compilation of MFA standard tables.

Eurostat's 2009 MFA questionnaire for years 2000-2007 was completely filled in. Missing data for these years were estimated on the bases of existing data. Available data for years 1991-1999 and for 2008 were filled in to questionnaire, but no effort was made to estimate all missing values for these years. Data since the restoration of Estonian Republic in 1991 were considered, earlier year were not studied. This project will help to reduce the observed gaps in EU totals for the EW-MFA as data for Estonia are compiled first time.

As this project was the first attempt of investigation of movements of physical material flows through Estonian economy, attention was paid on revealing the direct material flows. Indirect material flows associated with export and import were not estimated. Hidden material flow was estimated only as unused domestic extraction. Memorandum items for balancing were compiled as far as were asked in Eurostat' MFA questionnaire 2009.

Some Material Flow Accounts and Indicators were calculated and analyzed briefly. No attempt was made for compiling physical input-output tables and separate material stock accounting. These more advanced practices stayed outside this project and will be topics for future development.

In this report the data were presented according the classification in "Economy-wide material flow accounts and derived indicators - A methodological guide". At the same time focus was on the data asked by Eurostat's MFA questionnaire 2009, so in the chapters 3 (material input) and 4 (material output) numeration of variables according to this questionnaire is used. The data availability, quality and estimation methods for missing data were discussed in quite details having in mind that this report could be used as guide for future MFA data compilations in Estonia. For each indicator the next aspects are brought out: background information, data availability, description of the compilation of MFA standard table of Eurostat's 2009 MFA Questionnaire, and remaining problems. This report is divided into next chapters:

1. Introduction
2. Summary
3. Material input
4. Material output
5. Material flow accounts and balances for Estonia
6. Indicators derived from accounts
7. Main findings
8. Problems encountered
9. References

Very rough quality assessment of the basic data was made, the description of method used and the results were presented in the ANNEX 11.

The compilation of the accounts has been useful as the use of materials, is one of the key area also for a sustainable development strategy. First time the economy-wide material flow accounts as consistent compilations of the overall material inputs into national economies, the changes of material stock and the material outputs to other economies or to the environment were compiled.

2. Summary

Economy wide material flow account was compiled for Estonia at the first time. All existing statistical and administrative data sources and availability of data needed for compilation of EW-MFA were investigated. In case of absence of available data, the possible estimation methods for missing data were examined.

Data sources, quality characteristics and problems occurred for each indicator of the Eurostat's MFA questionnaire 2009 were described in detail; this analysis could be used as guidelines for next data collection for compilation of MFA standard tables.

The Eurostat's MFA questionnaire 2009 for years 2000-2007 was completely filled in.

Some Material Flow Accounts and Indicators were calculated and analyzed briefly. As this project was the first attempt of investigation of movements of physical material flows through Estonian economy, attention was paid on revealing the direct material flows. Indirect material flows associated with export and import were not estimated. Hidden material flow was estimated only as unused domestic extraction. Memorandum items for balancing were compiled as far as were asked in Eurostat's MFA questionnaire 2009.

In Estonia in 2007 the direct material flow was about 70% bigger than in 2000. It was concluded, that material flow into and out from domestic economy in Estonia has increased in 2007 compared to 2000 due to substantial increase of domestic extraction of construction minerals and consequent increase of stock (buildings). Another considerable factor of increase of material flow is increased domestic extraction of oil shale (increase of production of electricity) and consequent increase of air emissions.

Domestic material consumption DMC is constantly increasing during the years 2000-2007. The increase of DMC has been quicker than increase of gross domestic product at the same period.

There were no big changes in direct material productivity during the time period 2000-2007 although the overall trend of direct material productivity was declining. Domestic materials productivity is considerably higher than direct material productivity; at the same time decreasing of domestic materials productivity during time period under discussion is more noticeable – about 22%. In 2000 4.9 thousand EEK (315 EURO) was generated; in 2007 per one ton of consumed materials only 4.0 thousand EEK (259 EURO) was generated.

Direct material output (DMO) per capita has increased during given time period from 26 tons per capita in 2000 to 32 tons per capita in 2007. The increase of export had the biggest share in increase of DMO.

The substantial decoupling of GDP and quantities of output of materials could be observed. The growth of GDP was not accompanied with the substantial growth of quantity of output materials.

Net addition to stock (NAS) per capita is growing much quicker than NAS per GDP. Big share in increase of NAS is connected with construction activity of households and purchasing of private cars and household appliances. Although net addition to stock is growing very quickly, it is still much smaller than domestic processed output

The value of one ton of imported material is almost twice higher than the value of same quantity of exported material. This means, that Estonia imports the commodities of higher value and exports the commodities of lower value. Nevertheless the value of one ton of physical exports is constantly increasing since 2003 and difference between values per ton of exported and imported material is slightly diminishing.

3. Material input

Total material input for years 2000-2007 is presented in the ANNEX 13

3.1. Domestic extraction (used)

3.1.1. Biomass extraction

3.1.1.1. Primary crops

Background information

Statistical data on primary crops production is collected by Statistics Estonia in department of Agricultural statistics. The total population of holdings includes all holdings from the Farm Register. Total survey has been used on holdings having at least 500 hectares utilized agricultural land. From holdings having less than 500 hectares utilized agricultural land a simple random sample has been made by size of utilized agricultural land. The data collected by sample survey are groosed up to the whole population. In case of unit non-response in completely enumerated stratum, the data were calculated by the data obtained from other data sources.

Data availability

The next table indicates the breakdown by crops and time series available for each crop. In fact some time series goes back to 1980, but the soviet time was not taken into account, and the time of restoration of Estonian Republic in 1991 was considered as the beginning of time series.

Table 3.1 Data availability for primary crops

Crop	The first year available	The last year available
Cereals	1991	2008
..winter crops	1991	2008
....rye	1991	2008
....winter wheat	1991	2008
....winter barley	2003	2008
....triticale	2001	2008
..spring crops	1991	2008
....spring wheat	1991	2008
....barley	1991	2008
....oats	1991	2008

....mixed grain	1991	2008
....buckwheat	1991	2008
Legumes	1991	2008
Flax stalks	1991	2007
Oil flacks seed	2000	2008
Sugar beet	1991	2007
Rape seed	1991	2008
Vegetables and greens	1991	2008
..open-field vegetables	1991	2008
....cabbage	1991	2008
....cucumbers	1991	2008
....red beets	1991	2008
....carrots	1991	2008
....onions	1991	2008
....garlic**	1991	2008
....green peas	1991	2008
....swedes***	1992	2008
....other vegetables	1991	2008
Potatoes	1991	2008
Forage roots	1991	2008
Green fodder*	1991	2008

In addition to crops listed in table 3.1 the data on orchards and berry plantations are collected. These data contain information on apples and pears, cherries and plums and berries.

Compilation of MFA standard tables

Comparison of Table 3.1 with EW-MFA standard table A (Domestic extraction) indicates that classification of the crops is not the same.

How the statistical data of agricultural statistics collected by Statistics Estonia were distributed under the 3-digit classification of MFA standard table A is shown in the table 3.2.

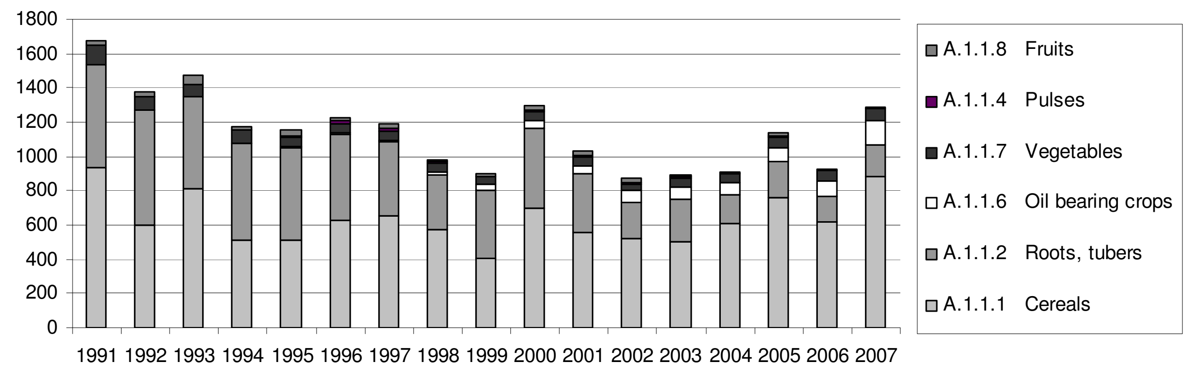
Table 3.2 Distribution of data of agricultural statistics under the 3-digit classification of MFA standard table A

Classification of MFA	Classification of agricultural statistics
A.1.1.1 Cereals	Rye
	Spring wheat
	Winter wheat
	Barley
	Winter barley
	Triticale
	Oats
	Mixed grain
	Buckwheat
A.1.1.2 Roots, tubers	Potatoes

A.1.1.3 Sugar crops	Sugar beet
A.1.1.4 Pulses	Legumes
A.1.1.5 Nuts	Not valid for Estonia
A.1.1.6 Oil bearing crops	Rape seed
	Oil flacks seed
A.1.1.7 Vegetables	Vegetables and greens
A.1.1.8 Fruits	Fruits and berries
A.1.1.9 Fibers	Flax stalks
A.1.1.10 Other crops (Spices, Stimulant crops, Tobacco, Rubber and other crops)	Data not available

Nuts are not cultivated in Estonia in any notable quantity. There are some farms cultivating the spices and herbs, but no data are available on their yield in weight units. Data exists only on area under these types of plants, which is very small compared to other crops. No effort was made to estimate the harvest of herbs and spices, as it would probably staid much less than 500 tons and will be indicated as 0.0 in 2009 MFA standard table A. Figure 1 illustrates the production of primary crops in Estonia by 3-digit MFA category.

Figure 3.1 The production of primary crops in Estonia by 3-digit MFA category, thousand tons.



Remaining problems

Only fruits and berries grew for markets are taken into consideration by agricultural statistics. Considerable quantity of fruits and berries are grown by households and were not considered because data about their yield are not available.

In case of forage roots it was not clear under which 3-digit MFA classification category it should be shown. Forage roots could be indicated under category A.1.1.2 (Roots, tubers) or under category A.1.2.2.1 (Fodder crops). It was decided to indicate forage roots under category A.1.2.2.1.

3.1.1.2. Crop residues (used), fodder crops and grazed biomass

Data availability

Data about total use of crops residues in physical units are not collected in Estonia. Monetary data collected by Statistics Estonia about intermediate consumptions of farmers include also data about use of straw inside the farms. Monetary data for 1995-2006 are available.

From the other side, the data of agricultural statistics (animal feeding balance sheet (supply) in product weight), collected by Agricultural statistics department of Statistics Estonia, includes data about use of crop residues and grazed biomass in tons. Data are available for periods 2002/2003 - 2007/2008. Data about forage roots and biomass harvest from grassland (green fodder) are regularly collected by agricultural statistics.

Compilation of MFA standard table

In case of used crop residues data of agricultural statistics about use of fodders were used for compilation of the MFA standard table A. Data were appointed to the earlier year, assuming that fodder were harvested at summer and consumed by animals during following winter. It is not exactly correct in case of grazed biomass, but no data was available for exacts division of agricultural data by years. Total use of straw, chaff and other crop residues is shown as one number in the agricultural statistics, so only 3-digit biomass category A.1.2.1. was shown in the MFA standard table A, data for separate indication of used straw (row A.1.2.1.1.) were not available.

The regular statistical data about forage roots and biomass harvest from grassland (green fodder) were used for filling in the row A.1.2.2.1. (fodder crops) and data of animal feeding balance sheet were used for row A.1.2.2.2. (grazed biomass). The dry weight coefficient 0,235 suggested in the “Compilation Guidelines” were used for estimation of the dry weight for fodder crops, biomass harvest from grassland and gazed biomass. It was supposed that data about use of crop residues (of which straw made up the majority) are in the dry weight already.

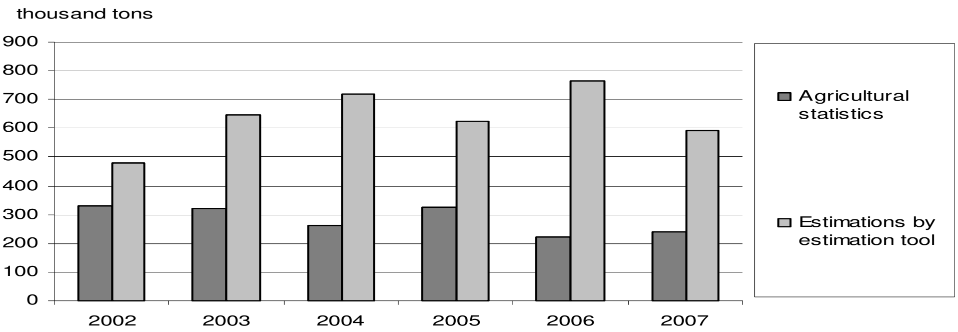
Data for years up to 2002 were available only for forage roots and biomass harvest from grassland. In order to compile MFA standard table A for years 2000-2001, the average data of available years about quantities of gazed biomass and used crop residues were used for these years.

Remaining problems

For the comparison, the estimation tools added to 2009 MFA questionnaire was used in order to estimate the quantity of used crops residues and grazed biomass. No country specific coefficients were available, so coefficients, suggested by Eurostat's experts in estimation tool, were not changed. Yearly average numbers of agricultural animals collected by agricultural statistics of Statistics Estonia were used.

The next figure illustrated the differences between quantities in grazed biomass estimated by estimation tool and statistical data.

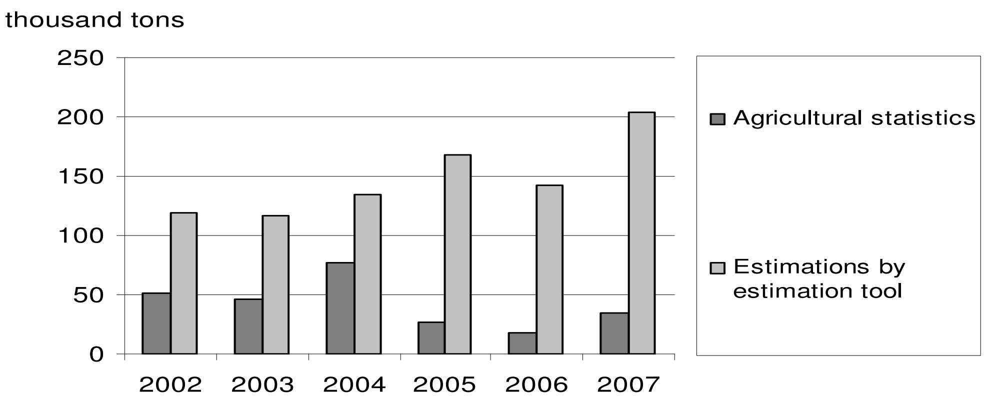
Figure 3.2 Quantity of grazed biomass



It is seen also on the figure above, that estimations are systematically bigger. There could be two reasons for this difference. From the one side Geographical conditions in Estonia are not as favorable for biomass growth as in Middle and South Europe. Coefficients used in estimation tools of 2009 MFA questionnaire might cause overestimation in Estonian case. From the other side, very small agricultural holdings, which produce only for their own consumption and are classified under households, but might have some agricultural animals, are not covered by statistical survey for producing animal feeding balance sheet. This mean, that statistical data may be somehow underestimated.

Next figure illustrates the differences in quantities of used crops residues based on statistical data of animal feeding balance sheets and estimations made by the estimation tools added to 2009 MFA questionnaire.

Figure 3.3 Quantity of used crops residues



As could be seen also on the figure 3.3., in case of crops residues the differences between statistical data and estimations are even bigger. The same reasons as were mentioned in case of grazed biomass are also valid for crops residues. But in case of straw additional aspect is important. Use for animal feeding is not the only way of use for straw. It is used also as biofuel and as additive material in compost production etc. This means that estimated data might be more correct if they are based on the quantity of generated straw. The specialist from agricultural research institutes and Estonian University of Life Sciences should be consulted in future, in order to decide the most suitable coefficients for Estonia.

It was already mentioned, that in case of forage roots it was not clear under which 3-digit MFA classification category it should be shown. It was decided to indicate forage roots under category A.1.2.2.1. The problem of proper classification of forage roots arose again connected with use of estimation tool for grazed biomass. If forage roots were classified under category "Fodder crops and grazed biomass" their quantity should be discounted from estimated grazed biomass needed for agricultural animals. In case of classification of forage roots under category A.1.1.2 "Roots, tubers" their quantity is not discounted from needed grazed biomass for agricultural animals. The proper classification of forage roots need future reconsidering after consultations of specialist from agricultural institutes.

3.1.1.3. Wood

Background information

About half of Estonian territory is covered by forests. Wood is one of the most important natural resources of Estonia. About half of the forest belongs to state, 40% is private forest and 10% is so called other forest which is not owned by state but is not privatized yet and is managed by local governments.

Up to 1999 all felling statistics was based on felling documents; different types of documents are applied for forest of different ownership. Data for state forest are based on documentation of State Forest Management Centre; data on felling from other forest are licenses based. Felling documents of these forests refer to actual felling. At the same time felling documents of private forest refer to felling plan for the next year, actual felling might be smaller than

planned, in this case unfelled share could be added to felling of next year. Actual felling might be also bigger than planned in case if some of felling planned for previous year was actually undone. In addition some timber (mostly of firewood) which forest owner use for ones own purpose need not be reported. So data about felling from private forest were confusing.

Since 1999 Statistical forest inventory (SFI) is made every year, which is alternative information source about felling. The first SFI indicated almost twice bigger felling compared to statistics based on felling documents. In resents years difference between SFI and documented felling constantly decreased and in last two years the both methods gave practically the same results.

Data availability
Statistical data about felling according to felling documents are available since 1991; data according to Statistical Forest Inventory since 1999. Both data are on cubic meters of solid volume. Up to 2001 the felling of firewood were reported separately in felling documents, later on no data of firewood are collected.

Compilation of MFA standard table
For compilation of data on wood extraction in MFA standard table A, the felling data based on felling documents were used. This choice was made because:

1) Data based on felling documents had much longer time series.
2) the same methodology of data collection is kept for all reported time series.
3) Data based on felling documents included information about firewood felling.

The reported data of firewood felling were used for 3-digit level category A.1.3.2 up to 2001. For the later years the average share of firewood in total felling of years 1991-2001 was used in order to estimate the quantity of firewood.

Data on net increment of timber stock is based on forest inventory up to 1997 and on SFI since 1999. The change of methodology caused the break in time series and lack of data for 1998.

The average coefficient suggested in "Economy Wide Material Flow Accounts: Compilation Guidelines for reporting to the 2009 Eurostat's questionnaire" was used in order to recalculation of cubic meters solid volume into tons of wood with 15% of moisture.

Remaining problems
SFI indicated that felling for years 1999-2003 is underestimated.

Data about firewood are of low quality, estimation methods of quantity of firewood should be improved. Data from energy statistics and household budget survey should be examined for additional information.

The coefficients for recalculation of cubic meters of solid volume into tons should be adjusted.

3.1.1.4. Fish catch and other aquatic plants/animals

Background information

At the beginning of the 90-s the ocean catch was the main fishing subactivity in Estonia – about 70% of fish catch originated from ocean. Importance of ocean catch rapidly decreased from year to year since and in 2008 the ocean catch shared only for 14% of the total. The Baltic Sea catch has become the main activity in Estonian fishery. Inland waters catch (mainly from Lake Peipsi and Lake Võrtsjärv) is constantly relatively small, making up about 3% of total. Fishing is localy important in some regions of Estonia: coastline and islands

Fishery statistics has been collected by different administrative organizations: by Fishery Board in the beginning of 90-s, then by Ministry of Environment and since 2003 the catch statistics is compiled by Ministry of Agriculture.

Beside the fish catch the seaweed agarik (*Furcellaria lumbricalis)* is commercially gathered from Baltic See. Agarik is raw material for production of agar-agar used in confectionery industry.

Data availability

Data on catch and landings by species and catch regions are available since 1992. Only commercial catch is included. Estimations of recreational catch have not been made. Data about agarik production are available only for some years.

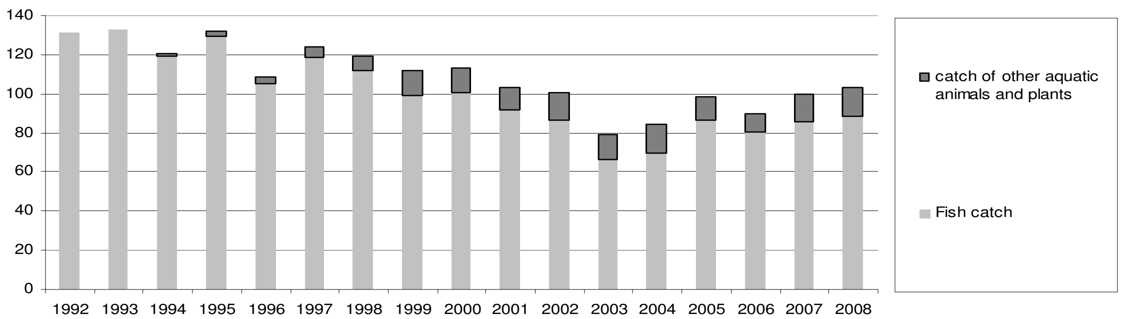
Compilation of MFA standard table

The statistical catch data were used for compilation the MFA standard table. In 3-digid level classification shrimps were shown under code A.1.4.2 (all other aquatic animals and plants). Shrimps make up about 85-90% of Estonian ocean catch of last years. In fishery statistics shrimps are considered together with other fish species, but in foreign trade statistics shrimps

are shown under separate commodity code, by his reason shrimps were shown separately also in MFA standard table A.

Production of agarik for years, when data were available, was shown under code A1.4.2 also. Recalculation for 15% moisture content was made. For recalculation experts from company excavating agarik and producing agar-agar were consulted. Figure 3.4 illustrates the production of fish catch and other aquatic plants/animals in Estonia by 3-digit MFA category.

Figure 3.4 The production of fish catch and other aquatic plants/animals by 3-digit MFA category, thousand tons



Remaining problems

Data about recreational catch are not available and are not included to table A of fish catch. Quantity of agarik is available only for some years.

3.1.1.5. Hunting and gathering

Background information

Estonia is rich of the big game animals like elks, roe deer's, wild boars and beavers, which sometimes cause the trouble harming crops fields and forest plantations. Hunting is small, but at the same time notable activity in Estonia. There is quite big quantity of mushrooms and wild berries in Estonia, which are gathered not only for household consumption, but also for industrial use (especially cranberries, blue berries, cowberries, and chanterelles). No statistical data are collected on quantity of mushrooms and wild berries yield however.

Data availability

Yearly summary data on hunting by species (38 game species in total) and counties are handed over to Statistics Estonia by Ministry of Environment according agreement between

these two organizations. Data includes only number of hunted games, data on weight are not available.

Compilation of MFA standard table

In order to compile the MFA standard table A, the number of hunted games was recalculated to tons. Expert opinion of specialists from Department of Hunting of Ministry of Environment about average weight of bigger games was used for calculations. The games, which were considered for calculation and their average weights, were listed in table 3.3.

Table 3.3 Average weights of games considered in MFA standard table A.

Game	Average weight, kg
Elk	174
Red deer	128
Roe deer	16
Wild boar	42
Brown bear	135
Beaver	12
Hare	3
Duck	1
Goose	2

Next for the bigger games the average yield of meat (based on expert opinion) was used to estimation of quantity of total meat obtained by hunting. Yields of meat of bigger games used for estimations were presented in table 3.4.

Table 3.4 Yields of meat of bigger games used for estimations

Game	Average yield of meat, %
Elk	55
Red deer	52
Roe deer	48
Wild boar	65

No effort was made to estimate the used quantity of furs and leathers, as it was considered to be considerably smaller than reporting limit of 500 tons.

In order to estimate the quantity of gathered mushrooms and wild berries the results of research made by specialists of Ministry of Environment were used. Although yield of mushrooms and wild berries differ from year to year, the same average yield (see table 3.5.) was used for all years.

Table 3.5 Average yields of mushrooms and wild berries

Species	Average biological stock per year, tons	Average yield, %	Harvested quantity, tons
Cranberry	6 000	40	2 400
Blue berry	3 500	50	1 750
Cowberry	250	50	125
Mushrooms			4 000

3.1.2. Minerals extraction

3.1.2.1. Metal ores

Metal ores are not excavated in Estonia

3.1.2.2. Non metallic minerals

Background information

Following non metallic minerals are excavated in Estonia: limestone, dolomite, sand, clay, gravel, lake lime, sea mud and sapropel. All mineral resources are under management of Estonian Land Board. In order to excavate the mineral the license issued by Estonian Land Board is needed. Licenses are issued separately for each deposit and quarry inside the deposit. Companies having licenses have obligation of reporting quantities of excavated minerals to Estonian Land Board, who compiles the statistics on mineral resources excavation.

Data availability

Data on excavation of minerals by kinds and regions are available since 1992. Classification of minerals used for statistical reporting and units of reporting are presented in the table 3.6.

Table 3.6 Classification of minerals used for statistical reporting

Mineral	Reporting unit
Oil shale	thousand tons
Peat for fertilizers	thousand tons
Peat dust	thousand tons
Construction sand	thousand m^3
Sand for technology and ceramics	thousand m^3
Cement and ceramic clay	thousand m^3
Infusible and ceramsite clay	thousand m^3
Construction limestone	thousand m^3
Technological limestone and limestone for cement,	thousand m^3

Phosphorite	thousand tons
Construction dolomite	thousand m^3
Decorative dolomite	thousand m^3
Lake lime	thousand m^3
Constructional gravel sand	thousand m^3
Constructional gravel,	thousand m^3
Sea mud,	thousand tons
Sapropel,	thousand tons
Granite	thousand m^3

Phosphorite and granite are not excavated in period 1991-2008.

Compilation of MFA standard table

Classification of the minerals used by Estonian statistics is different from classification of MFA standard table A. How the statistical data compiled by Estonian Land Board were distributed under the 2-digit and 3-digit classification of MFA standard table A is shown in the table 3.7.

Table 3.7 Distribution of statistical data of Estonian Land Board under the 2-digit and 3-digit classification of MFA standard table A

Classification of MFA	Classification of Estonian Land Board
A.3.1 Non metallic minerals - stone and industrial use	
A.3.1.1 Ornamental or building stone	Technological limestone and limestone for cement
	Construction limestone
	Granite
A.3.1.2 Chalk and dolomite	Decorative dolomite
	Construction dolomite
A.3.1.3 Slate	not valid for Estonia
A.3.1.4 Chemical and fertilizer minerals	Phosphorite
A.3.1.5 Salt	not valid for Estonia
A.3.1.6 Other mining and quarrying products n.e.c.	Lake lime
	Sea mud, thousand tons
	Sapropel, thousand tons
	Sand for technology and ceramics
A.3.2 Non-metallic minerals - bulk materials used primarily for construction	
A.3.2.1 Limestone and gypsum	Shown under A.3.1.1.
A.3.2.2 Gravel and sand	Construction sand
	Constructional gravel sand
	Constructional gravel
A.3.2.3 Clays and kaolin	Cement and ceramic clay
	Infusible and ceramsite clay
A.3.2.4 Excavated soil, only if used	Estimated based on waste statistics data

Cubic meters were calculated into tons using the density data presented in “Economy Wide Material Flow Accounts: Compilation Guidelines for reporting to the 2009 Eurostat questionnaire”.

Remaining problems

Dividing the minerals under 2-digit classification – stones and industrial use and for construction – was in some cases quite confusing:

1) Limestone is widely used as construction stone and it is unclear under which 2-digit category (A.3.1. Stones) or A.3.2 (materials used for construction) it has to be shown. Regardless of availability of separate data for excavated limestone for construction and excavated limestone for industrial use they were added together and shown under category A.3.1.

2) Other mining and quarrying products are implicitly added to minerals for industrial use, which cause the problems to find the proper classification for sea mud, sapropel and lake lime. Sea mud and sapropel are sediments from sea or lake consisting of complex mixtures of mineral and organic compounds having terapeutical use. Lake lime is lake sediment consisting mostly of highly dispersed $CaCO_3$ used in agriculture for treatment of acidic soils.

3) Clay is used in ceramic industry rather than in construction, but is classified only under 2-digit category “materials used primarily for construction”.

4) Sand is classified together with gravel as “materials used primarily for construction”. At the same time sand has also the industrial use (for example for glass production). The quantity of industrial sand was shown under the category A.3.1.6 “Other mining and quarrying products” as there was no separate 3-digit classificatory for industrial sand under A.3.1.

3.1.2.3. Excavated soil

Background information

Statistical data about soil excavation are not collected in Estonia. From the other side, every enterprise, which activity is accompanied with wastes generation needs a waste permit. Waste permit holders are required to keep regular records of the type, quantity, properties and generation of the waste produced, collected, stored or temporarily stored, transported, recovered or disposed of during its activities. Estonian Environment Information Centre

(EEIC) maintains a primary database of enterprises holding waste permits. Internal recycling is included to the EEIC waste database.

Waste category 17 05 00 (soil and stones) according to European List of Wastes, is one of the biggest waste categories generated in the Estonia. For example in 2007 soil and stones shared to 7% of all waste generation in Estonia. At the same time, the most of the soil and stones, reported as waste by construction companies were recycled (often by the same company). In this project recycled (used) quantity of soil and stones was considered as use of excavated soil.

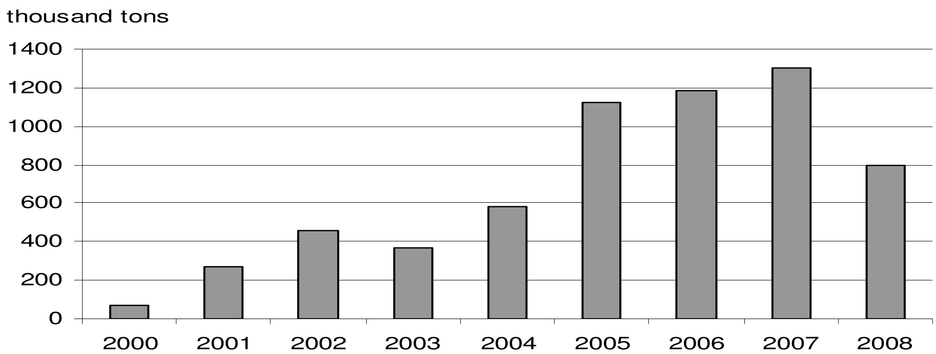
Data availability

Statistical data about generation, recycling and disposal of wastes of soil are available in administrative database since 1993, but classification system based on European List of Waste was introduced since 2000. At the years earlier 2000 the Estonian material based classification was used for compilation of waste statistics and due to different classifications the data of earlier years are not totally comparable.

Compilation of data for MFA

Waste statistics database of Estonian Environmental Information Centre was used for compilation of data about used extraction of soil. Quantity of recycled waste category 17 05 00 according to European List of Waste (soil and stones) from waste database of EEIC was considered to be used quantity of soil.

Figure 3.5 Use of excavated soil, thousand tons



3.1.2.4. Oil shale excavation wastes

Background information

In Estonia every enterprises, dealing with mining and quarrying need a waste permit. Wastes from mining and quarrying are the biggest generated waste category in Estonia sharing to about one third of yearly waste generation. Oil shale excavation wastes made up the biggest part of mining and quarrying wastes. The majority of these wastes are landfilled, but quantity of recycling of oil shale excavation wastes is growing from year to year (mostly as stuffing in road construction). Oil shale excavation wastes consist mainly from limestone and soil and recycled (used) part of these wastes was considered as use of excavated soil and added to row A.3.2.4. in the MFA standard table A.

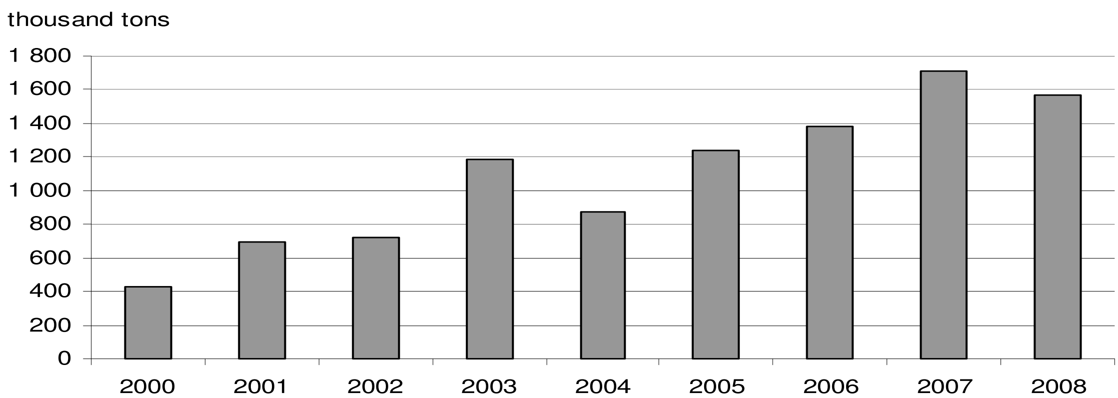
Data availability

Statistical data about generation, recycling and disposal of excavation wastes are available in administrative database since 1993, but classification system based on European List of Waste was introduced since 2000. At the earlier years the Estonian material based classification was used for compilation of waste statistics and due to different classifications the data of earlier years are not totally comparable.

Compilation of data for MFA

Waste statistics database of Estonian Environmental Information Centre was used for compilation of data about usage of oil shale excavation wastes. Quantity of recycling of waste category 01 01 00 (excavation wastes) according to European List of Waste from waste database of EEIC was considered as use of excavated soil.

Figure3.6 Use of excavation wastes, thousand tons



3.1.3. Fossil fuels

Background information
Two kind of fossil energy carriers are excavated in Estonia: oil shale and peat. Oil shale is the Estonian most important natural resource; electricity is mostly produced from oil shale. Quantity of excavated oil shale decreased considerably from the beginning of 90-s, but is increasing again lately. Oil shale is also used for production of shale oil and other industrial chemicals.

Excavated peat can be divided by two categories: slightly decomposed peat mostly for industrial use and highly decomposed peat (peat dust) mostly used as fuel.

Oil shale and peat resources are under management of Estonian Land Board and the license issued by Estonian Land Board is needed for excavation. Licenses are issued separately for each deposit and quarry inside the deposit. Companies having licenses have obligation of reporting excavated quantities to Estonian Land Board, who compiles the statistics on fossil energy carrier's excavation.

Data availability
Data on excavation of fossil energy carrier's by kinds and regions are available since 1992. Data on oil shale excavation and peat excavation are presented in thousand tons.

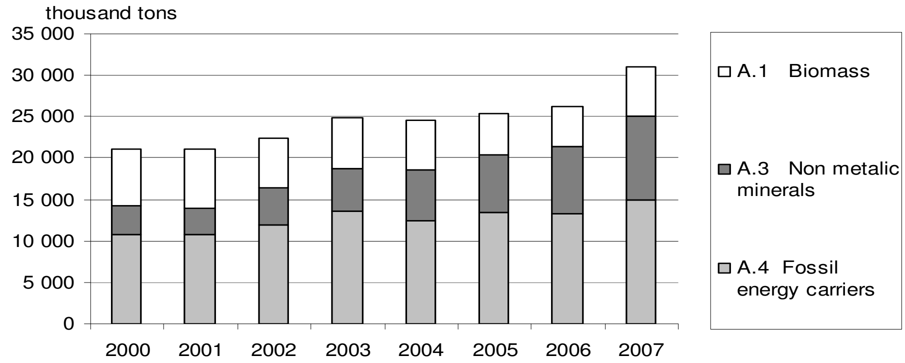
Compilation of MFA standard table
MFA standard table A was compiled with data of Estonian Land Board about quantities of excavated oil shale and peat without any additional processing. Both types of excavated peat were added together under the 3-digit category A.4.1.4.

3.1.4. Results of data compilation of domestic extraction

Figure 3.7 illustrates Estonian used domestic extraction (DE) by MFA 1-digit level categories. Total used DE has constantly increased since 2001. In 2007 DE exceeded the DE of 2000 almost by 50%. Fossil energy carriers constitute the major part of domestic extraction. Extraction of fossil energy carriers has increased slightly during recent years. Considerable increase of domestic extraction has happened mostly due to increase of extraction of non metallic minerals. In 2000 non metallic minerals shared to 17% of domestic extraction. In 2007 extraction of non metallic minerals has increased almost three times and shared to one

third of DE. Extraction of biomass has decreased from 31% to 19% of Estonian total domestic extraction.

Figure 3.7 Estonian domestic extractions by MFA 1-digit level categories, thousand tons



Next figure illustrates Estonian domestic extraction by MFA 2-digit level categories. Solid energy carriers made up about half of total domestic extraction. Other important MFA 2-digit level categories are non-metallic minerals used primarily for construction, which share is constantly increasing and wood, which extraction stayed more or less constant over the years.

Figure 3.8 Estonian domestic extractions by MFA 2-digit level categories, thousand tons

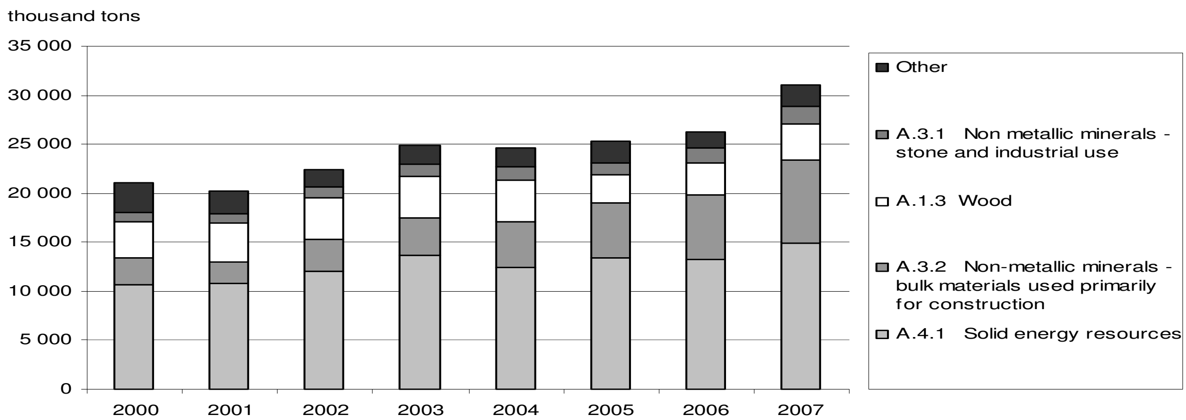
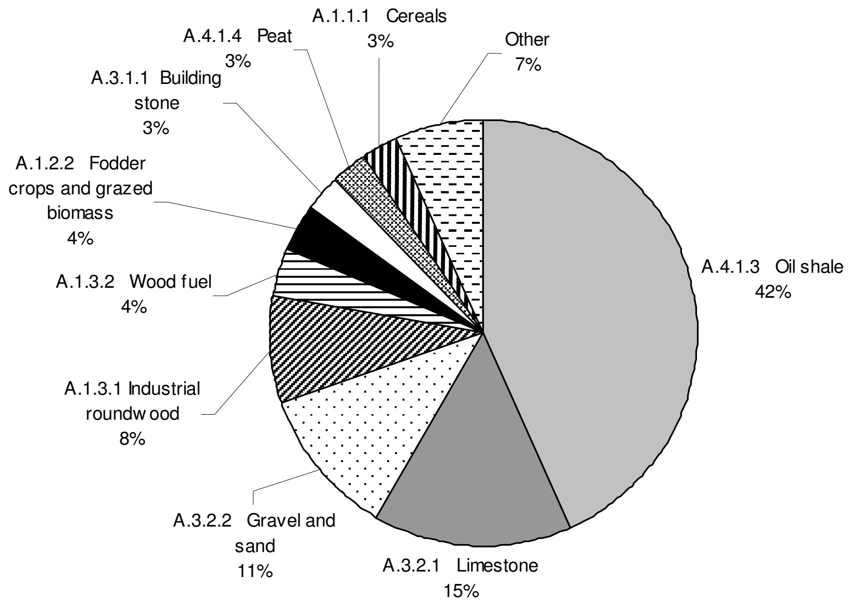


Figure 3.9 illustrates Estonian domestic extraction by MFA 3-digit level categories for 2007. One material category – oil shale – is highly dominating in total Estonian used DE. Other materials of bigger importance are limestone, gravel and sand and industrial round wood.

Figure 3.9 Estonian domestic extractions by MFA 3-digit level categories, thousand tons



3.2. Import

In case of import only direct material flows were considered.

3.2.1. Methdological issues

Background information of foreign trade ststistics

In 2004 the methodology of foreign trade statistics changed due to Estonia's accession to the European Union. Statistics published before and after the accession to the EU are not directly comparable in terms of quality and methodology.

<u>Methodology of foreign trade statistics before 2004</u>

Up to 2004 foreign trade statistics were based on the data of customs declarations declared on single administrative documents (SAD). Statistical survey was used for goods which are not subject to customs clearance. The foreign trade data of the current year were revised monthly, data of previous years were revised twice a year. Both exports and imports were valued at the Estonian border: exports are valued at sale price and imports are valued at purchase price. In exports, the partner country was the country of destination, in imports — the country where the goods have been produced (country of origin).

Commodities were classified according to the Nomenclature of Estonian Commodities (NEC) - a national classification, which was based on the Harmonized System (HS) used in international trade.

Since 1994, foreign trade statistics excluded temporary exportation (importation) subject to re-exportation (re-importation) in an unaltered state. (The purpose or object of the temporary importation or exportation of goods may be, for example, exhibitions, fairs, symposiums, conferences, competitions, etc., where goods are displayed or demonstrated and equipment and materials necessary for carrying out exhibitions, fairs, symposiums, conferences, etc.).

Exports and imports do not included information concerning the conveyance of goods, owned by legal persons residing in foreign countries, from one foreign country to another through the territory of Estonia (with both the sender and consignee of goods being outside the Estonian borders), i.e. so-called transit haulage, as well as imports and exports of goods owned by private persons.

<u>Methodology of foreign trade statistics since 2004</u>

Since 2004 the foreign trade statistics is collected by two different data collecting systems:

1) Intrastat (Intra EC Trade Statistics) — the special system for collecting statistics on the trade in goods between the Member States of the European Union (EU). In case of Intra EC Trade Statistics, the concepts **dispatches and arrivals** are used instead of exports and imports. Statistics Estonia is the institution responsible for the Intrastat data collection directly from enterprises involved in foreign trade. Intrastat data are based on statistical survey and companies with lower foreign trade turnover are not obliged to submit data. Additionally there are other data losses caused by non-response or late response. Missing data are replaced with estimations and estimated figures are revised upon receiving additional information. The estimations are calculated on 2-digit commodity code and partner country level.

2) Extrastat (Extra EC Trade Statistics) — the special system for collecting statistics on the trade in goods between the EU Member States and non-EU countries. The concepts of **exports and imports** are used. Tax and Customs Board is the institution responsible for the Extrastat data collection. Extrastat data are based on customs declarations and contain practically the whole information on the trade with non-EU countries (so called third countries). There are no data losses caused by non-response or by other issues.

Statistical database contains all data collected through Extrastat and Intrastat systems. Speaking of all foreign trade statistics, the concepts of **exports and imports** are used. In case of imports by countries the partner country is the country of consignment (the country from the goods have directly arrived).

Commodities are classified according to the numerical codes of **the Combined Nomenclature (CN)**; introduced in May 2004 and the information is presented in current prices.

Due to the the implementation of Intrastat system it should be taken into account that large amounts of goods, which formerly moved under the supervision of customs authorities in customs warehouses and which were not taken into account in statistics according to the rules of the special trade system, are now in free circulation and included in statistics as customs warehouses were replaced by intermediate depots in the case of the internal EU trade.

Data availability

Data on foreign trade statistics were available for years 1993-2007. Data for 2008 were not available at the beginning of the project and were not considered while compiling MFA tables. However data of different years were located in different databases, which have the different structure and were compiled based on different methodology.

Separate data on foreign trade statistics on internal EU and external EU are available. In case of imports by countries the partner country is the country of consignment (the country from the goods have directly arrived). Commodities are classified according to the numerical codes of the Combined Nomenclature (CN) and the information is presented in current prices.

Data about physical quantities of traded commodities include several of different units: kilograms, tons, metric tons, square meters, meters, pieces, etc. Data about the net weight of traded commodities in kilograms were included into databases also.

Compilation of MFA standard tables of foreign trade

MFA foreign trade standard tables were compiled for the years 2000-2007. Standard tables Table B (Imports: total trade) and Table D (Exports: total trade) were compiled for all mentioned years. Standard tables Table C (Imports: extra-EU27 trade) and Table E (Exports:

extra-EU27 trade) were compiled for years 2004-2007 since Estonia's accession to the European Union. Net weights of traded commodities in kilograms were used as physical weight data. Weight of used packages of exported and imported commodities was not included in both cases and was not estimated.

Reclassification

Foreign trade statistics data are classified according Combined Nomenclature (CN) they had to be reclassified for MFA purpose.

One of the main goals of this project was to fill in Eurostats EW-MFA Questionnaire 2009. The correspondence table between HS 2007 codes and Questionnaire Tables B/C/D/E Codes included to the last version of Eurostat's Economy-Wide Material Flow Account Questionnaire 2009 were used for reclassification and filling in of foreign trade statistics data in tables B/C/D/E of Eurostats EW-MFA Questionnaire 2009.

At the same time the detailed classification and allocation of CN codes presented in the annex 4 of methodological guide "Economy-wide material flow accounts and derived indicators. A methodological guide. 2001" are different. For this reason the foreign trade data were reclassified and allocated under the MFA material categories twice, according to the both correspondance tables.

Databases of summary export and import on the HS-codes 6-digit level were used as the bases in case of reclassification for Eurostat EW-MFA questionnaire 2009. Some the HS-codes on 6-digit level which were used in Estonian foreign trade databases were not included to the "Correspondence table of Eurostat's Economy-Wide Material Flow Account Questionnaire". In total 651 codes without correspondent MFA Table B/C/D/E Code were identified in foreign trade databases for the years 2000-2007. Missing codes were determined on the bases of commodity name and MFA codes of commodities with similar 5-digit level code. Missing HS 6-digit level codes and their appointment under MFA Table B/C/D/E Codes are presented in the ANNEX 12

Remaining problems

Intra EU foreign trade data are based on statistical survey. Enterprises with low foreign trade turnover are not covered by survey. For these enterprises and for non-response or late response enterprises, the estimations which are based on additional information are made. The estimations are calculated on 2-digit commodity code and partner country level and are made

for monetary value only. Added estimated monetary value of import and export made up about 4-5% of total, but differs considerably on different 2-digit commodity group level.

Missing physical quantities were estimated using monetary data estimations. The next pragmatic assumptions were made:

1) Share of missing physical quantity on 2-digit commodity code level is the same as the share of estimated monetary value of the same 2-digit code level commodity.
2) Inside 2-digit commodoty level the division of estimated physical quantity by 6-digit level follows the same pattern as in case of survyed data.

According to the MFA classification, the biggest quantities added to physical imports as estimates were in case of codes B.1.3.1 (Timber), B.3.2.2 (Gravel and sand), B.1.7 (Products mainly from biomass), B.2.1 (Iron ores and concentrates, iron and steel, primary and processed), B.2.3 (Products mainly from metals), B.3.3 (Products mainly from non metallic minerals) and B.5 (Other products). The description of estimation procedure and the shares of estimated quantities of physical import according to MFA classification are presented in the ANNEX 10.

The methodology for estimations of missing data in Intra EU foreign trade statistics is worked up for monetary values. There is necessarily no correlation between price and quantity – commodity with small physical weight might be with big value (jewellery, art) and low value commodity might have large physical weight (waste for disposal). Therefore estimations of weight on the bases of monetary value might be misleading.

Enterprises which are not covered by intrastat statistical survey are usually small enterprises and products imported by these enterprises may be different from products of big enterprises. Splitting the total of 2-digit commodity level estimates by 6-digit codes level with the same shares as in case of survyed enterprises might be inaccurate.

3.2.2. Results of data compilation of import

The Estonian physical imports data are presented in the table 3.8.

Table 3.8 Estonian total physical imports 2000-2007, thousand tons

	2000	2001	2002	2003	2004	2005	2006	2007
Raw materials	**2 371**	**2 391**	**2 545**	**3 031**	**3 856**	**3 697**	**3 623**	**4 012**
Fossil fuels	1 241	1 063	783	1 225	1 404	441	300	1 031

Minerals	534	526	823	622	764	1 222	1 378	1 355
Metallic minerals	2	2	3	5	2	1	1	2
Non-metallic minerals	533	524	820	617	762	1 221	1 377	1 353
Biomass	591	783	905	1 178	1 682	2 031	1 939	1 626
Agricultural	260	233	316	286	334	228	209	221
Forestry	292	499	549	854	1 313	1 766	1 696	1 372
Fish	39	51	41	39	35	37	34	33
Secondary raw materials	5	18	34	6	6	3	7	0
Semi-manufactured products	**1 495**	**1 420**	**1 564**	**1 910**	**2 735**	**2 982**	**5 059**	**4 582**
From fossil fuels	740	854	948	944	1 453	1 813	3 765	3 166
From minerals	596	400	441	707	928	732	792	876
From metallic minerals	536	328	379	629	878	687	716	812
From non-metallic minerals	60	72	62	78	50	45	76	64
From biomass	159	166	175	259	354	437	501	540
From forestry	159	166	175	259	354	437	501	540
Finished products	**1 724**	**1 851**	**1 985**	**2 614**	**3 148**	**2 739**	**3 315**	**3 546**
Predominantly from minerals	429	488	584	892	1 260	901	1 127	1 165
Predominantly from metallic minerals	294	349	413	699	954	616	700	702
Predominantly from non-metallic minerals	135	139	172	192	306	285	427	463
Predominantly from biomass	191	217	223	236	298	328	406	448
Forestry finished products	191	217	223	236	298	328	406	448
Other products	1 104	1 145	1 178	1 487	1 590	1 510	1 782	1 933
Other products of abiotic kind	71	74	113	103	109	111	150	172
Other products of biotic kind	392	424	439	484	542	506	576	629
Agricultural plant products	259	280	275	324	390	336	383	405
Agricultural animal products	60	58	59	75	62	66	67	74
Animal as products	1	2	3	4	4	9	10	17
Other biotic products	72	83	102	81	86	95	115	133
Other products n e c	641	648	626	899	939	893	1 057	1 132
Packaging materials imported with products	**n.e.**	**n.e.**	**n.e.**	**n.e.**	**n.e.**	**n.e.**	**n.e.**	**n.e.**
Waste imported for final treatment	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**
TOTAL	**5 591**	**5 662**	**6 094**	**7 555**	**9 739**	**9 418**	**11 998**	**12 141**

3.3. Memorandum items for balancing

3.3.1. Oxygen for combustion

The quantity of oxygen used for combustion indicated in the Eurostat’s 2009 MFA questionnaire table G was calculated using data of energy statistics and coefficients from Economy-wide Material Flow Accounting “Guide for beginners“. As coefficients for oil shale and peat were not included to this guide in addition data of Tallinn University of Technology

about the content of hydrogen, oxygen and carbon in oil shale and peat were used for calculations.

3.3.2. Oxygen for respiration

Calculation of oxygen quantities respired by humans and livestock in Eurostat's 2009 MFA questionnaire table G were based on yearly data about population number and livestock numbers in Estonia. Thereafter respective standard coefficients provided in Economy-wide Material Flow Accounting "Guide for beginners" were applied on the basic data.

3.4. Unused domestic extraction

3.4.1. Unused extraction from mining and quarrying

Background information

In Estonia every enterprises, dealing with mining and quarrying need a waste permit. A waste permit is a document, which gives the right for generation, disposal and recovery of waste. Waste permit holders are required to keep regular records of the type, quantity, properties and generation of the waste produced, collected, stored or temporarily stored, transported, recovered or disposed of during its activities. Estonian Environment Information Centre (EEIC) maintains a primary database of enterprises holding waste permits. Internal recycling is included to the EEIC waste database.

Wastes from mining and quarrying are the biggest generated waste category in Estonia sharing to about one third of yearly waste generation. Oil shale excavation wastes made up the biggest part of mining and quarrying wastes. The majority of these wastes are landfilled.

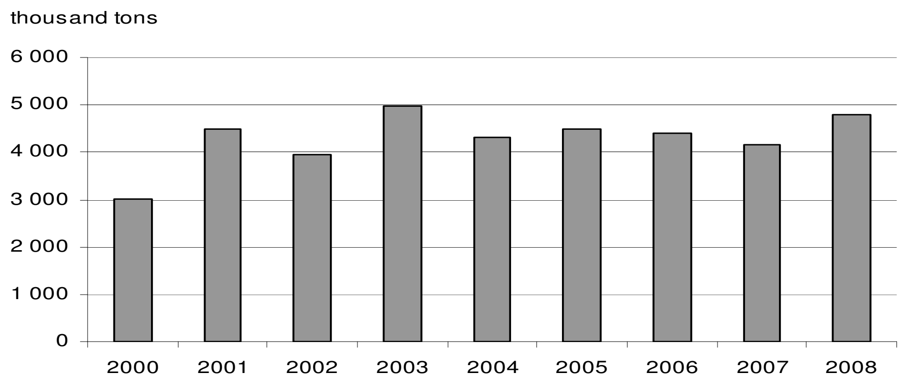
Data availability

Statistical data about generation, recycling and disposal of excavation wastes are available in administrative database since 1993, but classification system based on European List of Waste was introduced since 2000. At the earlier years the Estonian material based classification was used for compilation of waste statistics and due to different classifications the data of earlier years are not totally comparable.

Compilation of data for MFA

Waste statistics database of Estonian Environmental Information Centre was used for compilation of data about unused extraction from mining and quarrying. Quantity of landfill of waste category 01 01 00 (excavation wastes) according to European List of Waste from waste database of EEIC was considered to be unused extraction from mining and quarrying.

Figure 3.10 Unused extractions from mining and quarrying 2000-2008



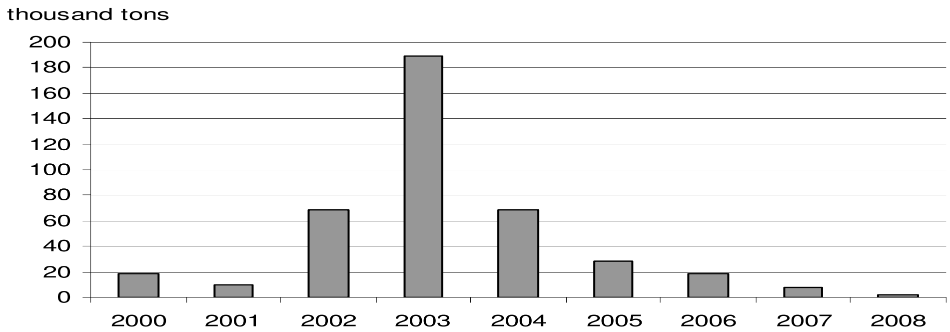
3.4.2. Soil excavation and dredging

Waste category 17 05 00 (soil and stones) according to European List of Wastes, is one of the biggest waste categories generated in Estonia. For example in 2007 soil and stones shared to 7% of all waste generation in Estonia. At the same time, the most of the soil and stones, reported as waste by construction companies were recycled.

Data availability
Statistical data about generation, recycling and disposal of wastes of soil are available in administrative database since 1993, but classification system based on European List of Waste was introduced since 2000. At the earlier years the Estonian material based classification was used for compilation of waste statistics and due to different classifications the data of earlier years are not totally comparable.

Compilation of data for MFA
Waste statistics database of Estonian Environmental Information Centre was used for compilation of data about unused extraction of soil. Quantity of landfill of waste category 17 05 00 (soil and stones) according to European List of Waste from waste database of EEIC was considered to be unused extraction of soil.

Figure 3.11.Unused extraction of soil



3.4.3. Unused extraction of biomass

3.4.3.1. Wood harvesting losses

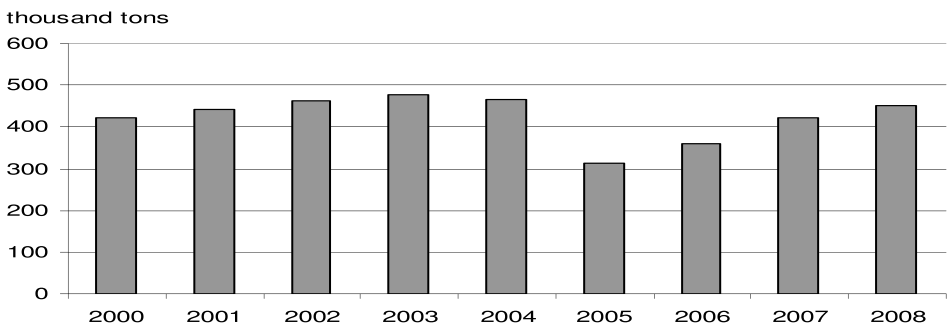
Data availability

Statistical data on wood harvesting losses are not collected in Estonia.

Compilation of data for MFA

Estimations of wood harvesting losses were made using the felling data based on felling documents. The shares of 10% for harvesting losses were supposed. The average coefficient suggested in "Economy Wide Material Flow Accounts: Compilation Guidelines for reporting to the 2009 Eurostat questionnaire" was used in order to recalculation of cubic meters solid volume into tons of wood with 15% of moisture.

Figure 3.12 Wood harvesting losses 2000-2008



3.4.3.2. Discarded by-catch in fishery

Background information

Statistical data on discarded catch and by-catch are not collected in Estonia. Estimations of discarded catch for 2004 were made in the frame of pilot project "Fish and Fisheries Accounts" conducted by Statistics Estonia (Fish and Fisheries Accounts. Final report of the Grant Agreement No. 71401.2005.001-2005.293. Statistical Office of Estonia, Tallinn, 2007).

As far as possible, the discard estimations in project were made according to percentages from Estonian report "Estonian National Program for collection of Fisheries Data for 2007". This report did not covered all kind of species; for species, which were not mentioned in report, the average percentage of discard 3% in case of inland water species and 10% for Baltic Sea catch were used for estimation of discard. For species which were caught in Baltic Sea and in inland waters as well discards for quantities caught from sea and inland waters were made separately and added.

Physical asset accounts for 17 species were constructed. In total these 17 species made up 99% of catch what was considered. Ocean catch was not considered in project and discard estimation for ocean catch was not made.

Data availability

Estimations about quantities of discarded catch by species were made for Baltic Sea and inland waters catch for 2004.

Compilation of data for MFA

Data of pilot project made by Statistics Estonia about discarded catch on Baltic Sea and inland waters were used for 2004. For 2000-2003 and 2005-2008 discarded catch was estimated using (weighted by species) average coefficients used in project: 5% for inland water catch and 3% for Baltic Sea catch.

For ocean catch no estimations of discards were readily available. For MFA compilation ocean catch was divided to two parts: catch of fish and catch of shrimps. Share of shrimps in Estonian ocean catch has constantly increased: from 1% in 1994 to 88% in 2008.

In order to estimate the discards of ocean fish catch the share 10% of catch was used. In case of shrimps, the catch is accompanied with the big quantity of discarded by-catch. Estimations made by FAO ("Discards and by-catch in Shrimp trawl fisheries" http://www.fao.org/docrep/W6602E/w6602E09.htm.) indicate, that in the North Atlantic

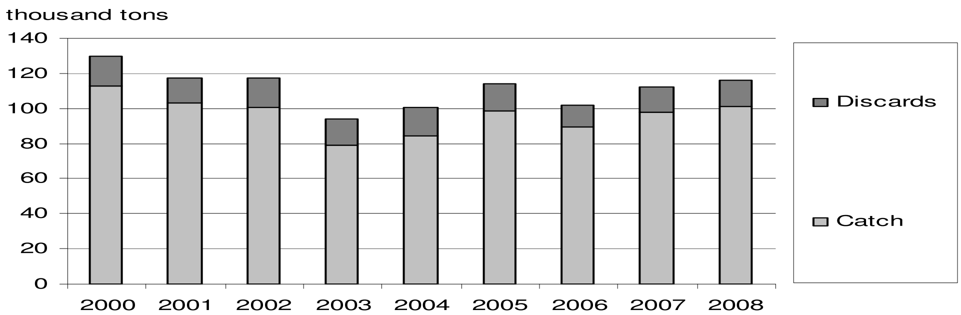
share of by-catch of shrimps made up 98%. This share was used for estimation of Estonian ocean catch discards. Estimations of discards of Estonian fishery in different fishing regions are presented in the table 3.9.

Table. 3.9 Discarded by-catch in fishery 2000-2008, thousand tons

	2000	2001	2002	2003	2004	2005	2006	2007	2008
Ocean fish catch	1,2	0,4	0,3	0,3	0,3	0,4	0,4	0,3	0,2
Shrimps catch	12,5	11,0	14,0	12,6	13,9	12,1	9,1	11,8	12,5
Baltic Sea catch	2,6	2,5	2,4	1,8	1,9	2,4	2,2	2,4	2,5
Inland water catch	0,2	0,1	0,2	0,2	0,1	0,1	0,1	0,1	0,1
Total	16,4	14,1	16,8	14,9	16,2	15,1	11,8	14,7	15,3

The share of total discard make up about 15% compared to total catch.

Figure 3.13 Comparison of catch and discarded by-catch in fishery 2000-2008



4. Material output

Total material output for years 2000-2007 is presented in the ANNEX 13

4.1. Emissions and wastes

4.1.1. Emissions to air

Background information

Estonian Environment Information Centre (EEIC) collects the Estonian Air Emission Database since 1976. Emissions from point sources are calculated on the bases of measurements or national estimations methods. National Air Emission Database includes also emissions from the diffuse sources: road transport and other mobile sources and machinery, household sector, agriculture, nature, fugitive fuel emissions (gasoline distribution and gas distribution networks) and domestic solvent use. Emissions from all area sources were calculated on the base of CORINAIR methodology ("Atmospheric Emission Inventory Guidebook").

Emissions from road transport sector have been calculated using the COPERT III software (tool developed by European Environment Agency) on the base of data about number of vehicle spitted by categories, mileage, fuel consumption, speed and other. Emissions from other mobile sources (as agriculture and industrial machinery, railways, inland water transport, and air traffic) and fugitive fuel emissions are calculated on the basis of the fuel consumption of energy balance and emission factors. Emissions from air traffic include LTO cycles and cruise traffic data.

The Ministry of the Environment is responsible for the finalization of Estonian National Inventory Report under the UNFCCC (United Framework Convention on Climate Change) and their submission to the UNFCCC Secretariat and the EC Commission. Estonian report under the UNECE convention on long range transboundary air pollutants is compiled by Estonian Environment Information Centre.

4.1.1.1. Greenhouse gases

Greenhouse gases include carbon dioxide (CO_2), methane (CH_4), dinitrogen oxide (N_2O), hydroflourcarbons (HFCs), perflourocarbons (PFCs), sulfur hexafluoride (SF_6).

Data availability

Estonian National Inventory Report under the UNFCCC covers emissions for years 1990-2007. Data about emissions of CO_2, N_2O and CH_4 are available for all mentioned years. Data

about emissions of HFCs and SF_6 are available since 1995 and data on emissions of PFCs are available since 2006.

Compilation of MFA standard table

EW-MFA Compilation guides suggest that NAMEA Air emissions data should be used as the primary data source for compilation of the MFA standard table F, as NAMEA Air emissions data are in line of residence principle which should be applied in MW-MFA also. In Estonia NAMEA Air emissions is not compiled on the regular bases. Only one attempt was made during the pilot project conducted by Statistics Estonia for the year 2002. So data of Estonian National Inventory Reports under the UNFCCC 2009 were used as data sources during compiling domestic processed output table of EW-MFA concerning the air emissions of greenhouse gases.

Emissions of carbon dioxide (CO_2)

Data about emissions of carbon dioxide were directly extracted from Estonian National Inventory Report under the UNFCCC 2009. Emissions of carbon dioxide sourced from energy use by international civil air and international sea transport are shown separately under "memo item" in the mentioned Report and were added to national total. CO2 emissions from biomass are indicated on separate row so; these data are also directly extracted from Estonian National Inventory Report 2009. Data about CO2 emissions for 2000-2007 are presented in the table 4.1

.

Table 4.1 Carbon dioxide emissions for 2000-2007 by categories, thousand tons

CO_2source categories	2000	2001	2002	2003	2004	2005	2006	2007
Total CO_2 emissions excluding net CO_2 from LULUCF	**15 556**	**15 858**	**15 433**	**17 168**	**17 443**	**16 848**	**16 341**	**19 093**
International Bunkers	**389**	**363**	**427**	**409**	**556**	**520**	**764**	**925**
Aviation	59	48	54	55	84	143	94	148
Marine	331	315	373	355	472	377	670	777
CO_2 Emissions from Biomass	**2 253**	**2 327**	**2 324**	**2 546**	**2 684**	**2 609**	**2 162**	**2 468**

Emissions of methane (CH_4)

Data about emissions of methane were directly extracted from Estonian National Inventory Report under the UNFCCC 2009. Emissions of methane originated from landfilled wastes were subtracted from national total.

"Economy Wide Material Flow Accounts: Compilation Guidelines for reporting to the 2009 Eurostat Questionnaire" suggests, that methane emissions sourced from uncontrolled landfills

should be subtracted from total. At the same time according to the "Economy-wide Material Flow Accounting "Guide for Beginner", 2006" landfilled wastes could be treated by two different ways in MFA: as "Addition to stock" or as "Domestic processed output". In case of Estonia waste deposited in landfills are rather materials, which are permanently discarded, than potential raw materials not yet used. Landfilled wastes were considered as "Domestic processed output" in current project. In order to avoid double counting, emissions from all solid waste disposals were subtracted from total. Methane emissions from international bunkers were added to national totals. Data about CH_4 emissions for 2000-2007 are presented in the table 4.2.

Table 4.2 Methane emissions for 2000-2007 by categories, thousand tons

CH4 source categories	2000	2001	2002	2003	2004	2005	2006	2007
Total CH_4 emissions excluding CH_4 from LULUCF	**81,61**	**84,16**	**77,68**	**79,70**	**83,48**	**81,97**	**82,05**	**82,11**
Solid Waste Disposal on Land	32,67	32,38	30,59	29,44	28,86	26,69	25,81	24,59
International Bunkers	**0,02**	**0,02**	**0,03**	**0,02**	**0,03**	**0,03**	**0,04**	**0,05**
Aviation	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Marine	0,02	0,02	0,02	0,02	0,03	0,03	0,04	0,05

Emissions of dinitrogen oxide (N_2O)

Data about emissions of dinitrogen oxide were directly extracted from Estonian National Inventory Report under the UNFCCC 2009.

Emissions of N_2O originated from agriculture were subtracted from national total. No emissions from waste landfilling are shown in the Estonian National Inventory 2009. Dinitrogen oxide emissions from international bunkers were added to national totals. Data about N_2O emissions for 2000-2007 are presented in the table 4.3. Quantities of emitted dinitrogen oxide are relatively small.

Table 4.3 Dinitrogen oxide emissions for 2000-2007 by categories, thousand tons

N2O source categories	2000	2001	2002	2003	2004	2005	2006	2007
Total N_2O emissions excluding N_2O from LULUCF	**3,34**	**2,85**	**2,97**	**3,01**	**3,35**	**3,06**	**3,14**	**3,40**

Agriculture	2,61	2,43	2,22	2,47	2,50	2,43	2,49	2,69
International Bunkers	**0,00**	**0,00**	**0,00**	**0,00**	**0,01**	**0,01**	**0,01**	**0,01**
Aviation	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Marine	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,01

Emissions of hydroflourcarbons (HFCs)

Data about emissions of hydroflourcarbons are based on Estonian National Inventory Report under the UNFCCC 2009. Under this category, Estonia reports HFC emissions from all refrigeration and air conditioning equipment, emissions from foam blowing and use of HFC-containing foam products, emissions from fire extinguishers and emissions from aerosols. Assessment of F-gas consumption and emissions in Estonia is based on results from the twinning project between the Estonian Ministry of Environment and the German Ministry of the Environment, Nature Conservation and Nuclear Safety made in 2006 "Twinning Project EE2005/IB/EN/01 "Enhancing the capacity to reduce the emissions of fluorinated greenhouse gases in Estonia". Within this project all sectors of possible F-gas consumption as described in the IPCC Guidelines for National Greenhouse Gas Inventories (2006 edition) were investigated.

Data about emissions of hydroflourcarbons in Estonian National Inventory Report are presented in CO2 equivalents. The global warming potentials (GWP) of individual HFCs reported in the Estonian National Inventory Report were used for the estimation of the natural quantities of emissions. Table 4.4 gives the overview of individual HFCs and their GWPs used for calculation of the total emissions of HFCs for the row F.1.5 of MFA standard tableF.

Table 4.4 HCF and their GWPs reported in the MFA standard table F 2000-2007 thousand tons

HFC	GWP
HFC-23	12000
HFC-32	550
HFC-125	3400
HFC-134a	1300
HFC-152a	120
HFC-143a	4300
HFC-227ea	3500

Emissions of perflourocarbons (PFCs)

Data about emissions of perflourocarbons are also based on Estonian National Inventory Report under the UNFCCC 2009. Under this category, Estonia reports PFC emissions from sport shoe soles. Emissions of only one individual substance (C3F8) are reported. For calculation of the emissions in natural tons of GWP value 8,600 was used.

Emissions of sulfur hexafluoride (SF_6)

Data about emissions of sulfur hexafluoride are based on Estonian National Inventory Report under the UNFCCC 2009. Under this category, Estonia reports SF_6 emissions from electrical equipment. For calculation of the emissions in natural tons GWP value 22.200 was used. In table 4.5the emissions of hydroflourcarbons, perflourocarbons and sulfur hexafluoride in tons of CO2 equivalents and in natural tons are presented.

Table 4.5.Emissions of fluorinated gases, 2000-2007

Greenhouse gas	2000	2001	2002	2003	2004	2005	2006	2007
Emissions of HFCs in tons of CO_2 equivalents	70 791	86 215	87 245	93 040	105 706	118 698	139 529	144 734
Emissions of PFCs in tons of CO_2 equivalents	:	:	:	:	:	:	75	61
Emissions of SF6 in tons of CO2 equivalents	2 734	1 736	1 427	1 311	1 081	1 076	1 154	966
Emissions of HFCs in tons	43,00	52,77	51,51	58,14	65,97	74,06	87,11	98,94
Emissions of PFCs in tons	:	:	:	:	:	:	0,01	0,01
Emissions of SF6 in tons	0,11	0,07	0,06	0,05	0,05	0,05	0,05	0,04

The table 4.5 outlines that the emissions of fluorinated gases in CO2 equivalents are quite remarkable due to very high GWPs values of these substances. Quantities of emissions in natural tons are small and stay far under the reporting level of Eurostat's MFA Questionnaire (500 tons).

4.1.1.2. Other air pollutants

Other air pollutants include nitrous oxides (NOx), carbon monoxide (CO), non-methane volatile organic compounds (NMVOC), sulfur dioxide (SO_2), ammonia (NH_3), heavy metals, persistent organic pollutants (POPs) and particles (e.g. PM10, Dust).

Data availability

Data about emissions of sulfur dioxide, nitrogen oxides, carbon monoxide non-methane volatile organic compounds (NMVOC), lead and particles are available since 1990; data about emissions of ammonia and other heavy metals are available since 1999.

Compilation of MFA standard table

Though compilation guides suggest that NAMEA Air emissions should be used as the primary data source for compilation of the air emissions part of MFA domestic processed output (standard table F), this data source is not available in Estonia. Estonian report under the UNECE convention on long range transboundary air pollutants and data from administrative Air Emissions Database of EEIC were used for compilation of MFA standard table F.

Emission of sulfur dioxide (SO_2)

Data about emissions of sulfur dioxide were directly extracted from Estonian report under the UNECE convention on long range transboundary air pollutants of 2008.

Emission of nitrogen oxides (NOx)

Data about emissions of nitrogen oxides were directly extracted from Estonian report under the UNECE convention on long range transboundary air pollutants of 2008.

Emission of carbon monoxide (CO)

Data about emissions of carbon monoxide were directly extracted from Estonian report under the UNECE convention on long range transboundary air pollutants of 2008.

Emissions of non-methane volatile organic compounds (NMVOC)

For compiling the data about emissions of non-methane volatile organic compounds Estonian report under the UNECE convention on long range transboundary air pollutants of 2008 were used. From national total the emissions due to use of solvents (data from the same report) were subtracted.

Emissions of ammonia (NH_3)

Data of administrative Air Emissions Database of EEIC about air emissions from stationary sources were used for compilation of the MFA standard table F. Only data of air emissions from facilities having air pollution licenses from EEIC database were indicated on the row F.1.11. of table F of MFA standard tables. As emissions from agriculture should not be shown under the domestic processed output, these estimations were not made.

Emissions of heavy metals

For compilation of the heavy metals emission data administrative Air Emissions Database of EEIC about air emissions from stationary sources were used. Air emissions of next heavy metals were included to the EEIC database: mercury (Hg), lead (Pb), cadmium (Cd), arsenic (As), zinc (Zn), chromium (Cr), copper (Cu) and nickel (Ni). .For mobile sources only air

emissions of lead were accounted. Total mobile sources lead air emission data were directly extracted from Estonian report under the UNECE convention on long range transboundary air pollutants of 2008. Sum of heavy metal air emissions from stationary sources and lead air emission from mobile sources were indicated on the row F.1.12. in the MFA standard table F.

Emissions of persistent organic pollutants (POPs)

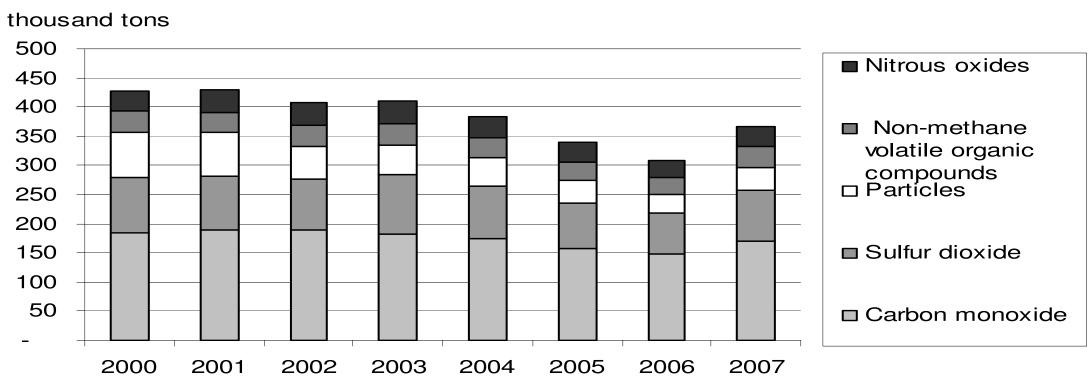
Administrative Air Emissions Database of EEIC of EEIC about air emissions from stationary sources (facilities having air pollution licenses) includes the emissions about more than 100 different individual organic and inorganic substances. There are in total 12 different organic substances listed as persistent organic pollutants in “Economy-wide Material Flow Accounting “Guide for Beginner”, 2006”; none of these substances appear in the EEIC database for years 1999-2008.

In addition brominated flame-retardants are included to POPs. Statistics Estonia has collected the data about use of ozone depleting substances (ODS) for years 1997-2006. One category of ODS are halones (bromofluorohyrdocarbons), which were used as flame-retardants and/or in refrigeration equipments. In Estonia brominated flame-retardants were used mainly in aircrafts, but are mostly replaced for now. According to the survey data of Statistics Estonia total air emissions of halones stay under the 100 kilograms per year. In the frame of EW-MFA these quantities are marginal. So emissions of POP were considered to be zero in the domestic processed output table.

Emissions of particles

Data about emissions of particles were directly derived from Estonian report under the UNECE convention on long range transboundary air pollutants of 2008. Air emissions of particles of all sizes were included. Quantities of emissions of other air pollutants are illustrated by the figure 4.1.

Figure 4.1 Air emissions of main air pollutants, 2000-2007



Remaining problems

Data in the Administrative Air Emissions Database of EEIC and data in the Estonian report under the UNECE convention on long range transboundary air pollutants as well are compiled according to the territorial principles.

Estonian National Inventory Report under the UNFCCC includes only the estimations about greenhouse gases emissions due to international bunkers for aviation and marine. Estimations of air emissions due to international land transportation are not made.

Also no data are available about Estonian residents fuel use and caused air emissions outside the country. Proper adjusting of the air emissions data according to residential principles is one of the tasks for the future development.

4.1.2. Waste landfilled

Background information

The control over waste management, incl. collection and transport, is exercised via the system of issuing waste permits. A waste permit is a document, which gives the right for disposal and recovery of waste, generation of waste, collection and transport of waste on professional basis. Waste permits are issued by county environmental authorities according to the relevant legal acts. Waste permit holders are required to keep regular records of the type, quantity, properties and generation of the waste produced, collected, stored or temporarily stored, transported, recovered or disposed of during its activities. Obligation to keep records covers all the persons having waste permits or integrated environmental permits and registered waste handlers, also hazardous waste generators. As all operators of the waste recovery and disposal facilities must have permit or registration, they are also covered with reporting duty.

Estonian Environment Information Centre (EEIC) is responsible for the assembling of the waste reporting forms from enterprises holding waste permits. EEIC maintains a primary database of enterprises holding waste permits. Waste amounts in this database, were differentiated by waste types according to the classification system based on European List of Waste and waste treatment (disposal and recovery operations) are described by D- and R-codes.

Estonian law covers waste management operators and facilities running all recovery and disposal operations. There are no exemptions for internal recycling (recycling of waste on the site where it was generated). Waste permit may not be required for some recovery and disposal activities, but the operators must be registered and have anyway obligation to report.

4.1.2.1. Municipal waste

Data availability

Data about municipal waste landfilled are available in administrative database since 1993. At the earlier years the Estonian material based classification was use for waste statistics. Since 2000 the new waste classification system based on European List of Waste was introduced. The definitions (compositions) of municipal waste in two classifications were not identical. The waste information collection system was reorganized also, which means that data concerning municipal waste landfill up to 1999 and after 2000 are not completely comparable. Number of landfills of municipal wastes is decreased rapidly at the beginning of 2000-s. 125 municipal waste landfills were in use in 2001, and in 2007 only 17 municipal waste landfills were operating.

Compilation of MFA standard table

Compilation Guidelines for reporting to the 2009 Eurostat MFA questionnaire suggested that only waste deposited to uncontrolled landfills should be accounted in MFA. Still Eurostat MFA Questionnaire 2009 has two separate rows in the table F: F.2.1.a municipal waste – controlled and F.2.1.b municipal waste – uncontrolled.

Total quantity of municipal waste landfilled could be extracted from the above described primary database of enterprises holding waste permits. At the same time division of total quantity between controlled and uncontrolled landfill is problematic.

In Estonian report of Eurostat/OECD Joint Questionnaire “State of Environment. Waste” in the table 5c “Treatment and disposal of municipal waste” are reported the total quantity of municipal waste landfilled and separately quantity of municipal waste landfilled to controlled landfills, which is less than total for the years 1995-2001. The difference between total and controlled municipal waste landfill quantities in the table 5c of JQ could be taken as uncontrolled landfill. But it should be kept in mind, that definitions of uncontrolled landfill according Estonian legislations and MFA are different.

According to Estonian administrative waste statistics controlled landfills are landfills authorized by the County Environmental Authorities (Ministry of the Environment) and having waste permits according to Estonian law. Up to 2001 waste could be deposited on the territory of enterprises which had the waste permit by County Environmental Authorities but which were not classified as landfill. This internal landfill was considered as deposition in uncontrolled landfills.

According MFA definitions controlled landfill is one whose operation is subject to permit system and to technical control procedures in accordance with national legislation force. Uncontrolled landfill is wild dumping. As all landfill in primary waste database managed by EEIC was performed with permits and in accordance with Estonian legislation, all quantity of municipal waste landfilled indicated in EECI database should be considered as controlled landfill in MFA and has to be indicated on the row F.2.1.a. Since the 2002 only landfills authorized by the County Environmental Authorities are operating as municipal waste landfills.

No data are available about illegal landfill (wild dumping) of municipal waste. At the same time, as it was already discussed earlier, according to the "Economy-wide Material Flow Accounting "Guide for Beginner", 2006" landfilled wastes could be treated in MFA as "Addition to stock" or as "Domestic processed output". In Estonia wastes are deposited permanently into landfills and are not considered as potential raw materials. In this pilot project landfilled wastes were considered as "Domestic processed output".

Remaining problems

Estimation of illegal landfill should be useful in the future development.

4.1.2.2. Industrial waste

Background information

Estonian waste statistics does not use the term "industrial waste" subsequently such waste category as "industrial waste" could not be extracted from Estonian waste database. For this reason the proxy of industrial waste was used. The proxy for "industrial waste landfilled" was calculated by formula:

total quantity of waste landfilled – municipal waste landfilled

The quantity of waste landfilled calculated by this formula includes also quantities of waste generated by other economical branches (agriculture, trade, services, construction etc.) and is considerably bigger than quantity of landfilled waste generated by industry. From other hand, as all landfilled waste should be indicated under the category F2 of MFA standard table F, use of proxy calculated by formula above, seems reasonable.

Data availability

Total quantity of waste landfilled could be extracted from the waste database managed by EEIC. As it was discussed in case of municipal waste also for other waste categories quantities landfilled in administrative database refer to licensed landfill and should be considered as controlled landfill in the MFA tables. Data about illegal landfill of waste of other categories than municipal waste are not available.

Compilation of MFA standard table

Also in case of „industrial waste", only deposit to uncontrolled landfills should be accounted in MFA. Also for industrial wastes Eurostat's MFA Questionnaire 2009 has two separate rows in the table F: F.2.2.a industrial waste – controlled and F.2.2.b industrial waste – uncontrolled. As all landfill included to primary waste database managed by EEIC was performed with permits and in accordance with Estonian legislation, all quantity waste landfilled indicated in EECI database was considered control landfill in MFA and was all shown on the row F.2.2.a.

Next waste categories were excluded from total quantity of landfilled waste:
Municipal waste (are indicated on the row F.2.1.a) excavation wastes, soil and stones, (were indicated under disposal of unused extraction) and gardening wastes.

Remaining problems

Estimation of illegal landfill should be useful in the future development.
Term "industrial waste" is not used by European waste statistics and is confusing as two different interpretations were possible: "Waste generated in industry" or "Waste generated else than in households".

4.1.3. Emissions to water

Background information

In Estonia State Water Cadastre keeps record of the amount, level, quality, use and users of water. The Ministry of Environment is the responsible processor of the database whereas the Estonian Environment Information Centre (EEIC) is the authorized processor. The State Water Cadastre consists of a surface water database, groundwater database, marine water database, water use and wastewater database.

The control over waste water management is based on the system of environmental permits. "Water permits" are needed starting from certain quantities of water use. Environmental Information Centre of the Ministry of Environment manages the database of the special water

permits. According to the permit, the water user must keep an account over the volume and parameters of the used water and wastewater and organize monitoring according to the prescriptions of the environmental authority of the location of the special use of water. The State Water Cadastre database contains reported data of the permit holders on water extraction, water use, wastewater generation, discharge and pollution load into the environment. Enterprises that send their wastewater to public sewerage do not need water permits for that.

Data availability

Data about quantities of pollutants emitted to aquatic environment with discharged waste water are available since 1992.

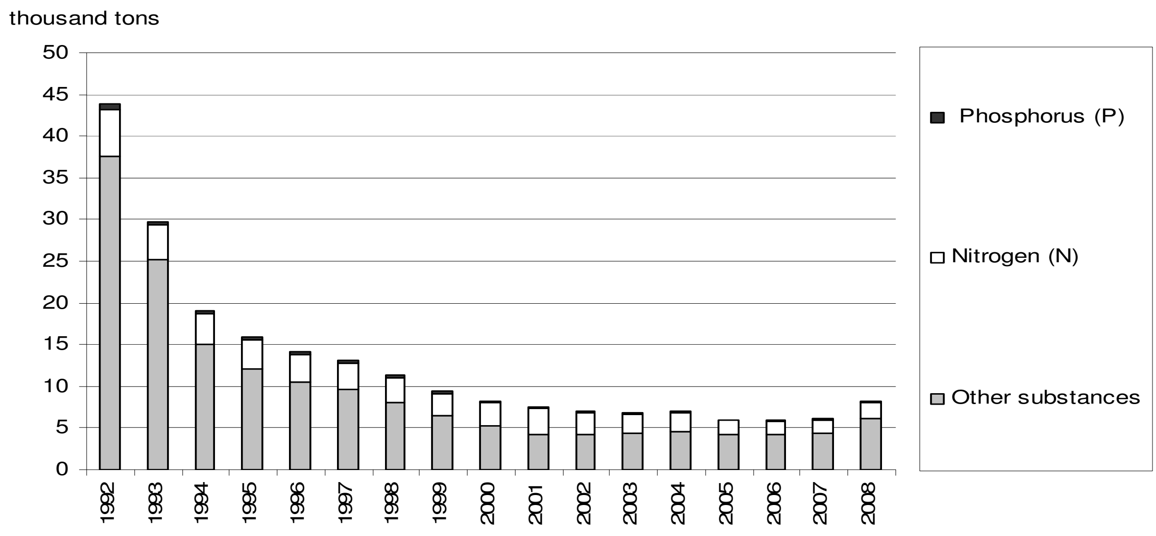
Compilation of MFA standard table

MFA standard table F rows F.3.1 – F.3.5. (emissions to water) were compiled on the bases of information of State Water Cadastre about pollution loads in discharged waste water. Only emissions from point sources (waste water outlets with environmental permits for release waste water into environment) are considered.

Data on emissions of nitrogen, phosphorus and heavy metals are extracted directly from State Water Cadastre. On the row F.3.4 “Other substances and (organic) materials” the sum of the emissions of next pollutants is shown: petroleum products, other organic substances and suspended solids.

Dumping of materials at sea is illegal activity; no data are shown at this row. The quantity of emissions to water from point sources is illustrated on the next figure. Emissions of heavy metals stay under one tons per year and are not shown on the figure 4.2.

Figure 4.2 Emissions to water from point sources 1992-2008



Only data of emissions of pollutants from point sources (waste water outlets with environmental permits) are accounted. Emissions from area sources were not considered. Emissions of N and P from area sources were estimated during pilot project conducted by Statistics Estonia by the experts of Tallinn University of Technology. (Kaia Oras, Eda Grüner, Karin Pachel, Arvo Iital, Estimation of the wastewater generation by source categories. Final report on the Eurostat grants 71301.2005.001-2005.017, Tallinn, 2006). Emissions to water environment due to manure storage, other agriculture activities, clear cuttings, atmospheric load, urban storm water pollution load were estimated for year 2004.
Next table shows emissions to water from non-point sources.

Table 4.6 Total non-point source pollution to water, 2004

Source	N, tons	P, tons
Forest areas	7 464	299
Clear cuttings	125	7
Wetlands	910	24
Agriculture	15 748	268
Rainfall precipitation	731	19
Urban storm water	332	53
Total non-point load 670	**25 310**	**670**
of which induced by human activities (Clear cuttings, agriculture, rainfall precipitation, storm water)	16 936	347
Pollution load from manure stores reaching water environment	1 201	92

Table shows that total emissions to water from non-point sources exceeded the total emission from point sources almost 4 times in 2004. At the same time majority of non point emissions originated from agriculture, which, according to the MFA compilation guide, should not be accounted in MFA standard table F. Emissions from rainfall precipitations and urban storm water are accounted in part of air emissions and should not be accounted also. Emissions from forest areas and wetlands stayed outside the MFA boundaries. So, the emissions to water from non point sources are really unimportant in the framework of MFA and could be omitted.

4.2. Dissipative use of products

4.2.1. Dissipative use on agricultural land

4.2.1.1. Mineral fertilizers

Background information

Data about use of mineral fertilizers are regularly collected by department of agricultural statistics of Statistics Estonia as one module of yearly sample survey “Crop production”.

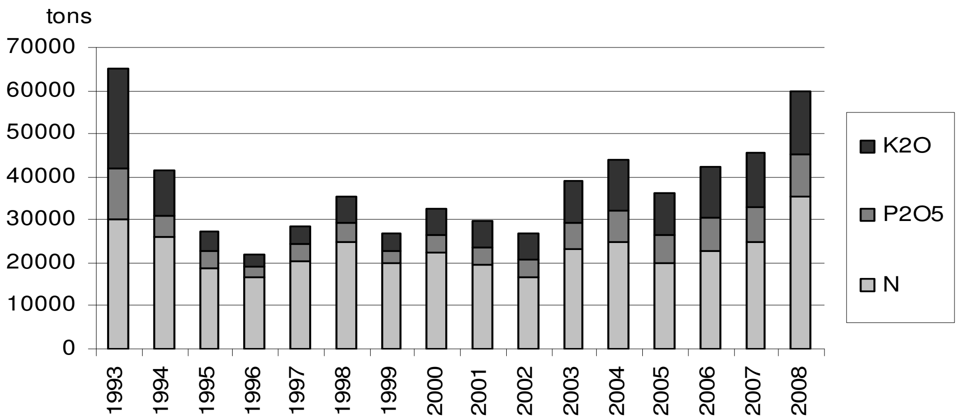
Data availability

Statistical data about use of mineral fertilizers are available in Statistics Estonia since year 1992. Data cover nitrogen, potassium and phosphorus fertilizers and are expressed as quantity of used nutrient: quantity of used nitrogen in case of nitrogen fertilizers and quantities of respective oxides in cases of phosphorus and potassium fertilizers.

Compilation of MFA standard table

Total quantity of nitrogen, potassium and phosphorus fertilizers expressed as quantity of used nutrient was indicated in the row F.4.2. of MFA standard table F. Quantity of used mineral fertilizers expressed in nutrients were illustrated on figure 4.3.

Figure 4.3 Use of mineral fertilizers 1993-2008



Remaining problems

According to compilation guides, use of mineral fertilizers should be accounted in total masses. Statistical data are available, however only for quantities of used nutrients. There was no additional information available for estimation of the total masses of used fertilizers, so these estimations were not made during this project. Working out the coefficients for calculation the total masses of used fertilizers based on data of used nutrients will be one task for the future developments.

Another problem, which may cause some underestimation, is that only agricultural holdings were covered by the survey. Non-agricultural use of fertilizers (for example households and recreational and sport facilities like golfing fields) is not included.

4.2.1.2. Farmyard manure

Background information

Data about use of organic fertilizers (manure) are regularly collected by department of agricultural statistics of Statistics Estonia. Data were collected from agricultural holdings by sample survey and refer to the total quantity of manure used for harvest of accounting year.

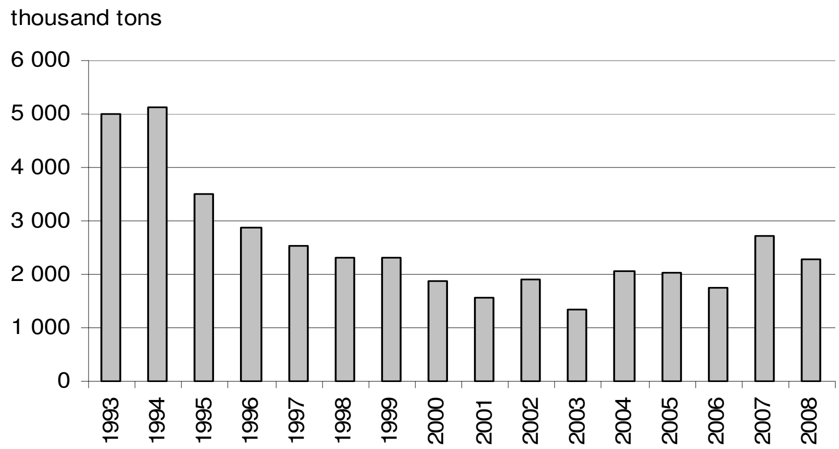
Data availability

Statistical data about use of organic fertilizers (manure) are available since year 1992.

Compilation of MFA standard table

Statistical data about use of organic fertilizers available were used for compilation of the row F.4.1. of MFA standard table F. Quantity of used organic fertilizers were illustrated on figure 4.4.

Figure 4.4 Use of organic fertilizers, thousand tons



Remaining problems

No data were available referring to the water content of used manure, which in fact may differ in big quantities and influence the considerably the data quality.

4.2.1.3. Sewage sludge

Background information

The control over waste water management is based on the system of environmental permits of wastewater treatment plants in State Water Cadastre managed by Estonian Environmental Information Centre (EEIC). Existing administrative databases of sludge generation and

treatment (disposal) in WWTP-s contained lot of data gaps and are incomplete from statistical perspective. The data gaps regarding sludge have been of minor importance while monitoring individual WWTP performance. However it has been an obstacle to create complete statistics of sewage sludge generation and treatment in Estonia.

In 2007-2008 Statistics Estonia carried out the pilot project during which the methods for the estimation of total quantities of sewage sludge dry solid and splitting it up by various disposal methods was elaborated. (Kaia Oras, Sewage Sludge Statistics. Final Report on Grant Agreement No 71301.2006.002-2006.466, Tallinn, 2009).
Dry solid factors, which show the quantity of dry solids (in tons) resulting per one unit (1000 m3) of wastewater treated, based on WWTP type and treatment efficiency categories, were calculated. One of the important outcomes of the project was also bringing out the quantity of dry solids per each disposal method and thereby creating the actual base for comparison of disposal methods for the first time.

Data availability
Statistical data on usage of sewage sludge is not directly collected. Usage of sewage sludge could be estimated based on quantities of sewage sludge disposed by different disposal methods by waste water treatment plants (WWTP).

Compilation of MFA standard table
The MFA standard table F was compiled based on results of pilot project "Sewage Sludge Statistics" conducted by Statistics Estonia. The dry solid factors for estimation of quantities of generated dry solids for three types of WWTP-s (urban, independent and industrial) and three efficiencies of WWTP-s (primary, secondary and tertiary) worked out during the project were applied for estimation of the quantity of generated dry matter of sewage sludge.

For years 2005-2007 the quantities of generated dry matter of sludge reported in final report of project were used. For years 2000-2004 the quantities of generated dry matter of sludge were estimated using methodology and factors described in final report. The detailed description of estimation methods and used factors are presented in the final report of the project.

During the project the quantities of dry matter of sewage sludge are disposed by different methods were estimated. In the next table the quantities of sewage sludge disposed by different methods during 2005-2007 from final report of the project are presented.

Table 4.7 Quantities of sewage sludge disposed by different methods in years 2005-2007

Disposal method	Data for the year 2005		Data for the year 2006		Data for the year 2007	
	Dry matter, tons	Share in total dry matter	Dry matter, tons	Share in total dry matter	Dry matter, tons	Share in total dry matter
Composted	1 281	4,3%	1 400	4,9%	1 483	5,0%
Handed over to waste collector	1 779	6,0%	1 713	6,0%	1 797	6,0%
Given for agricultural use	3 020	10,2%	3 523	12,4%	3 785	12,7%
Incinerated	278	0,9%	275	1,0%	276	0,9%
Disposed on WWTP territory	3 115	10,6%	2 841	10,0%	2 964	10,0%
Urban landscaping and reclamation	10 533	35,7%	9 170	32,4%	9 942	33,5%
Covering landfill or semi coke hill	9 161	31,0%	9 058	32,0%	9 092	30,6%
Other	312	1,1%	330	1,2%	357	1,2%
No treatment data	28	0,1%	25	0,1%	24	0,1%
Total	29 507	100,00%	28 335	100,00%	29 720	100,00%

The sum of the next treatment (disposal) methods was considered as use of sewage sludge: "Given for agricultural use", „Urban landscaping and reclamation", „Covering landfill or semi coke hill". Composting was excluded because use of compost has to be indicated separately in the MFA standard table F.

For the years 2000-2004 the quantity of sewage sludge disposed by these three methods was estimated using the weighted average share of each particular treatment method during 2005-2007. (For example 3020+3523+3785=10328 tones of sludge was given for agricultural use during the 2005-2007, which made up 11.8% of dry matter of sludge generated during 2005-2007. 11.8% of sludge was considered used for agricultural use in the years 2000-2004 also.) Estimated quantities of sewage sludge used during 2000-2007 are presented in the table 4.8.

Table 4.8 Estimated quantities of sewage sludge usage, 2000-2007, tons

Disposal method	2000	2001	2002	2003	2004	2005	2006	2007
Given for agricultural use	2 674	2 621	2 344	2 206	2 541	3 020	3 523	3 785
Urban landscaping and reclamation	8 823	8 650	7 736	7 278	8 384	10 533	9 170	9 942
Covering landfill or semi coke hill	8 021	7 864	7 033	6 617	7 622	9 161	9 058	9 092
Total use	19 518	19 135	17 113	16 101	18 546	22 714	21 751	22 818

4.2.1.4. Compost

Background information

Also in case of compost statistical data on usage is not collected and therefore could only be estimated. Quantity of biological treatment of waste (recovery code R3) in the primary database of the waste reporting of enterprises holding waste permits managed by Estonian Environment Information Centre (EEIC) is only available data concern quantity of generation of compost. At the same time not all generation of compost is indicated in the EEIC waste database. For example backyard composting of households and composting of residuals of plant cultivation are not included; these activities are also excluded from European waste statistics as internal recycling. From the other side, recycling code R3 is boarder than just composting.

Statistics Estonia has conducted two pilot projects were, as one of outcomes, generation of compost in particular economic area were estimated. One project was dedicated to investigation of the generation of the waste in agriculture. In the project the waste generation and treatment in households was studied. In both of these projects composting was not very closely investigated, but some coefficients for estimation of composted waste quantity were delivered.

Data availability

As no data on use of compost are available, it was supposed, that all generated quantity of compost was also used at the same year.

Compilation of MFA standard table

In order to compile the row F.4.4. in MFA standard table F, quantities of compost generation estimations based on three different data sources were made. Estimated compost quantities were added up and considered as use.

1) Quantity of biological treatment of waste (recovery code R3o) in the primary database of the waste reporting of enterprises holding waste permits managed by EEIC was extracted. These data refers to the compost produced by companies specialized on waste management. The biological treatment of next waste categories was included: 20020100; 20030400; 19080500; 3010500; 3030100; 2010300; 2010600; 2020400; 2050200.
2) Estimation of the quantity of biological waste composted by agricultural holdings was based on the results of the pilot project conducted by Statistics Estonia. Quantity of waste generation by waste categories were estimated using waste factors based on economical sizes and production types of agricultural holding. Shares of different types of waste treatment (of which one treatment type was composting) were

calculated based on statistical survey for each production type of agricultural holdings. The detailed methodology of estimation methods and used factors are presented in the final report of the pilot project.

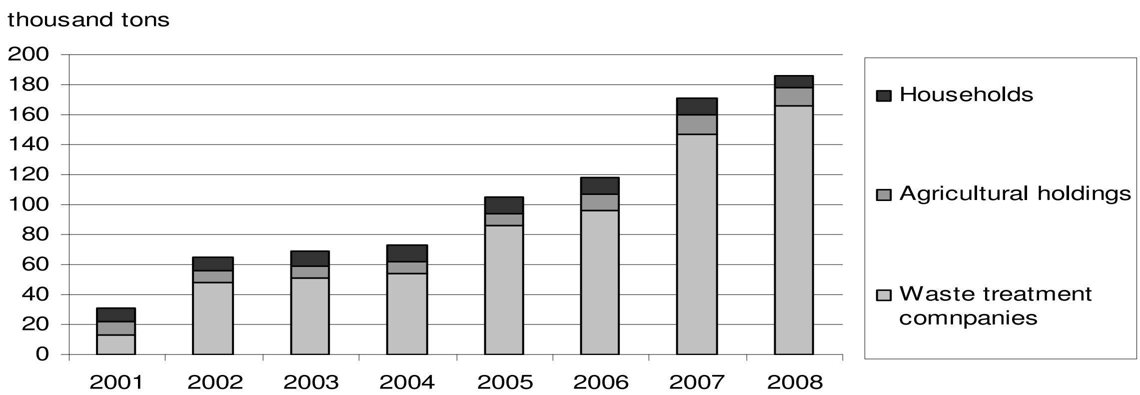
3) Estimation of the compost generated in households was made using to different approaches. Outcome of the pilot project conducted by Statistics Estonia on waste generation and treatment in household's shows that in 2001 about 22% of generated wastes were treated by households themselves, mainly burned and composted. Composting shared to 33% of household's internal waste treatment. Assumed that these shares stayed unchanged, the quantity of produced compost as estimated for years 2000 and 2002-2008.

   The second estimation was made using opinion of the experts of the Ministry of Environment published in the Waste Programme for 2008-2013 (http://www.valitsus.ee/failid/j__tmekava_2008_2013.pdf (27.11.2009), which indicated, that 7% of municipal waste was composted in 2005. 75% of municipal wastes were composted by households.

   Comparison of the quantities of generated compost estimated by two approaches shows that estimations based on Waste Programme were about 10% bigger than estimations based on project conducted by Statistics Estonia. For years 2000-2004 the data of Statistics Estonia were preferred, as they were based on statistical survey. For the later years (2005-2008) the estimations based on expertise of Ministry of Environment were preferred, as they were based on the newer data.

Figure 4.5 shows the quantities of compost generation from different data sources. As quantity of dry matter of compost should be indicated in the MFA standard table F, the coefficient 50% proposed in the Manual was used for calculation of dry matter of the compost.

Figure 4.5 Generation of compost, thousand tons of dry matter



Remaining problems

Use of compost was estimated via generation, assuming, that all generated compost was also used at the same year. It is not necessarily true and may be the source of over or underestimation. As compost is the second bigger material fractions of "dissipative use of products" in the last years and made up a considerable part of domestic processed output, the increase of data quality on use of compost is one of the tasks for future developments.

4.2.1.5. Pesticides

Background information

Statistical data on use of pesticides were collected by Statistics Estonia since 1991. For years 1991-1996 all agricultural enterprises and railways were questioned, but data about farmers were not available. Since 1997 the methodology of pesticide use survey was changed. No more data were collected from railways, but sample survey about of use of pesticides in farms was started. Data about the quantity of used pesticide formulation were compiled.

Data availability

Statistical data on use of pesticides in quantity of used formulation are available for 1991-2008 in Statistics Estonia. Data of different years are not totally comparable, as coverage and methodology of data collection and compilation have changed over the years.

Sales data on pesticides are available in Plant Production Inspectorate. Since 2006 data on sale of pesticide refer to active substance, for earlier years to quantities of formulations.

Comprehensive investigation of use of pesticides on wheat in 2007 was made in pilot project conducted by Statistics Estonia

Compilation of MFA standard table

Data about total use of pesticide formulations in agricultural holdings (agricultural enterprises and farms) for years 1997-2007 were shown in MFA standard table F. Available data about use of pesticides (mostly herbicides) on railways indicates, that use of pesticides in this area was marginal in comparison with agricultural use. No effort was made to estimate non agricultural use of pesticides for 1997-2007. Data of earlier years were not indicated in MFA standard table F.

Total agricultural use of pesticide formulations for years 1997-2007 is presented in the table 4.9.

As Eurostat's MFA standard tables ask the data in thousand tons, the pesticide use exceed the reporting level only for last two years.

Table4.9 Agricultural use of pesticides, tons of formulations

Year	Total use of pesticides, tons
1997	199
1998	195
1999	187
2000	306
2001	328
2002	267
2003	321
2004	245
2005	349
2006	775
2007	898

Remaining problems

Data about use of pesticides are probably slightly underestimated as non agricultural use is not considered. Statistics Estonia started the collection of non agricultural use of pesticides in 2009 and more correct data about use of pesticides will be available in future.

4.2.1.6. Seeds

Background information

Statistical data about the use of seeds in agriculture are collected by agricultural statistics department of Statistics Estonia.

Data availability

Next datasets are available:

Use of hey seeds; data for 1995-2007.

Use of crops seeds; data for 1999/2000-2007/2008.

Use of legume seeds; data for 1999/2000-2007/2008.

Use of potatoes as seeds; data for 1999/2000-2007/2008.

Use of oil seeds as seeds; data for 1999/2000-2007/2008

All data except data about hey seeds, refer for period the 1[s] of July of previous year to the 30th of June of next year.

Compilation of MFA standard table

Data about use of seeds in MFA standard table F for years 2000-2007 were compiled based on agricultural statistics data. It as assumed, that seeds are mostly used at the spring that is before the 1[st] of July that fore the quantity of used seed was appointed to the next year. It causes the mistake in the case of quantity of used winter crops seeds (winter wheat and winter barely), but no data about use of crops seeds by crops were available. As no big changes occur in pattern of grown crops by species from year to year, this mistake was considered to be of minor importance. Total use of seeds by agriculture is presented in the table 4.10.

Table 4.10 Use of seeds in agriculture, tons

Seed	2000	2001	2002	2003	2004	2005	2006	2007	2008
Hey	199	369	139	43	73	58	201	166	…
Cereal	82 592	67 477	56 579	65 492	64 494	64 376	66 140	75 951	86 823
Dried legumes	826	1 087	1 656	835	1 554	1 213	1 427	1 814	1 668
Potatoes	83 404	94 623	72 808	41 904	55 294	52 539	35 600	30 060	33 431
Oilseeds	337	395	262	310	309	356	290	449	585
Total	167 358	163 951	131 444	108 584	121 724	118 542	103 658	108 440	122 507

Alos the table 4.7 above shows that only crops seeds and potatoes are used in the considerable quantities. As only data about use of hey seeds were available for 1995-1999, no data were entered at the row F.4.6. for these years.

Remaining problems

Proper appointment of seeds of winter cereals will be the future task.

4.2.2. Dissipative use on roads

Background information

Statistics Estonia has collected the data about use of de-icing substances on the roads in the years 1993-1999. The quantity of NaCl, $CaCl_2$ and kyanite (mixture of NaCl and KCl) used on the roads were asked. Data are not collected since 1999 any more.

Compilation of MFA standard table

The empirical coefficient for estimation of the used de-icing substances in 2000-2007 was worked out n order to compile the Eurostat MFA Questionnaire 2009. Data of quantity of

precipitations, monthly average temperature and available data of earlier years were used as bases for this empirical coefficient.

The de-icing substances are used in mixture with grit (sand or granite grave). Statistical data on road length and types and the expert opinion of the company dealing with road treatment that 1 kg of gravel mixture is needed treatment of 1 m^2 of road was used for calculation.

4.2.3. Dissipative use of other kind

Data from Estonian report under the UNECE convention on long range transboundary air pollutants (compiled by Estonian Environmental Information Centre) about use of solvents were used for compilation of MFA standard table F.

4.3. Dissipative losses

4.3.1. Abrasion

Emissions due to abrasion of the road vehicle tyres and brake wear were calculated using the coefficients according to "EMEP/EEA air pollutant emission inventory guidebook - 2009". Statistical data about number of vehicles and average yearly run of different vehicles types were used. Only passenger cars and duty vehicles were accounted. No estimations for motorcycles or bicycles were made as no data were available about average yearly run of these vehicles.

Coefficients used are presented in the table 4.11.

Table 4.11 Coefficients of emissions from road vehicle tyres and brake, g km^{-1} $vehicle^{-1}$

	TSP	PM10	PM2.5
Passenger Cars	0,0182	0,0138	0,0074
Light Duty Vehicles	0,0286	0,0216	0,0117
Heavy Duty Vehicles	0,0777	0,059	0,0316

4.3.2. Leakages

Data of energy statistics about leakages of fuels were used. The next fuels were considered: natural gas, bottled gas, bunker oil, shale oil, domestic fuel oil, diesel oil, gasoline and aviation fuel.

4.3.3. Erosion and corrosion of infrastructures

Emissions due to erosion of roads were calculated using the coefficients according to "EMEP/EEA air pollutant emission inventory guidebook - 2009". Statistical data about number of vehicles and average yearly run of different vehicles types were used. Only passenger cars and duty vehicles were accounted. No estimations for motorcycles or bicycles were made as no data were available about average yearly run of these vehicles.

Coefficients used are presented in the table 4.12.

Table 4.12 Coefficients of emissions from road vehicle tyres and brake, g km^{-1} $vehicle^{-1}$

	TSP	PM10	PM2.5
Passenger Cars	0,015	0,0075	0,0041
Light Duty Vehicles	0,015	0,0075	0,0041
Heavy Duty Vehicles	0,076	0,038	0,0205

4.4. Exports

Background information of foreign trade statistics and compilation of MFA standard tables of Eurostat's MFA Questionnaire 2009 on physical trade was discussed in the chapter 1. Results of data compilation of physical export for years 2000-2007 are presented in the table 4.13.

Table 4.13 Estonian total exports 2000-2007, thousand tons

	2000	2001	2002	2003	2004	2005	2006	2007
Raw materials	**5 699**	**5 387**	**5 578**	**5 562**	**4 774**	**4 485**	**4 436**	**4 175**
Fossil fuels	803	880	1 036	1 004	797	616	644	897
Minerals	364	361	472	556	617	692	763	735
Metallic minerals	0	0	0	0	0	0	0	0
Non-metallic minerals	364	361	472	556	617	692	763	735
Biomass	4 513	4 122	4 053	3 983	3 355	3 177	3 028	2 542
Agricultural	34	40	53	39	26	180	217	207
Forestry	4 406	3 981	3 937	3 890	3 275	2 918	2 736	2 260
Fish	73	102	64	54	54	79	76	75
Secondary raw materials	19	22	16	19	4	0	1	1
Semi-manufactured products	**1 861**	**1 748**	**1 734**	**1 947**	**2 352**	**3 219**	**4 923**	**4 283**
From fossil fuels	175	163	213	195	663	1 285	2 802	2 108
From minerals	1 015	883	740	982	1 004	1 146	1 382	1 510
From metallic minerals	547	422	392	645	668	804	1 005	875
From non-metallic minerals	467	460	348	337	336	342	378	635
From biomass	671	702	781	770	685	788	738	665
From forestry	671	702	781	770	685	788	738	665
Finished products	**1 531**	**1 737**	**1 724**	**2 095**	**2 546**	**2 777**	**3 028**	**3 115**
Predominantly from minerals	377	393	429	498	735	859	897	975
Predominantly from metallic minerals	170	215	209	235	406	455	447	484
Predominantly from non-	206	178	221	263	329	404	450	491

metallic minerals								
Predominantly from biomass	367	417	450	472	541	589	657	642
Forestry finished products	367	417	450	472	541	589	657	642
Other products	787	927	845	1 125	1 271	1 330	1 474	1 498
Other products of abiotic kind	134	140	30	70	137	116	114	100
Other products of biotic kind	137	201	239	256	298	340	395	418
Agricultural plant products	63	79	73	97	143	143	141	172
Agricultural animal products	43	52	68	66	68	89	141	126
Animal as products	14	46	62	58	43	51	48	42
Other biotic products	17	23	35	35	44	57	66	78
Other products n e c	517	586	576	799	837	874	965	979
Packaging materials imported with products	**n.e.**	**n.e.**	**n.e.**	**n.e.**	**n.e.**	**n.e.**	**n.e.**	**n.e.**
Waste imported for final treatment	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
TOTAL	**9 091**	**8 872**	**9 036**	**9 604**	**9 672**	**10 481**	**12 386**	**11 573**

4.5. Memorandum items for balancing

4.5.1. Water vapor from combustion

4.5.1.1. Water vapor from water (H_2O) content of fuels

Volumes of water vapor from water (H_2O) content of fuels were derived based on the statistical data about yearly quantities of domestic consumption of fuels. Relevant exemplary values presented in Economy-wide Material Flow Accounting “Guide for beginners” were used for estimating water quantity emitted from water content in various fuels used for combustion.
For specific types of energy carriers used in Estonia, which are not covered by MFA "Guide for beginners" (oil shale and peat) data of Tallinn University of Technology about average number of water content in these energy carriers were used.

4.5.1.2. Water vapor from hydrogen (H) content of fuels

Computation of water vapor quantities from hydrogen (H) content of fuels was also based on the statistical data about yearly quantities of domestic consumption of fuels. Content of hydrogen in energy carriers from Economy-wide Material Flow Accounting “Guide for beginners” were applied. For oil shale and peat data of Tallinn University of Technology about hydrogen quantity of these fuels were used.

4.5.2. Respiration of humans and livestock

4.5.2.1. Emission of carbon dioxide (CO_2) from respiration (of humans and livestock)

Quantities of carbon dioxide (CO_2) emitted from respiration of humans and livestock were also worked out based on statistical data about population number and livestock numbers in Estonia. Standard coefficients presented in Economy-wide Material Flow Accounting "Guide for beginners" were applied for calculating respective quantities of carbon dioxide (CO_2) emissions from humans´ and livestock's respiration.

4.5.2.2. Water (H_2O) vapor from respiration (of humans and livestock)

Calculation of water (H_2O) vapor quantities from respiration of humans and livestock is calculated on the same way as carbon dioxide (CO_2) volumes emitted from respiration - Standard coefficients presented in Economy-wide Material Flow Accounting "Guide for beginners" were applied on yearly data about population number and livestock numbers in Estonia.

4.6. Disposal of unused domestic extraction

The estimation of quantity of unused domestic extraction was described in the chapter 1. The same quantities were for output as were described in the Capter1.

5. Material flow accounts and balances for Estonia

EW-MFA comprises two main elements: material flow accounts and material flow indicators. In current chapter the follwing accounts and balances are described: direct material input, domestic material consumption, physical trade balance, domestic processed output, net addition to stock, direct material flow balance, unused extraction accounts, domestic total material requirement and total domestic output.

As this project is the first attempt to compile the MFA for Estonia, the most effort was made to compile the input and output tables as far as possible. Only these material flow accounts and balances were made, which do not include indirect flows associated to foreign trade.

5.1. Direct Material Input (DMI) accounts

Direct material inputs (DMI) includes all solid, liquid and gaseous materials that enter the economy for further use, either in production or consumption processes. DMI is the sum of used domestic extraction and imports. In next tables the DMI accounts for years 2000 and 2007 are presented.

Table 5.1. DMI accounts for 2000, thousand tons

RESOURCES		USES	
Used domestic extraction	**23 087,2**		
Fossil fuels	***10 729,7***		
Oil shale	9 970,0		
Peat	759,7		
Minerals	***5 657,6***		
Industrial minerals	967,5		
Special clays	246,3		
Special sands	76,1		
Technological limestone and limestone for cement	643,8		
Other	1,3		
Construction minerals	4 690,1		
Sand and gravel	1 580,8		
Crushed stones	849,4		
Dimension stones	1 763,4		
Soil	68,9		
Excavation by-products (oil shale excavation wastes)	427,4		
Biomass	***6 699,9***		
Biomass from agriculture	2 786,0		
Biomass from agriculture harvest	1 294,0		
Cereals	697,0		

Roots	472,0		
Pulses	7,0		
Oil crops	39,0		
Vegetables	53,0		
Fruits	26,0		
Fibre crops	0,0		
Other	0,0		
Biomass from agriculture by-products of harvest	42,5		
Crop residues used as fodder	42,5		
Fodder crops	1 166,7		
Biomass from grazing of agricultural animals	282,8		
Biomass from forestry	3 790,6		
Wood	3 790,6		
Biomass from fishing	113,1		
Marine fish catch	97,1		
Inland waters fish catch	3,2		
Other aquatic animals and plants	12,8		
Biomass from hunting	1,6		
Biomass from other activities	8,6		
Honey	0,3		
Gathering of berries and mushrooms	8,3		
Imports	**5 590,8**		
Raw materials	***2 371,4***		
Fossil fuels	1 240,7		
Minerals	534,5		
Biomass	591,0		
Secondary raw materials	5,2		
Semi-manufactured products	***1 495,4***		
From fossil fuels	740,5		
From minerals	595,6		
From biomass	159,3		
Finished products	***1 724,0***		
Predominately from minerals	429,0		
Predominately from biomass	191,3		
Other products	1 103,7		
Other products of abiotic kind	70,9		
Other products of biotic kind	392,1		
Other products n.e.c.	640,6		
Waste imported for final treatment and disposal	***0,0***		
		DMI-direct material input	**28 678,0**

Table 5.2. DMI account for 2007, thousand tons

RESOURCES		USES	
Used domestic extraction	**40 576,4**		
Fossil fuels	***14 893,0***		
Oil shale	13 992,2		
Peat	900,8		
Minerals	***19 657,5***		
Industrial minerals	1 464,1		
Special clays	457,6		
Special sands	80,0		
Technological limestone and limestone for cement	926,1		

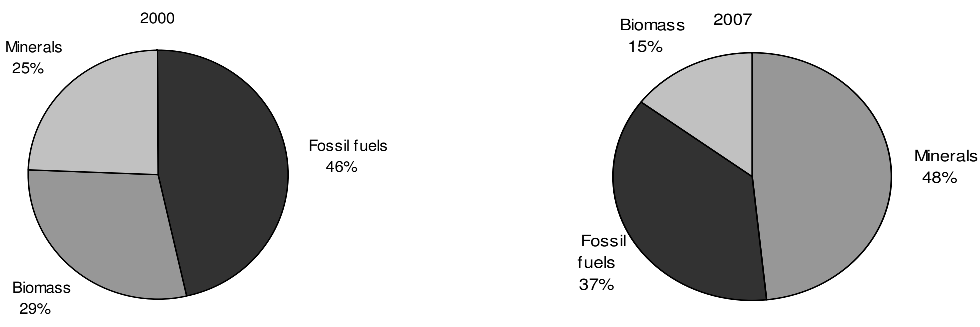
Other	0,4		
Construction minerals	18 193,4		
Sand and gravel	6 531,9		
Crushed stones	3 675,3		
Dimension stones	4 974,4		
Soil	1 302,7		
Excavation by-products (oil shale excavation wastes)	1 709,1		
Biomass	***6 025,9***		
Biomass from agriculture	2 119,7		
Biomass from agriculture harvest	1 292,0		
Cereals	879,0		
Roots	192,0		
Pulses	9,0		
Oil crops	133,0		
Vegetables	72,0		
Fruits	7,0		
Fiber crops	0,0		
Other	0,0		
Biomass from agriculture by-products of harvest	35,1		
Crop residues used as fodder	35,1		
Fodder crops	553,0		
Biomass from grazing of agricultural animals	239,5		
Biomass from forestry	3 795,4		
Wood	3 795,4		
Biomass from fishing	99,3		
Marine fish catch	81,1		
Inland waters fish catch	2,6		
Other aquatic animals and plants	15,7		
Biomass from hunting	2,4		
Biomass from other activities	9,0		
Honey	0,8		
Gathering of berries and mushrooms	8,3		
Imports	**12 140,6**		
Raw materials	***4 012,0***		
Fossil fuels	1 030,8		
Minerals	1 354,8		
Biomass	1 626,3		
Secondary raw materials	0,0		
Semi-manufactured products	***4 581,7***		
From fossil fuels	3 165,6		
From minerals	875,7		
From biomass	540,4		
Finished products	***3 545,8***		
Predominately from minerals	1 164,9		
Predominately from biomass	447,8		
Other products	1 933,2		
Other products of abiotic kind	172,5		
Other products of biotic kind	629,1		
Other products n.e.c.	1 131,6		
Waste imported for final treatment and disposal	***1,0***		
		DMI-direct material input	**52 717,0**

In Estonia direct material input has increased almost twice during given time period – from 28.7 million tons to 52.7 million tons. Increase had happened in both used domestic extraction and imports but imports have increased a little quicker than used domestic extraction. In 2000 imports shared to 20% of direct material input and in 2007 the share of import has increased to 23% of DMI. In 2000 raw materials made up the biggest part of imports; in 2007 relative importance of raw material decreased and semi-manufactured products dominated among imports.

Although share of used domestic extraction has decreased over the 8 years period, it still shared to majority of direct material input. At the same time substantial changes had occur during this period in the composition of extracted materials. In 2000 the fossil fuels made up almost 50% of domestic extraction. Even though domestic extraction of fossil fuels (mostly oil shale) has increased by 1.5 times in 2007 compared to 2000, the share of fossil fuels decreased to about one third of domestic extraction. The quantity of extraction of minerals (especially construction minerals) has increased very quickly and made up almost half of domestic extraction in 2007.

Quantity of extraction of biomass stayed stable over the years, but due to increase of extraction of other material types, the share of biomass in used domestic extraction has decreased from 30% in 2000 to 15% in 2007. The next figure illustrates the changes in composition of domestic extraction in 2007 compared to 2000.

Figure 5.1. Used domestic extraction of main material types in 2000 and 2007



DMI accounts for all years of period 2000-2007 are presented in the ANNEX 1

5.2. Domestic Material Consumption (DMC) accounts

Domestic material consumption measures the total amount of material directly used in the domestic economy. Difference between direct material input and domestic material consumption is that in DMC the quantity of materials leaving the domestic economy to the rest of the world are subtracted. DMC equals direct material input (DMI) minus export. (Indirect flows are not accounted in export).

Domestic material consumption accounts for 2000 and 2007 are presented in the tables 5.3. and 5.4.

Table 5.3. Domestic material consumption accounts for 2000, thousand tons

RESOURCES		USES	
Used domestic extraction	**23 087,2**	**Exports**	**9 090,7**
Fossil fuels	***10 729,7***	***Raw materials***	***5 698,8***
Oil shale	9 970,0	Fossil fuels	802,9
Peat	759,7	Minerals	364,1
Minerals	***5 657,6***	Biomass	4 512,5
Industrial minerals	967,5	Secondary raw materials	19,3
Special clays	246,3	***Semi-manufactured products***	***1 860,9***
Special sands	76,1	From fossil fuels	175,1
Technological limestone and limestone for cement	643,8	From minerals	1 014,6
Other	1,3	From biomass	671,2
Construction minerals	4 690,1	***Finished products***	***1 531,0***
Sand and gravel	1 580,8	Predominately from minerals	376,5
Crushed stones	849,4	Predominately from biomass	367,3
Dimension stones	1 763,4	Other products	787,2
Soil	68,9	Other products of abiotic kind	133,8
Excavation by-products (oil shale excavation wastes)	427,4	Other products of biotic kind	136,6
Biomass	***6 699,9***	Other products n.e.c.	516,8
Biomass from agriculture	2 786,0	***Waste exported for final treatment and disposal***	**0,0**
Biomass from agriculture harvest	1 294,0		
Cereals	697,0		
Roots	472,0		
Pulses	7,0		
Oil crops	39,0		
Vegetables	53,0		
Fruits	26,0		
Fiber crops	0,0		
Other	0,0		
Biomass from agriculture by-products of harvest	42,5		
Crop residues used as fodder	42,5		
Fodder crops	1 166,7		
Biomass from grazing of agricultural animals	282,8		
Biomass from forestry	3 790,6		
Wood	3 790,6		
Biomass from fishing	113,1		

Marine fish catch	97,1		
Inland waters fish catch	3,2		
Other aquatic animals and plants	12,8		
Biomass from hunting	1,6		
Biomass from other activities	8,6		
Honey	0,3		
Gathering of berries and mushrooms	8,3		
Imports	**5 590,8**		
Raw materials	***2 371,4***		
Fossil fuels	1 240,7		
Minerals	534,5		
Biomass	591,0		
Secondary raw materials	5,2		
Semi-manufactured products	***1 495,4***		
From fossil fuels	740,5		
From minerals	595,6		
From biomass	159,3		
Finished products	***1 724,0***		
Predominately from minerals	429,0		
Predominately from biomass	191,3		
Other products	1 103,7		
Other products of abiotic kind	70,9		
Other products of biotic kind	392,1		
Other products n.e.c.	640,6		
Waste imported for final treatment and disposal	***0,0***		
		DMC-domestic material consumption	**19 587,4**

Table 5.4. Domestic material consumption accounts for 2007, thousand tons

RESOURCES		USES	
Used domestic extraction	**40 576,4**	**Exports**	**11 573,0**
Fossil fuels	***14 893,0***	***Raw materials***	***4 174,8***
Oil shale	13 992,2	Fossil fuels	897,2
Peat	900,8	Minerals	735,2
Minerals	***19 657,5***	Biomass	2 541,8
Industrial minerals	1 464,1	Secondary raw materials	0,6
Special clays	457,6	***Semi-manufactured products***	***4 283,2***
Special sands	80,0	From fossil fuels	2 107,8
Technological limestone and limestone for cement	926,1	From minerals	1 510,0
Other	0,4	From biomass	665,4
Construction minerals	18 193,4	***Finished products***	***3 115,0***
Sand and gravel	6 531,9	Predominately from minerals	974,8
Crushed stones	3 675,3	Predominately from biomass	642,3
Dimension stones	4 974,4	Other products	1 497,9
Soil	1 302,7	Other products of abiotic kind	100,5
Excavation by-products (oil shale excavation wastes)	1 709,1	Other products of biotic kind	418,2
Biomass	***6 025,9***	Other products n.e.c.	979,2
Biomass from agriculture	2 119,7	***Waste exported for final treatment and disposal***	***0,0***
Biomass from agriculture harvest	1 292,0		

Cereals	879,0		
Roots	192,0		
Pulses	9,0		
Oil crops	133,0		
Vegetables	72,0		
Fruits	7,0		
Fiber crops	0,0		
Other	0,0		
Biomass from agriculture by-products of harvest	35,1		
Crop residues used as fodder	35,1		
Fodder crops	553,0		
Biomass from grazing of agricultural animals	239,5		
Biomass from forestry	3 795,4		
Wood	3 795,4		
Biomass from fishing	99,3		
Marine fish catch	81,1		
Inland waters fish catch	2,6		
Other aquatic animals and plants	15,7		
Biomass from hunting	2,4		
Biomass from other activities	9,0		
Honey	0,8		
Gathering of berries and mushrooms	8,3		
Imports	**12 140,6**		
Raw materials	***4 012,0***		
Fossil fuels	1 030,8		
Minerals	1 354,8		
Biomass	1 626,3		
Secondary raw materials	0,0		
Semi-manufactured products	***4 581,7***		
From fossil fuels	3 165,6		
From minerals	875,7		
From biomass	540,4		
Finished products	***3 545,8***		
Predominately from minerals	1 164,9		
Predominately from biomass	447,8		
Other products	1 933,2		
Other products of abiotic kind	172,5		
Other products of biotic kind	629,1		
Other products n.e.c.	1 131,6		
Waste imported for final treatment and disposal	***1,0***		
		DMC-domestic material consumption	**41 144,0**

The next figure illustrates the changes in DMC during the 8 years period. In 2000 the fossil fuel made up more than half of DMC; the share of fossil fuels in DMC has considerably decreased during this time. The share of minerals (of which construction minerals make up more than 90%) increased remarkably. Minerals were the most used material type in 2007, which was probably caused by very high construction activity in these years. The share of

domestic consumption of biomass has slightly increased in 2007 compared to 2000, at the same time the absolute quantity of biomass consumption has not changed over the years

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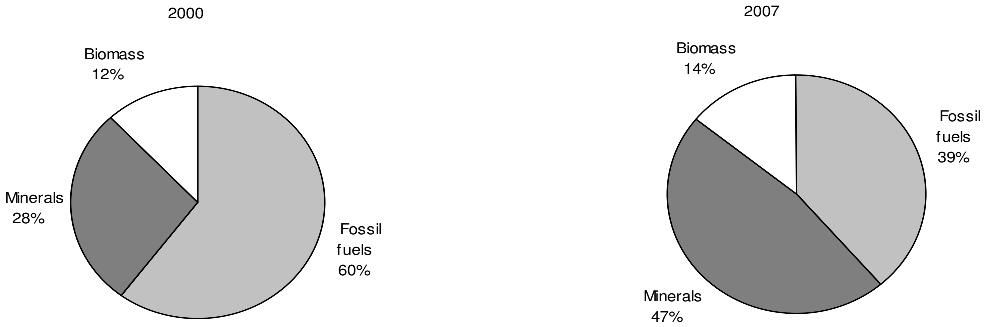
Figure 5.2 Domestic Material Consumption in 2000 and 2007.



In the table 5.5 the direct material input (DMI) and domestic material consumption (DMC) of the main material types for 2000 and 2007 are compared.

Table 5.5 Comparisons of Direct Material Input and Domestic Material Consumption in 2000 and 2007, thousand tons

	DMI	DMC	DMI-DMC	DMC/DMI*100
2000				
Fossil fuels	12 710,9	11 732,9	978,0	92%
Minerals	6 858,6	5 398,6	1 460,0	79%
Biomass	8 033,7	2 346,1	5 687,7	29%
2007				
Fossil fuels	19 089,5	16 084,5	3 005,0	84%
Minerals	22 060,5	19 714,9	2 345,7	89%
Biomass	9 269,5	5 917,3	3 352,2	64%

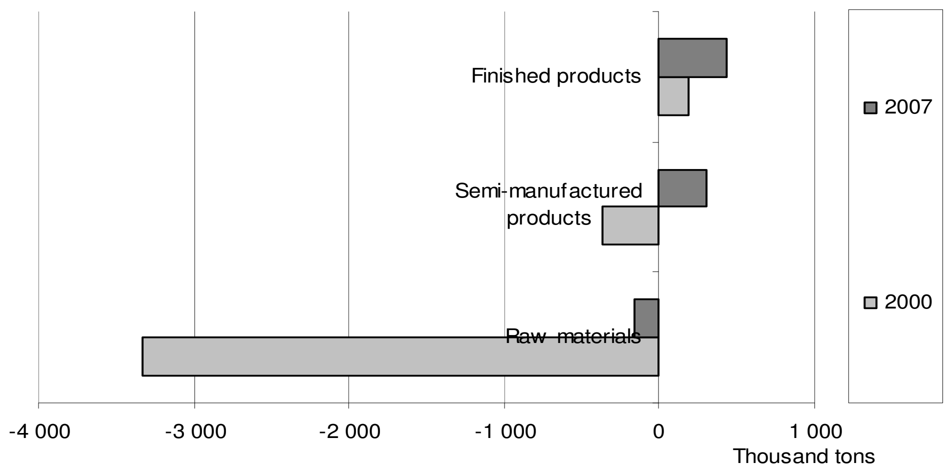
In 2000 there were no big difference between DMI and DMC of fossil fuels, which means, that all input of fossil fuels (excavated and imported) are consumed in domestic economy. Also majority of minerals (78% of input) are consumed domestically. Situation with biomass is opposite, only 30% of biomass input is consumed inside the country, the biggest share of biomass was exported. In 2007 the share of domestic consumption of minerals has increased; at the same time share of domestic consumption of fossil fuels has decreased, which means that share of exports of fossil fuels has increased. Still the majority of both these materials' types were consumed inside the country. The big changes occur in domestic consumption of biomass; in 2007also the bigger share (64%) of direct material input of biomass was consumed inside the country.

Domestic material consumption accounts for the years 2000-2007 are presented in the ANNEX 2.

5.3. Physical Trade Balance (PTB) accounts

Physical trade balance (PTB) measures surplus or deficit of the physical trade of country's economy. PTB equals imports minus exports. The physical trade balance has changed from deficit (-3 499.9 thousand tons) in 2000 to surplus (567.5 thousand tons in 2007). The figure 5.3 illustrates the changes in physical trade balance of materials with different degree of processing in 2007 compared to 2000. The main reason for change of PTB from deficit to surplus is PTB of raw materials. In 2000 about 2.5 times of raw materials were exported than imported. Raw materials made up 63% of all exported materials. In 2007 the quantities of imported and exported raw materials were almost the same. The change occurs due to considerable increase of import of raw materials, whereas a physical export of raw materials has slightly decreased also over the years.

Figure 5.3 Physical Trade Balance of materials with different processing level in 2000 and 2007, thousand tons



Estonian physical trade balances in years 2000 and 2007 are presented in following tables 5.6 and 5.7.

Table 5.6 Physical Trade Balance (PTB) account for 2000, thousand tons

RESOURCES		USES	
Imports	**5 590,8**	**Exports**	**9 090,7**
Raw materials	***2 371,4***	***Raw materials***	***5 698,8***
Fossil fuels	1 240,7	Fossil fuels	802,9
Minerals	534,5	Minerals	364,1
Biomass	591,0	Biomass	4 512,5
Secondary raw materials	5,2	Secondary raw materials	19,3
Semi-manufactured products	***1 495,4***	***Semi-manufactured products***	***1 860,9***
From fossil fuels	740,5	From fossil fuels	175,1
From minerals	595,6	From minerals	1 014,6
From biomass	159,3	From biomass	671,2
Finished products	***1 724,0***	***Finished products***	***1 531,0***
Predominately from minerals	429,0	Predominately from minerals	376,5
Predominately from biomass	191,3	Predominately from biomass	367,3
Other products	1 103,7	Other products	787,2
Other products of abiotic kind	70,9	Other products of abiotic kind	133,8
Other products of biotic kind	392,1	Other products of biotic kind	136,6
Other products n.e.c.	640,6	Other products n.e.c.	516,8
Waste imported for final treatment and disposal	***0,0***	***Waste exported for final treatment and disposal***	***0,0***
		PTB-physical trade balance	**-3 499,9**

Table 5.7 Physical Trade Balance (PTB) account for 2007, thousand tons

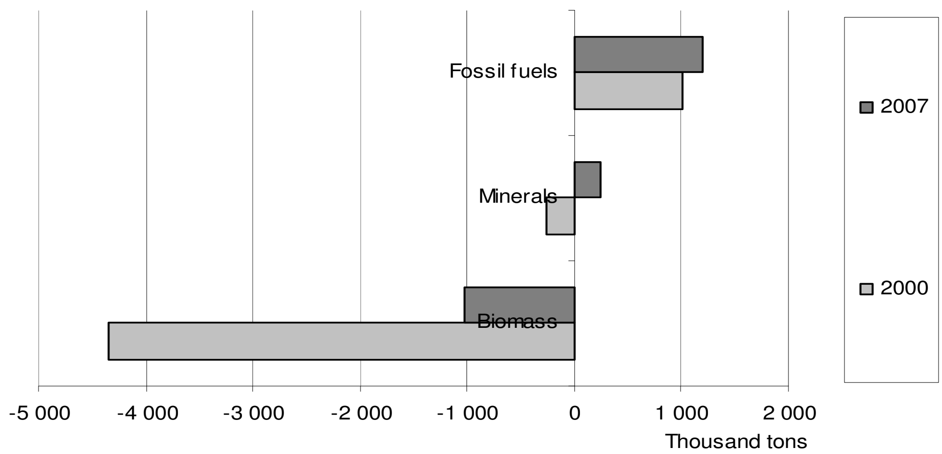
RESOURCES		USES	
Imports	**12 140,6**	**Exports**	**11 573,0**
Raw materials	***4 012,0***	***Raw materials***	***4 174,8***
Fossil fuels	1 030,8	Fossil fuels	897,2
Minerals	1 354,8	Minerals	735,2
Biomass	1 626,3	Biomass	2 541,8
Secondary raw materials	0,0	Secondary raw materials	0,6
Semi-manufactured products	***4 581,7***	***Semi-manufactured products***	***4 283,2***
From fossil fuels	3 165,6	From fossil fuels	2 107,8
From minerals	875,7	From minerals	1 510,0
From biomass	540,4	From biomass	665,4
Finished products	***3 545,8***	***Finished products***	***3 115,0***
Predominately from minerals	1 164,9	Predominately from minerals	974,8
Predominately from biomass	447,8	Predominately from biomass	642,3
Other products	1 933,2	Other products	1 497,9
Other products of abiotic kind	172,5	Other products of abiotic kind	100,5
Other products of biotic kind	629,1	Other products of biotic kind	418,2
Other products n.e.c.	1 131,6	Other products n.e.c.	979,2
Waste imported for final treatment and disposal	***1,0***	***Waste exported for final treatment and disposal***	***0,0***
		PTB-physical trade balance	**567,5**

Next figure illustrates the changes in physical trade balance of main materials groups in 2007 compared to 2000. Main reason for change of PTB from deficit to surplus is PTB of biomass. In 2000 biomass made up 59% of total physical exports and 24% of total physical import; 4 times more of biomass was exported than imported. Raw biomass from forestry shared to 83% of exported biomass.

In 2007 biomass shared to 36% of total physical exports and 33% of total physical imports. Quantity of exported biomass still exceeded the quantity of imported biomass by 30%, but has considerably decreased since 2000. In 2007 raw biomass from forestry shared to 53% of exported biomass.

It could be concluded, that decrease of export of raw materials from forestry had the biggest influence on change of PTB from deficit to surplus in 2007 compared to 2000.

Figure 5.4. Physical Trade Balance of main material types in 2000 and 2007, thousand tons



The Physical trade balances for years 2000-2007 are presented in the ANNEX 3

5.4. Domestic Processed Output (DPO) accounts

Domestic processed output is a total quantity of materials which flow to the environment after been used in domestic economy. Both extracted and imported materials are accounted (without indirect flows). Domestic processed output consists of flows of emissions to air and to water arising during the production and consumptions, wastes disposed into landfills and materials dispersed into the environment during use of the products. Estonian domestic processed output accounts for the years 2000 and 2007 are presented in the tables' 5.8 and 5.9.

Table 5.8 Domestic Processed Output (DPO) account for 2000, thousand tons

RESOURCES		USES	
Emissions and wastes	**23 854,8**		
Emissions to air	***16 423,1***		
Waste landfilled	***7 423,4***		
Emissions to water	***8,3***		
Dissipative use of products and losses	**2 143,0**		
Dissipative use of products	***2 127,2***		
Dissipative use on agricultural land	2 117,1		
Mineral fertilizers	32,4		
Farmyard manure	1 863,6		
Sewage sludge	19,5		
Compost	34,0		
Pesticides	0,3		
Seeds	167,4		
Dissipative use on roads	5,9		
Dissipative use of solvents	4,2		
Dissipative losses	***15,8***		
Abrasion of tyres and breaks	8,1		
Leakages	1,0		
Erosion of roads	6,7		
		DPO - domestic processed output	**25 997,8**

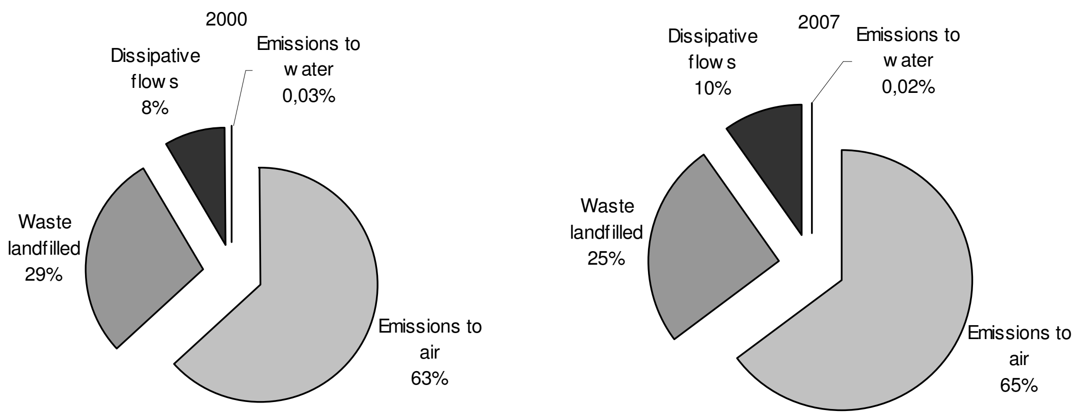
Table 5.9 Domestic Processed Output (DPO) account for 2007, thousand tons

RESOURCES		USES	
Emissions and wastes	**28 431,7**		
Emissions to air	***20 440,6***		
Waste landfilled	***7 984,9***		
Emissions to water	***6,1***		
Dissipative use of products and losses	**3 084,7**		
Dissipative use of products	***3 067,8***		
Dissipative use on agricultural land	3 053,3		
Mineral fertilizers	45,5		
Farmyard manure	2 704,3		
Sewage sludge	22,8		
Compost	171,4		
Pesticides	0,9		
Seeds	108,4		
Dissipative use on roads	9,7		
Dissipative use of solvents	4,8		
Dissipative losses	***16,9***		
Abrasion of tyres and breaks	9,1		
Leakages	0,0		
Erosion of roads	7,8		
		DPO - domestic processed output	**31 516,4**

Total quantity of domestics processed output has increased by 20% in 2007 compared to 2000. Shares of the different components of DPO in 2000 and 2007 were compared on the

following graph. No considerable changes occurred in domestic processed output quantities in 2007 compared to 2000. Emissions to air made up the majority of DPO and emissions to water are negligible in the both of the years.

Figure5.5 Domestic Processed Output in 2000 and 2007



Quantities of dissipative flows are not big, but are increasing; mainly by considerable increase of dissipative use on agricultural land (especially increase of use of farmyard manure).

Domestic processed output accounts for years 2000-2007 are presented in the ANNEX 4

5.5. Net Addition to Stock (NAS) accounts

Net addition to stock was calculated as balancing item i.e. as a difference between domestic material consumption and domestic processed output. Indirect flows were not considered. Net addition to stock for years 2000 and 2007 are presented in the tables 5.10 and 5.11.

Table 5.10 Net addition to stock calculated as balancing item for 2000, thousand tons

RESOURCES		USES	
Used domestic extraction	**23 087,2**	**Exports**	**9 090,7**
Fossil fuels	***10 729,7***	***Raw materials***	***5 698,8***
Oil shale	9 970,0	Fossil fuels	802,9
Peat	759,7	Minerals	364,1
Minerals	***5 657,6***	Biomass	4 512,5
Industrial minerals	967,5	Secondary raw materials	19,3
Special clays	246,3	***Semi-manufactured products***	***1 860,9***
Special sands	76,1	From fossil fuels	175,1
Technological limestone and limestone for cement	643,8	From minerals	1 014,6
Other	1,3	From biomass	671,2

Construction minerals	4 690,1	***Finished products***	***1 531,0***
Sand and gravel	1 580,8	Predominately from minerals	376,5
Crushed stones	849,4	Predominately from biomass	367,3
Dimension stones	1 763,4	Other products	787,2
Soil	68,9	Other products of abiotic kind	133,8
Excavation by-products (oil shale excavation wastes)	427,4	Other products of biotic kind	136,6
Biomass	***6 699,9***	Other products n.e.c.	516,8
Biomass from agriculture	2 786,0	***Waste exported for final treatment and disposal***	***0,0***
Biomass from agriculture harvest	1 294,0	**Emissions and wastes**	**23 854,7**
Cereals	697,0	***Emissions to air***	***16 423,0***
Roots	472,0	***Waste landfilled***	***7 423,4***
Pulses	7,0	***Emissions to water***	***8,3***
Oil crops	39,0	**Dissipative use of products and losses**	**2 143,0**
Vegetables	53,0	***Dissipative use of products***	***2 127,2***
Fruits	26,0	Dissipative use on agricultural land	2 117,1
Fiber crops	0,0	Mineral fertilizers	32,4
Other	0,0	Farmyard manure	1 863,6
Biomass from agriculture by-products of harvest	42,5	Sewage sludge	19,5
Crop residues used as fodder	42,5	Compost	34,0
Fodder crops	1 166,7	Pesticides	0,3
Biomass from grazing of agricultural animals	282,8	Seeds	167,4
Biomass from forestry	3 790,6	Dissipative use on roads	5,9
Wood	3 790,6	Dissipative use of solvents	4,2
Biomass from fishing	113,1	***Dissipative losses***	***15,8***
Marine fish catch	97,1	Abrasion of tyres and breaks	8,1
Inland waters fish catch	3,2	Leakages	1,0
Other aquatic animals and plants	12,8	Erosion of roads	6,7
Biomass from hunting	1,6	**Memorandum items for balancing**	**18 964,9**
Biomass from other activities	8,6	***Water vapor from combustion***	***16 178,8***
Honey	0,3	From water contents of fuels	2 172,7
Gathering of berries and mushrooms	8,3	From hydrogen contents of fuels	14 006,1
Imports	**5 590,8**	***Respiration of humans and livestock***	***2 786,1***
Raw materials	***2 371,4***	CO2	1 292,1
Fossil fuels	1 240,7	Water vapor	1 494,0
Minerals	534,5		
Biomass	591,0		
Secondary raw materials	5,2		
Semi-manufactured products	***1 495,4***		
From fossil fuels	740,5		
From minerals	595,6		
From biomass	159,3		
Finished products	***1 724,0***		
Predominately from minerals	429,0		
Predominately from biomass	191,3		
Other products	1 103,7		
Other products of abiotic kind	70,9		
Other products of biotic kind	392,1		
Other products n.e.c.	640,6		
Waste imported for final treatment and disposal	***0,0***		

Memorandum items for balancing	**25 100,0**		
Oxygen for combustion	***24 016,5***		
Oxygen for respiration	***1 083,5***		
		NAS - Net additions to stock	**-275,3**

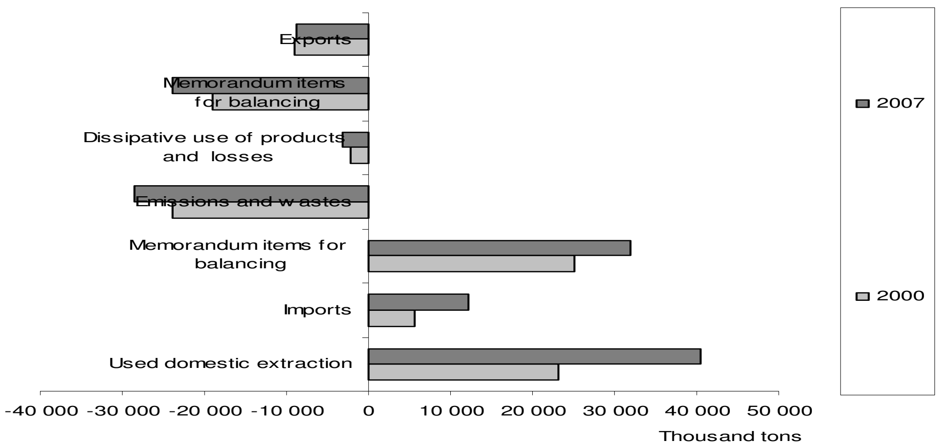
Table 5.11 Net addition to stock calculated as balancing item for 2007, thousand tons

RESOURCES		USES	
Used domestic extraction	**40 576,4**	**Exports**	**11 573,0**
Fossil fuels	***14 893,0***	***Raw materials***	***4 174,8***
Oil shale	13 992,2	Fossil fuels	897,2
Peat	900,8	Minerals	735,2
Minerals	***19 657,5***	Biomass	2 541,8
Industrial minerals	1 464,1	Secondary raw materials	0,6
Special clays	457,6	***Semi-manufactured products***	***4 283,2***
Special sands	80,0	From fossil fuels	2 107,8
Technological limestone and limestone for cement	926,1	From minerals	1 510,0
Other	0,4	From biomass	665,4
Construction minerals	18 193,4	***Finished products***	***3 115,0***
Sand and gravel	6 531,9	Predominately from minerals	974,8
Crushed stones	3 675,3	Predominately from biomass	642,3
Dimension stones	4 974,4	Other products	1 497,9
Soil	1 302,7	Other products of abiotic kind	100,5
Excavation by-products (oil shale excavation wastes)	1 709,1	Other products of biotic kind	418,2
Biomass	***6 025,9***	Other products n.e.c.	979,2
Biomass from agriculture	2 119,7	***Waste exported for final treatment and disposal***	***0,0***
Biomass from agriculture harvest	1 292,0	**Emissions and wastes**	**28 431,7**
Cereals	879,0	***Emissions to air***	***20 440,6***
Roots	192,0	***Waste landfilled***	***7 984,9***
Pulses	9,0	***Emissions to water***	***6,1***
Oil crops	133,0	**Dissipative use of products and losses**	**3 084,7**
Vegetables	72,0	***Dissipative use of products***	***3 067,8***
Fruits	7,0	Dissipative use on agricultural land	3 053,3
Fiber crops	0,0	Mineral fertilizers	45,5
Other	0,0	Farmyard manure	2 704,3
Biomass from agriculture by-products of harvest	35,1	Sewage sludge	22,8
Crop residues used as fodder	35,1	Compost	171,4
Fodder crops	553,0	Pesticides	0,9
Biomass from grazing of agricultural animals	239,5	Seeds	108,4
Biomass from forestry	3 795,4	Dissipative use on roads	9,7
Wood	3 795,4	Dissipative use of solvents	4,8
Biomass from fishing	99,3	***Dissipative losses***	***16,9***
Marine fish catch	81,1	Abrasion of tyres and breaks	9,1
Inland waters fish catch	2,6	Leakages	0,0
Other aquatic animals and plants	15,7	Erosion of roads	7,8
Biomass from hunting	2,4	**Memorandum items for balancing**	**23 941,9**
Biomass from other activities	9,0	***Water vapor from combustion***	***21 198,1***
Honey	0,8	From water contents of fuels	2 827,6

Gathering of berries and mushrooms	8,3	From hydrogen contents of fuels	18 370,5
Imports	**12 140,6**	***Respiration of humans and livestock***	***2 743,8***
Raw materials	***4 012,0***	CO2	1 272,5
Fossil fuels	1 030,8	Water vapor	1 471,3
Minerals	1 354,8		
Biomass	1 626,3		
Secondary raw materials	0,0		
Semi-manufactured products	***4 581,7***		
From fossil fuels	3 165,6		
From minerals	875,7		
From biomass	540,4		
Finished products	***3 545,8***		
Predominately from minerals	1 164,9		
Predominately from biomass	447,8		
Other products	1 933,2		
Other products of abiotic kind	172,5		
Other products of biotic kind	629,1		
Other products n.e.c.	1 131,6		
Waste imported for final treatment and disposal	***1,0***		
Memorandum items for balancing	**31 908,8**		
Oxygen for combustion	***30 841,8***		
Oxygen for respiration	***1 067,0***		
		NAS - Net additions to stock	**17 594,5**

There was a considerable difference between the NAS of two compared years. In 2000 the material output exceeded the material input by almost 300 thousand tons. In 2007 surplus of physical material balance was almost 17 million tons. Components of domestic material consumption and domestic processed output contributing to the NAS of the years under consideration are illustrated on figure 5.6. In 2007 domestic material consumption (positive side on the graph) has increased more than domestic processed output (negative side on the graph) compared to 2000. The biggest increase has occurred in used domestic extraction. As it was shown earlier, the rapid increase in quantity of excavation of construction minerals was the main reason behind the increase of domestic extraction in 2007.

Figure 5.6 Net addition to stock 2000 and 2007, thousand tons



5.6. Direct Material Flow Balance

Direct material flow balance accounts allow presenting a flow of direct material inputs and outputs. Direct material flow balance accounts for 2000 and 2007 are presented in tables 5.12 and 5.13.

Table 5.12 Direct material flow balance accounts for 2000, thousand tons

RESOURCES		USES	
Used domestic extraction	**23 087,2**	**Exports**	**9 090,7**
Fossil fuels	***10 729,7***	***Raw materials***	***5 698,8***
Oil shale	9 970,0	Fossil fuels	802,9
Peat	759,7	Minerals	364,1
Minerals	***5 657,6***	Biomass	4 512,5
Industrial minerals	967,5	Secondary raw materials	19,3
Special clays	246,3	***Semi-manufactured products***	***1 860,9***
Special sands	76,1	From fossil fuels	175,1
Technological limestone and limestone for cement	643,8	From minerals	1 014,6
Other	1,3	From biomass	671,2
Construction minerals	4 690,1	***Finished products***	***1 531,0***
Sand and gravel	1 580,8	Predominately from minerals	376,5
Crushed stones	849,4	Predominately from biomass	367,3
Dimension stones	1 763,4	Other products	787,2
Soil	68,9	Other products of abiotic kind	133,8
Excavation by-products (oil shale excavation wastes)	427,4	Other products of biotic kind	136,6
Biomass	***6 699,9***	Other products n.e.c.	516,8
Biomass from agriculture	2 786,0	***Waste exported for final treatment and disposal***	***0,0***
Biomass from agriculture harvest	1 294,0	**Emissions and wastes**	**23 854,7**
Cereals	697,0	***Emissions to air***	***16 423,0***
Roots	472,0	***Waste landfilled***	***7 423,4***
Pulses	7,0	***Emissions to water***	***8,3***
Oil crops	39,0	**Dissipative use of products and losses**	**2 143,0**
Vegetables	53,0	***Dissipative use of products***	***2 127,2***
Fruits	26,0	Dissipative use on agricultural land	2 117,1
Fiber crops	0,0	Mineral fertilizers	32,4
Other	0,0	Farmyard manure	1 863,6
Biomass from agriculture by-products of harvest	42,5	Sewage sludge	19,5
Crop residues used as fodder	42,5	Compost	34,0
Fodder crops	1 166,7	Pesticides	0,3
Biomass from grazing of agricultural animals	282,8	Seeds	167,4
Biomass from forestry	3 790,6	Dissipative use on roads	5,9
Wood	3 790,6	Dissipative use of solvents	4,2
Biomass from fishing	113,1	***Dissipative losses***	***15,8***
Marine fish catch	97,1	Abrasion of tyres and breaks	8,1
Inland waters fish catch	3,2	Leakages	1,0
Other aquatic animals and plants	12,8	Erosion of roads	6,7
Biomass from hunting	1,6	**Memorandum items for balancing**	**18 964,9**
Biomass from other activities	8,6	***Water vapor from combustion***	***16 178,8***

Honey	0,3	From water contents of fuels	2 172,7
Gathering of berries and mushrooms	8,3	From hydrogen contents of fuels	14 006,1
Imports	**5 590,8**	***Respiration of humans and livestock***	***2 786,1***
Raw materials	***2 371,4***	CO2	1 292,1
Fossil fuels	1 240,7	Water vapor	1 494,0
Minerals	534,5	**Net additions to stock**	**-275,3**
Biomass	591,0		
Secondary raw materials	5,2		
Semi-manufactured products	***1 495,4***		
From fossil fuels	740,5		
From minerals	595,6		
From biomass	159,3		
Finished products	***1 724,0***		
Predominately from minerals	429,0		
Predominately from biomass	191,3		
Other products	1 103,7		
Other products of abiotic kind	70,9		
Other products of biotic kind	392,1		
Other products n.e.c.	640,6		
Waste imported for final treatment and disposal	***0,0***		
Memorandum items for balancing	**25 100,0**		
Oxygen for combustion	***24 016,5***		
Oxygen for respiration	***1 083,5***		
	53 778,0		**53 778,0**

Table 5.13 Direct material flow balance accounts for 2007, thousand tons

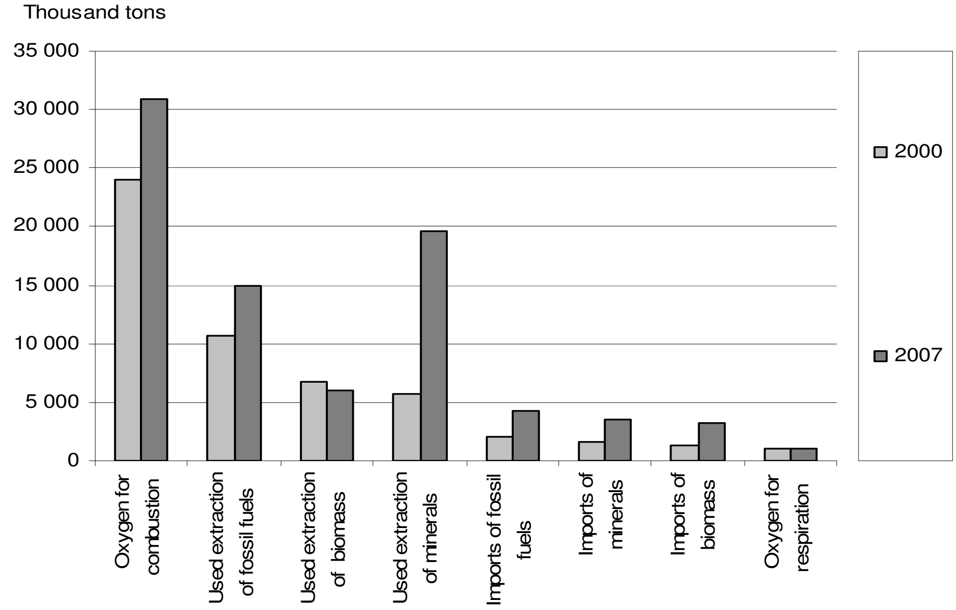
RESOURCES		USES	
Used domestic extraction	**40 576,4**	**Exports**	**11 573,0**
Fossil fuels	***14 893,0***	***Raw materials***	***4 174,8***
Oil shale	13 992,2	Fossil fuels	897,2
Peat	900,8	Minerals	735,2
Minerals	***19 657,5***	Biomass	2 541,8
Industrial minerals	1 464,1	Secondary raw materials	0,6
Special clays	457,6	***Semi-manufactured products***	***4 283,2***
Special sands	80,0	From fossil fuels	2 107,8
Technological limestone and limestone for cement	926,1	From minerals	1 510,0
Other	0,4	From biomass	665,4
Construction minerals	18 193,4	***Finished products***	***3 115,0***
Sand and gravel	6 531,9	Predominately from minerals	974,8
Crushed stones	3 675,3	Predominately from biomass	642,3
Dimension stones	4 974,4	Other products	1 497,9
Soil	1 302,7	Other products of abiotic kind	100,5
Excavation by-products (oil shale excavation wastes)	1 709,1	Other products of biotic kind	418,2
Biomass	***6 025,9***	Other products n.e.c.	979,2
Biomass from agriculture	2 119,7	***Waste exported for final treatment and disposal***	***0,0***
Biomass from agriculture harvest	1 292,0	**Emissions and wastes**	**28 431,7**
Cereals	879,0	***Emissions to air***	***20 440,6***

Roots	192,0	***Waste landfilled***	***7 984,9***
Pulses	9,0	***Emissions to water***	***6,1***
Oil crops	133,0	**Dissipative use of products and losses**	**3 084,7**
Vegetables	72,0	***Dissipative use of products***	***3 067,8***
Fruits	7,0	Dissipative use on agricultural land	3 053,3
Fiber crops	0,0	Mineral fertilizers	45,5
Other	0,0	Farmyard manure	2 704,3
Biomass from agriculture by-products of harvest	35,1	Sewage sludge	22,8
Crop residues used as fodder	35,1	Compost	171,4
Fodder crops	553,0	Pesticides	0,9
Biomass from grazing of agricultural animals	239,5	Seeds	108,4
Biomass from forestry	3 795,4	Dissipative use on roads	9,7
Wood	3 795,4	Dissipative use of solvents	4,8
Biomass from fishing	99,3	***Dissipative losses***	***16,9***
Marine fish catch	81,1	Abrasion of tyres and breaks	9,1
Inland waters fish catch	2,6	Leakages	0,0
Other aquatic animals and plants	15,7	Erosion of roads	7,8
Biomass from hunting	2,4	**Memorandum items for balancing**	**23 941,9**
Biomass from other activities	9,0	***Water vapor from combustion***	***21 198,1***
Honey	0,8	From water contents of fuels	2 827,6
Gathering of berries and mushrooms	8,3	From hydrogen contents of fuels	18 370,5
Imports	**12 140,6**	***Respiration of humans and livestock***	***2 743,8***
Raw materials	***4 012,0***	CO2	1 272,5
Fossil fuels	1 030,8	Water vapor	1 471,3
Minerals	1 354,8	**Net additions to stock**	**17 594,5**
Biomass	1 626,3		
Secondary raw materials	0,0		
Semi-manufactured products	***4 581,7***		
From fossil fuels	3 165,6		
From minerals	875,7		
From biomass	540,4		
Finished products	***3 545,8***		
Predominately from minerals	1 164,9		
Predominately from biomass	447,8		
Other products	1 933,2		
Other products of abiotic kind	172,5		
Other products of biotic kind	629,1		
Other products n.e.c.	1 131,6		
Waste imported for final treatment and disposal	***1,0***		
Memorandum items for balancing	**31 908,8**		
Oxygen for combustion	***30 841,8***		
Oxygen for respiration	***1 067,0***		
	84 625,8		**84 625,8**

In 2007 the direct material flow was about 70% bigger than in 2000. On the figure 5.7 the bigger items of input side of direct material flow balance for 2000 and 2007 are compared. As As could be seen also on the figure 5.7, the increase of material flow has occurred mainly due to substantial increase of excavation of minerals and also increased excavation of fossil fuels.

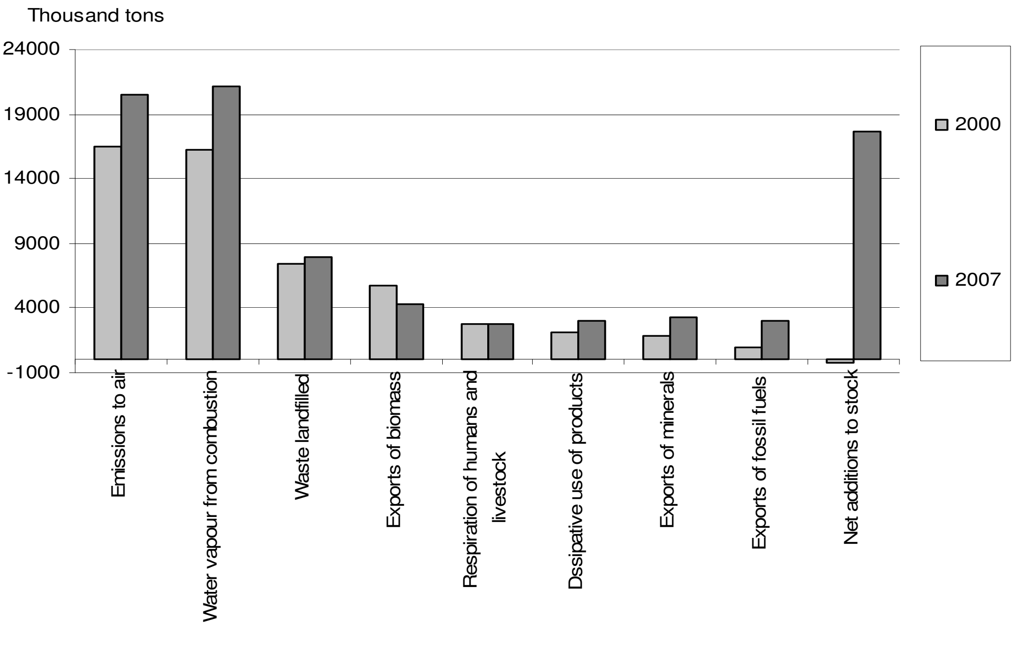
Balancing item oxygen for combustion has noticeably increased also, which is natural consequence of increased use of fossil fuels.

Figure 5.7 Input side of direct material flow balance for 2000 and 2007



On the figure 5.8, the bigger items of output side of direct material flow balance for 2000 and 2007 are compared. As it is seen from the figure the increase of material flow has occurred mainly due to substantial increase of net additions to stock. Considerable increase occurred also in quantity of air emissions and balancing item water vapor for combustion.

Figure 5.8. Output side of direct material flow balance for 2000 and 2007



It could be concluded, that material flow into and out from domestic economy in Estonia has increased in 2007 compared to 2000 due to substantial increase of domestic extraction of construction minerals and consequent increase of stock (buildings). Another considerable factor of increase of material flow is increased domestic extraction of oil shale (increase of production of electricity) and consequent increase of air emissions.

Direct material flow balance accounts for all years of period 2000-2007 are presented in the ANNEX 6.

5.7. Unused Extraction Accounts

Unused extraction consists of unused extraction from mining and quarrying, unused extraction of soil, wood harvesting losses and discarded by-catch in fishery. Unused extraction accounts for 2000 and 2007 are presented in the tables 5.14 and 5.15.

Table 5.14. Unused extraction accounts for 2000, thousand tons

RESOURCES		USES	
Unused domestic extraction	**3 478,7**	**Disposal of unused domestic extraction**	**3 478,7**
Unused extraction from mining and quarrying	***3 022,3***	***Unused extraction from mining and quarrying***	***3 022,3***
Unused biomass from harvest	***437,6***	***Unused biomass from harvest***	***437,6***
Wood harvesting losses	421,2	Wood harvesting losses	421,2
Discarded by-catch	16,4	Discarded by-catch	16,4
Soil excavation and dredging	***18,8***	***Soil excavation and dredging***	***18,8***
	3 478,7		**3 478,7**

Table 5.15. Unused extraction accounts for 2007, thousand tons

RESOURCES		USES	
Unused domestic extraction	**4 606,0**	**Disposal of unused domestic extraction**	**4 606,0**
Unused extraction from mining and quarrying	***4 161,7***	***Unused extraction from mining and quarrying***	***4 161,7***
Unused biomass from harvest	***436,4***	***Unused biomass from harvest***	***436,4***
Wood harvesting losses	421,7	Wood harvesting losses	421,7
Discarded by-catch	14,7	Discarded by-catch	14,7
Soil excavation and dredging	***7,9***	***Soil excavation and dredging***	***7,9***
	4 606,0		**4 606,0**

Waste from oil shale excavation make up about 90% of unused domestic extraction. In 2007 the quantity of unused domestic extraction has increased by about 30% compared to 2000. The used domestic extraction has increased by 75% at the same time. In 2000 the quantity of

unused domestic extraction was about 15% compared to used domestic extraction. In 2007 the relative quantity of unused extraction decreased to about 11%.

Unused extraction accounts for all years of period 2000-2007 are presented in the ANNEX 7.

5.8. Domestic total material requirement (d-TMR) accounts

A domestic total material requirement measures the material flows originating from the national territory. A domestic total material requirement is the sum of used and unused domestic extraction. Domestic total material requirement accounts for 2000 and 2007 are presented in tables 5.16 and 5.17.

Table 5.16 Domestic total material requirement accounts for 2000, thousand tons

RESOURCES		USES	
Used domestic extraction	**23 087,2**		
Fossil fuels	***10 729,7***		
Oil shale	9 970,0		
Peat	759,7		
Minerals	***5 657,6***		
Industrial minerals	967,5		
Special clays	246,3		
Special sands	76,1		
Technological limestone and limestone for cement	643,8		
Other	1,3		
Construction minerals	4 690,1		
Sand and gravel	1 580,8		
Crushed stones	849,4		
Dimension stones	1 763,4		
Soil	68,9		
Excavation by-products (oil shale excavation wastes)	427,4		
Biomass	***6 699,9***		
Biomass from agriculture	2 786,0		
Biomass from agriculture harvest	1 294,0		
Cereals	697,0		
Roots	472,0		
Pulses	7,0		
Oil crops	39,0		
Vegetables	53,0		
Fruits	26,0		
Fiber crops	0,0		
Other	0,0		
Biomass from agriculture by-products of harvest	42,5		
Crop residues used as fodder	42,5		
Fodder crops	1 166,7		
Biomass from grazing of agricultural animals	282,8		
Biomass from forestry	3 790,6		
Wood	3 790,6		

Biomass from fishing	113,1		
Marine fish catch	97,1		
Inland waters fish catch	3,2		
Other aquatic animals and plants	12,8		
Biomass from hunting	1,6		
Biomass from other activities	8,6		
Honey	0,3		
Gathering of berries and mushrooms	8,3		
Unused domestic extraction	**3 478,7**		
Unused extraction from mining and quarrying	***3 022,3***		
Unused biomass from harvest	***437,6***		
Wood harvesting losses	421,2		
Discarded by-catch	16,4		
Soil excavation and dredging	***18,8***		
		Domestic total material requirement	**26 566,0**

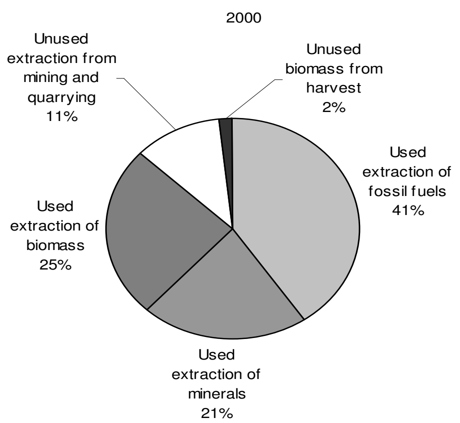
Table 5.17 Domestic total material requirement accounts for 2007, thousand tons

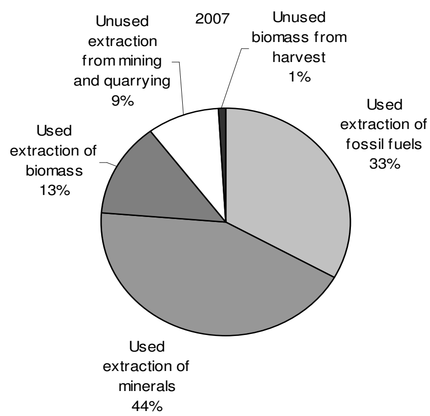
RESOURCES		**USES**	
Used domestic extraction	**40 576,4**		
Fossil fuels	***14 893,0***		
Oil shale	13 992,2		
Peat	900,8		
Minerals	***19 657,5***		
Industrial minerals	1 464,1		
Special clays	457,6		
Special sands	80,0		
Technological limestone and limestone for cement	926,1		
Other	0,4		
Construction minerals	18 193,4		
Sand and gravel	6 531,9		
Crushed stones	3 675,3		
Dimension stones	4 974,4		
Soil	1 302,7		
Excavation by-products (oil shale excavation wastes)	1 709,1		
Biomass	***6 025,9***		
Biomass from agriculture	2 119,7		
Biomass from agriculture harvest	1 292,0		
Cereals	879,0		
Roots	192,0		
Pulses	9,0		
Oil crops	133,0		
Vegetables	72,0		
Fruits	7,0		
Fiber crops	0,0		
Other	0,0		
Biomass from agriculture by-products of harvest	35,1		
Crop residues used as fodder	35,1		
Fodder crops	553,0		

Biomass from grazing of agricultural animals	239,5		
Biomass from forestry	3 795,4		
Wood	3 795,4		
Biomass from fishing	99,3		
Marine fish catch	81,1		
Inland waters fish catch	2,6		
Other aquatic animals and plants	15,7		
Biomass from hunting	2,4		
Biomass from other activities	9,0		
Honey	0,8		
Gathering of berries and mushrooms	8,3		
Unused domestic extraction	**4 606,0**		
Unused extraction from mining and quarrying	***4 161,7***		
Unused biomass from harvest	***436,4***		
Wood harvesting losses	421,7		
Discarded by-catch	14,7		
Unused domestic extraction	**4 606,0**		
		Domestic total material requirement	**45 182,5**

In 2007 domestic total material requirements increased by 70% compared to 2000. Considerable increase of used domestic extraction of minerals shared the most to this increase. Figure 5.9 illustrates the domestic total material requirements in 2000 and 2007.

Figure 5.9. Domestic total material requirements 2000 and 2007.





Domestic total material requirements accounts for years 2000-2007 are presented in the ANNEX 8.

5.9. Total Domestic Output (TDO) accounts

Total domestic output (TDO) measures the total quantity of materials which flow to the environment as the result of the production and/or consumption activities. It is bigger than

domestic processed output as includes in addition to the DPO also the disposal of unused extraction. Total domestic output accounts for years 2000 and 2007 is presented in the tables 5.18 and 5.19.

Table 5.18 TDO accounts for 2000, thousand tons

RESOURCES		USES	
Emissions and wastes	**23 854,8**		
Emissions to air	***16 423,1***		
Waste landfilled	***7 423,4***		
Emissions to water	***8,3***		
Dissipative use of products and losses	**2 143,0**		
Dissipative use of products	***2 127,2***		
Dissipative use on agricultural land	2 117,1		
Mineral fertilizers	32,4		
Farmyard manure	1 863,6		
Sewage sludge	19,5		
Compost	34,0		
Pesticides	0,3		
Seeds	167,4		
Dissipative use on roads	5,9		
Dissipative use of solvents	4,2		
Dissipative losses	***15,8***		
Abrasion of tyres and breaks	8,1		
Leakages	1,0		
Erosion of roads	6,7		
Disposal of unused domestic extraction	**3 478,7**		
Unused extraction from mining and quarrying	***3 022,3***		
Unused biomass from harvest	***437,6***		
Wood harvesting losses	421,2		
Discarded by-catch	16,4		
Soil excavation and dredging	***18,8***		
		TDO – total domestic output	**29 476,5**

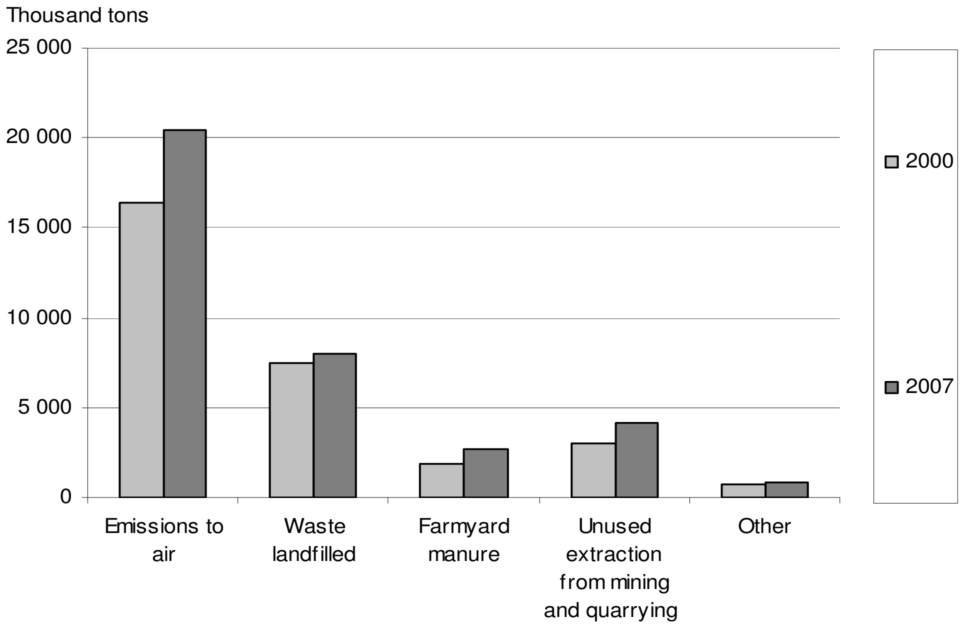
Table 5.19 TDO accounts for 2007, thousand tons

RESOURCES		USES	
Emissions and wastes	**28 431,7**		
Emissions to air	***20 440,6***		
Waste landfilled	***7 984,9***		
Emissions to water	***6,1***		
Dissipative use of products and losses	**3 084,7**		
Dissipative use of products	***3 067,8***		
Dissipative use on agricultural land	3 053,3		
Mineral fertilizers	45,5		
Farmyard manure	2 704,3		
Sewage sludge	22,8		
Compost	171,4		
Pesticides	0,9		
Seeds	108,4		

Dissipative use on roads	9,7		
Dissipative use of solvents	4,8		
Dissipative losses	***16,9***		
Abrasion of tyres and breaks	9,1		
Leakages	0,0		
Erosion of roads	7,8		
Disposal of unused domestic extraction	**4 606,0**		
Unused extraction from mining and quarrying	***4 161,7***		
Unused biomass from harvest	***436,4***		
Wood harvesting losses	421,7		
Discarded by-catch	14,7		
Soil excavation and dredging	***7,9***		
		TDO – total domestic output	**36 122,4**

Total domestic output has increased by 22% in 2007 compared to 2000. The figure 5.11 illustrates the main material flows of TDO in these two years. The emissions to air are the biggest materials output flows and also were the most increased during this time period.

Figure 4.11. The main material flows of TDO in 2000 and 2007, thousand tons



The most of the air emissions originated from electricity production based on oil shale burning. Oil shale excavation and electricity production from oil shale generates the big quantity of wastes which appear in various locations in TDO: - excavation wastes appear in TDO accounts as disposal of unused domestic extraction, oil shale ashes (which made up the greatest share of oilshale waste) appear as landfilled wastes. The increase of electricity production at the resent years had the bigger influence on quantity of air emissions than on the quantity of landfilled wastes and disposal of unused extraction.

Total domestic output (TDO) accounts for years 2000-2007 are presented in the ANNEX 9.

6. Indicators derived from account

This chapter gives an overview of the **material flow indicators** derived from the material flow accounts. With the help of these indicators the flows of materials between Estonian economy and environment are characterized. Indicators (input indicators, consumption and balance indicators and output indicators) were combined with each other or economic indicators in order to characterize various aspects of the Estonia's resource use and efficiency measures both in time horizon and in international comparison.

Most of the indicators reflect that material flow into and out from domestic economy in Estonia has increased in 2007 compared to 2000 due to substantial increase of domestic extraction of construction minerals and consequent increase of stock (buildings). Another considerable factor of increase of material flow is increased domestic extraction of oil shale (increase of production of electricity) and consequent increase of air emissions.

As indirect flows associated to imports and exports were not estimated during this project, only the set of main indicators, which can be derived without compilation of a complete material balances (i.e. not including the indirect flows) were calculated.

6.1. Input indicators

In Estonia the resource use has increased a lot in investigated time period 2000-2007. For example direct material input has increased almost twice – from 28.7 million tons in 2000 to 52.7 million tons in 2007. The increase of domestic extraction which makes up the majority of direct material input is a main factor of the increase. Though the quantity of imports is rather small, the share of imports in direct material input has been also quickly increasing.

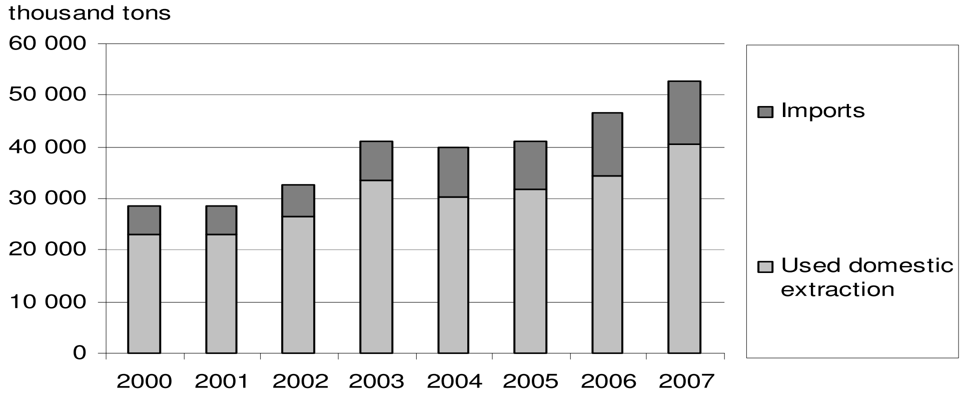
All three indicators input indicators below: direct material input, total material input and domestic total material requirement, reflect the various aspects of the same trend but in more detail below.

6.1.1. Direct Material Input (DMI)

Direct material input is the extensive indicator which represents materials supply. It measures the direct input of materials for use into the economy. Direct material input consists of all solid, liquid and gaseous materials which are of economic value and are used in production

and consumption activities DMI is defined as sum of used domestic extraction and imports. Estonian DMI in period 2000-2007 is presented on the figure 6.1.

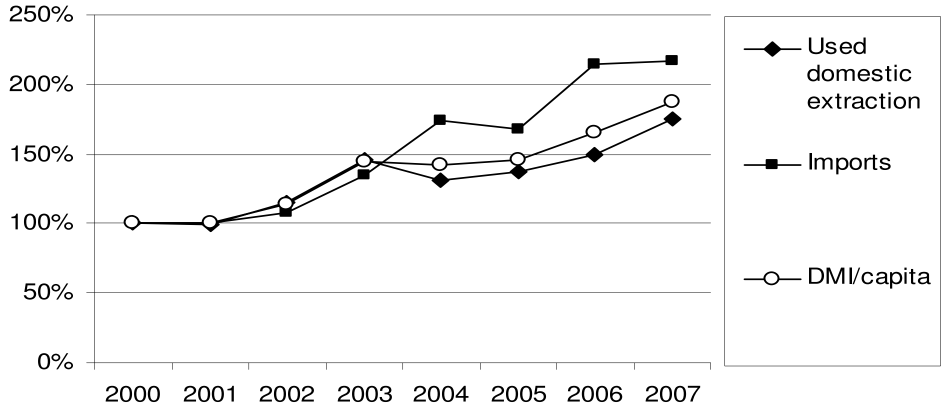
Figure 6.1 Direct Material Input 2000-2007, thousand tons



Both used domestic extraction and imports were constantly increased during this time period. The domestic extraction makes up the majority of direct material input during all considered time period.

Figure 6.2 illustrates the changes of used domestic extraction, imports and DMI compared to 2000. The following figure outlines that physical imports was growing much quicker than domestic extraction. Though quantity of imports is still rather small, the share of imports in direct material input is quickly increasing.

Figure 6.2 Changes of domestic extraction, imports and DMI, 2000=100%



The next figure illustrates the changes in domestic extraction of the main material groups during time period in question.

Figure 6.3. Changes of domestic extraction, 2000=100%

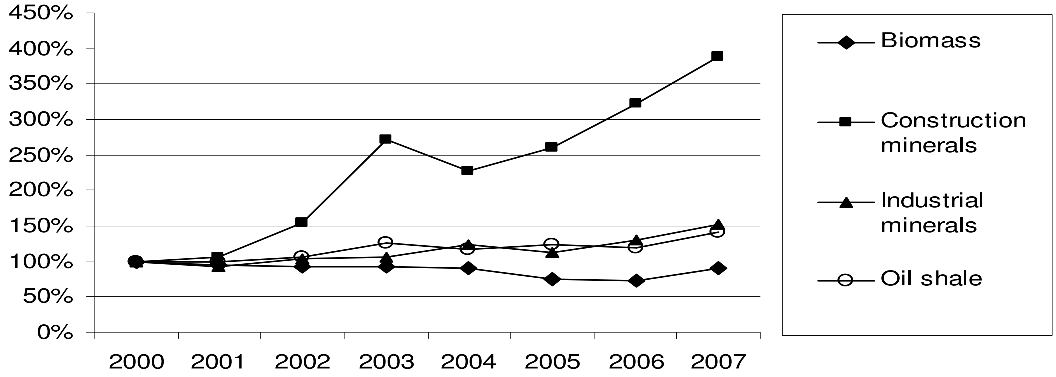
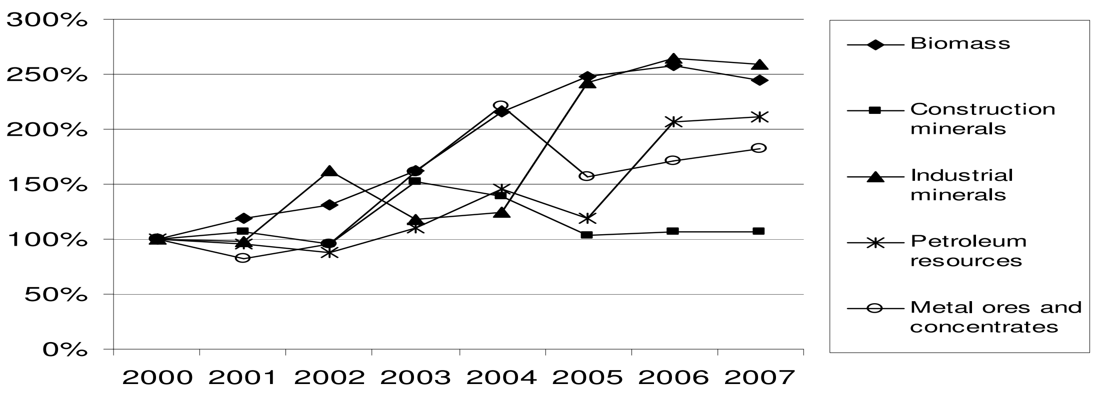


Figure 6.3 above outlines that extraction of construction minerals has increased tremendously over this period. This is understandable as construction activity has increased remarkably in these years also. There was a considerable increase of extraction of construction minerals in 2003. Reason for this increase was exploiting of the additional quarry of construction sand by one enterprise. Location of this quarry is quite unfavorable (on the small island in Baltic Sea) and it was not used before or after 2003. From the other side this shows that Estonian economy is very small and change in activity even of one enterprise might have a considerable influence on the total economy.

Excavation of oil shale and industrial minerals has slightly increased also. At the same time quantity if excavated oil shale is big and growth by 40% in 2007 compared to 2000, has considerable increment to total domestic extraction. Only extraction of biomass has declined a little in 2000-2006, but increased again in the last year.

Figure6.4 illustrates the changes of imports of the main material groups during the same time.

Figure 6.4 Changes of import, 2000=100%



Increase occurred in physical exports of all material groups; the biggest growth took place for biomass and industrial minerals. The export of petroleum resources has increased sharply in

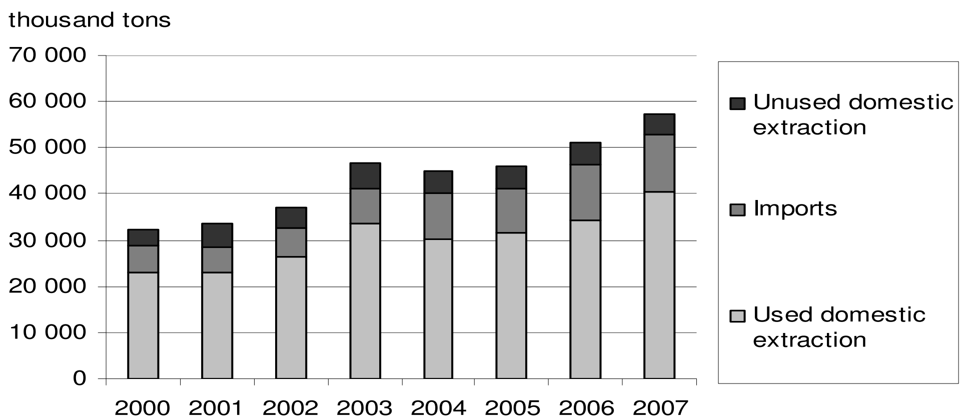
the last years. At the same time as petroleum resources have the biggest share in physical imports; petroleum resources had also the biggest influence for increase of total imports.

6.1.2. Total Material Input (TMI)

Direct material input characterized the material flow entering the economy/society from economical point of view i.e. only materials having economical value are accounted. From side of environment, the flow of moved (extracted) materials includes also so-called "domestic hidden flows" - unused domestic extraction of materials without economical value and not really used by economy.

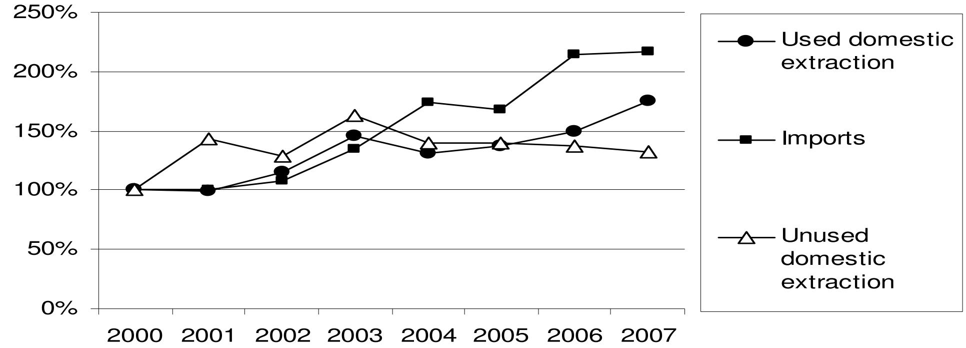
Total material input (TMI) is intensive indicator that characterizes all input flow of used and unused materials. Total material input includes, in addition to DMI, also unused domestic extraction i.e. materials that are moved by economic activities but that do not serve as input for production or consumption activities (mining overburden, etc.). Estonian TMI in 2000-2006 is presented on the figure 6.5. The quantity of unused extraction stays almost the same on this time period – about 5 thousand tons therefore TMI follows the same trends as it was in case of DMI.

Figure 6.5 Total Material Input 2000-2007, thousand tons



Next figure shows the changes in used and unused domestic extraction and physical imports during 2000-2007. It is seen, that imports is also the most increasing part of total material input.

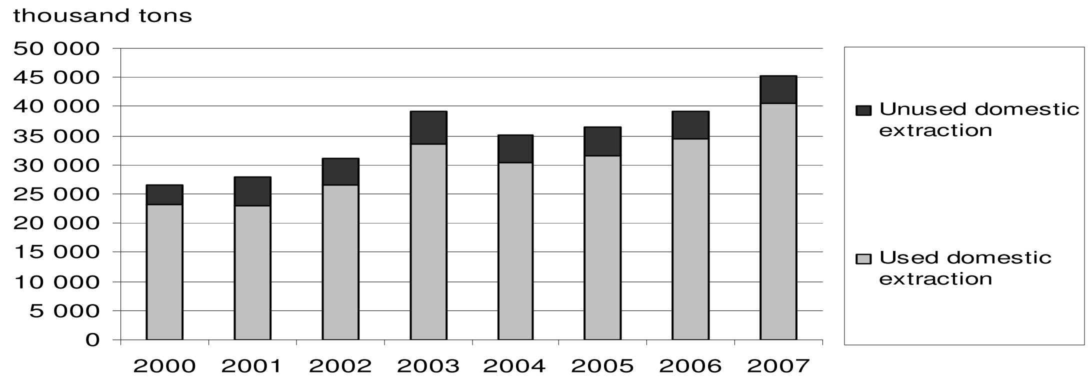
Figure 6.6. Changes of components of TMI, 2000=100%



6.1.3. Domestic Total Material Requirements (Domestic TMR)

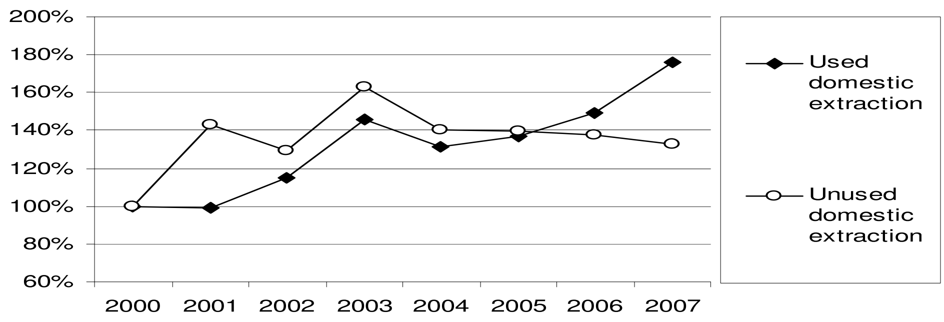
A domestic total material requirement is intensive indicator, which characterizes the material flows originating from the national territory. A domestic total material requirement is the sum of domestic used and unused extraction. Domestic TMR equals TMI less imports. Figure 6.7 shows the domestic total material requirement in the years 2000-2007. Indicator is constantly increasing due to increase of used domestic extraction.

Figure 6.7 Domestic Total Material Requirement 2000-2007, thousand tons



Next figure presents the changes in used and unused domestic extraction during the period 2000-2007 compared to 2000.

Figure 6.8. Changes in used and unused domestic extractions, 2000=100%



It is seen on figures above, that even though quantity if unused extraction has not changed considerably during the years, the important positive change has occurred lately. In 2000-2003 the unused domestic extraction was increasing quicker than the used extraction. Since 2003 the quantity of unused domestic extraction is declining although used domestic extraction is increasing. Oil shale excavation wastes made up majority of unused domestic extraction; recycling of oil shale excavation wastes has increased in the resent years which have a positive effect to increasing quantity of total unused extraction.

6.2. Consumption indicators

The materials consumption in estonia has incresed in last years. The main reason behind is the financial and for us specially the real estate boom. So also the main indicators in this row: the domestic material consumption constantly increased during the years 2000-2007. The increase of DMC has been quicker than the increase of gross domestic product at the same period.

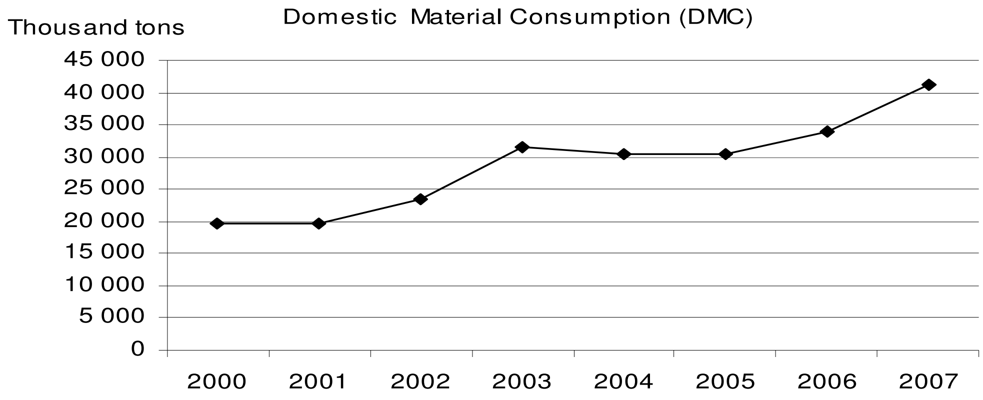
Basically and specifically for Estonia the fossil fuel use gives a big share of DMC in Estonia. If in 2000 it gave more than half of DMC than it share has decreased on expence of the the share of minerals which use has increased remarkably. Minerals were the most used material type in 2007, which was probably caused by very high construction activity in these years.

Total material consumption which includes indirect flows was not calculated during his project. The main consumption indicator domestic material consumption and in addition also the domestic resource dependancy are outlined below.

6.2.1. Domestic Material Consumption (DMC)

Domestic material consumption measures the total amount of material directly used in an economy (i.e. the direct apparent consumption of materials, excluding indirect flows). DMC equals direct material input (DMI) minus export. Estonian domestic material consumption in the years 2000-2007 is presented on the figure 6.9.

Figure 6.9 Domestic Material Consumption 2000-2007, thousand tons



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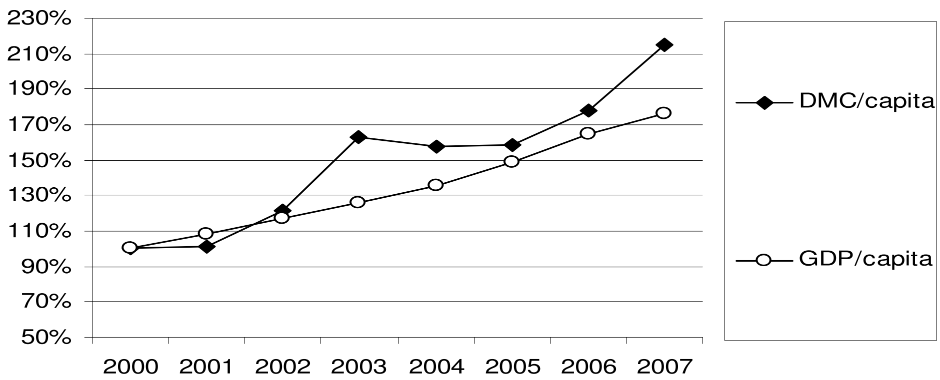
Domestic material consumption is constantly increasing during these years. As it is seen from the next figure, the increase of DMC has been quicker than increase of gross domestic product at the same period.

Figure 6.10 Changes in domestic material consumptions and GDP, 2000=100%

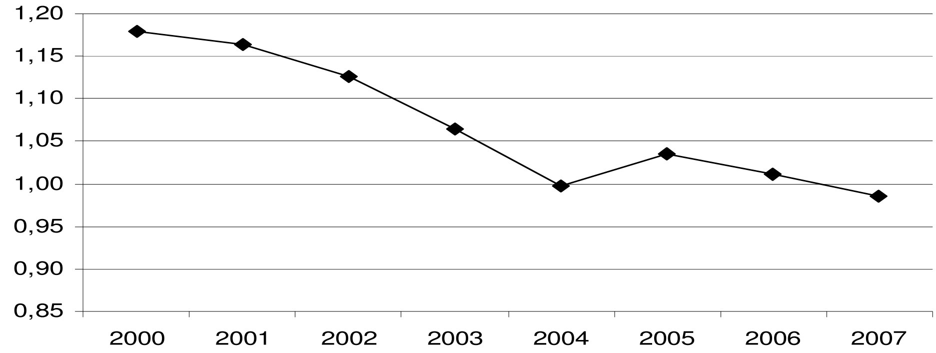


6.2.2. Domestic Resource Dependency (DRD)

The ratio of domestic extraction to domestic material consumption indicates the dependence of the physical economy on domestic raw material supply.

The domestic recourse dependency for years 2000-2007 is shown on the figure 6.11. The ratio DE/DMC is very close to 1, slightly decreasing from year to year. This indicates, that Estonian economy is depend almost totally on domestic raw material supply nevertheless as it was already mentioned, the share of imported raw materials is slightly increasing.

Figure 6.11 Domestic recourse dependency (DE/DMC) 2000-2007



6.3. Balance indicators

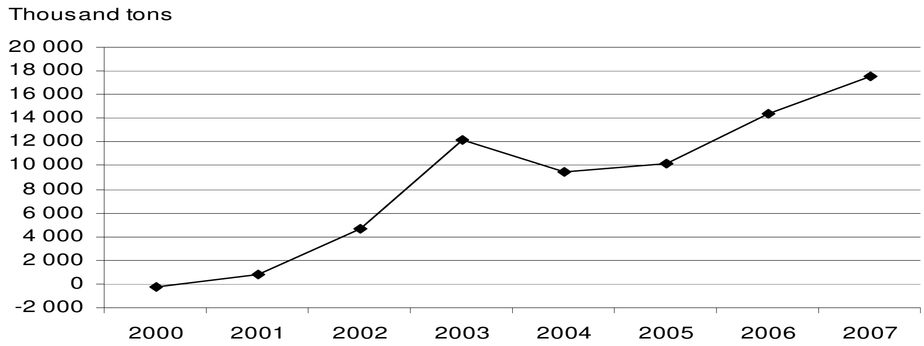
Balance indicators describe the physical growth of materials within the economy. They show net flows of materials added to the economy's stock each year taking into account gross flows added and removed from the stocks, or taking into account just materials coming from the international trade (physical trade flows). Balance indicators supplement consumption indicators.

6.3.1. Net Addition to Stock (NAS)

NAS has made the huge increase during last years: from negative quantity about -300 thousand tons in 2000 to a 18 million tons in 2007. So Estonias economy has grown in physical terms: the quantity (weight) of new construction materials used in buildings and other infrastructure have increased and materials incorporated into new durable goods such as cars, industrial machinery, and household appliances have accumulated. Main reason for such a quick increase is probably the considerably high construction activity in these years.

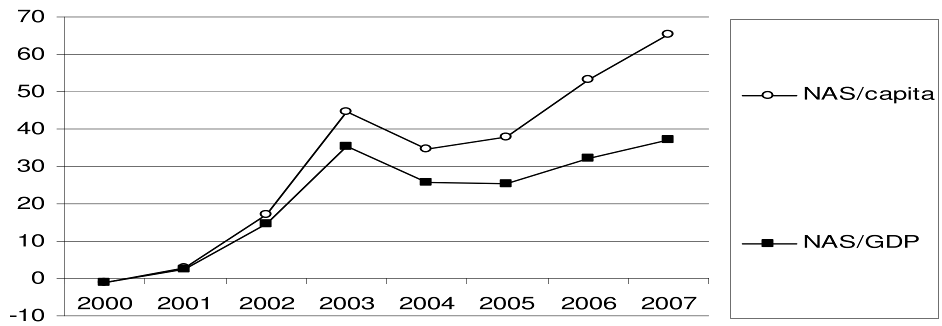
Net addition to stock is calculated as difference between total input and total output (not considering indirect flows) for years 2000-2007 are illustrated by figure 6.12.

Figure 6.12. Net Addition to Stock 2000-2007, thousand tons



Next figure compares the net addition to stock with gross domestic product. NAS per capita is growing much quicker than NAS per GDP. It might be concluded, that big share in increase of NAS is connected with construction activity of households and purchasing of private cars and household appliances.

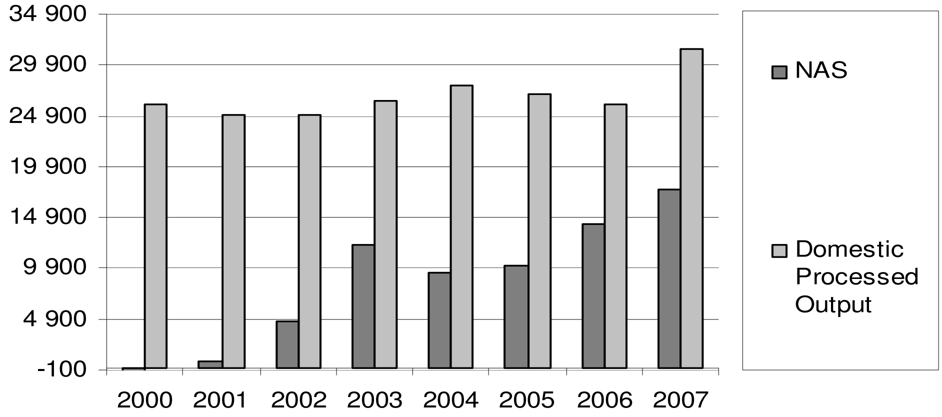
Figure 6.13. Net Addition to Stock and GDP*, 2000-2007



*GDP calculated through final uses and in constant prizes of 2000

Although net addition to stock is growing very quickly, it is still much smaller than domestic processed output as it is seen from figure 5.14. Helga Weisz and Heinz Schandl pointed out that physical stocks are increasing rapidly in industrial economies. From this point of view Estonia is moving towards industrial economy.

Figure 6.14 Net Addition to Stock and Domestic Processed Output, 2000-2007



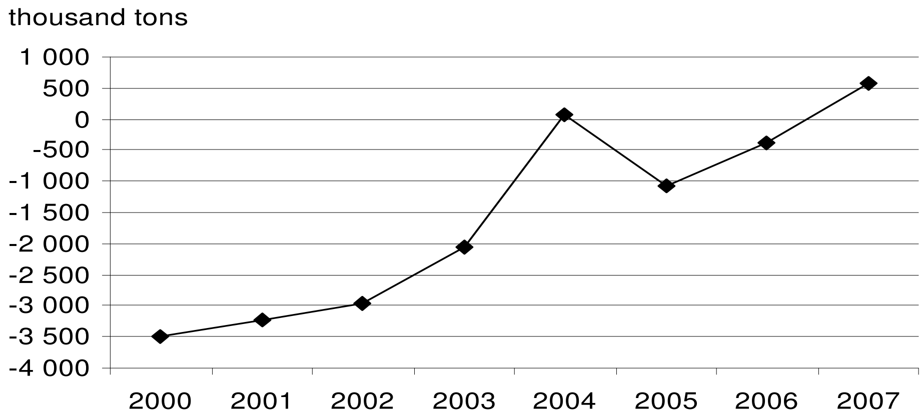
6.3.2. Physical Trade Balance (PTB)

Both, imports and exports, are growing in monetary and physical terms. However the growth of import is considerably quicker than growth of export.

Physical trade balance (PTB), which measures the physical trade surplus or deficit of an economy has changed from deficit at the beginning of century to surplus since 2006.

Estonian physical trade balance in years 2000-2007 is shown on the figure 6.15. Also the following figure illustrates the substantial changes have occurred in PTB during this period.

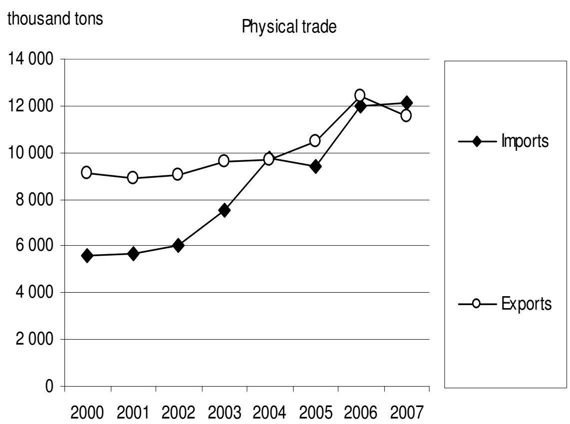
Figure 6.15 Physical Trade Balance 2000-2007, thousand tons

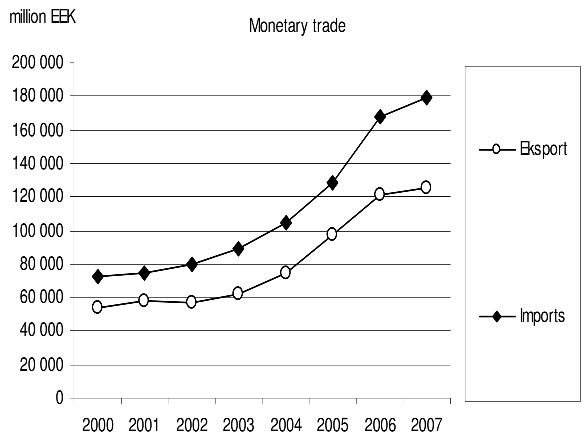


Physical and monetary trades during period under discussion are compared on the figure 6.16. Both, imports and exports, are growing in monetary and physical terms as well and growth of

import is considerably quicker than growth of export in both cases. The monetary import has exceeded the monetary export during all given time period and difference is increasing. At the same time physical import was considerably smaller than physical export at the beginning of given time period, but due to quick increase exceeded physical export by 2007.

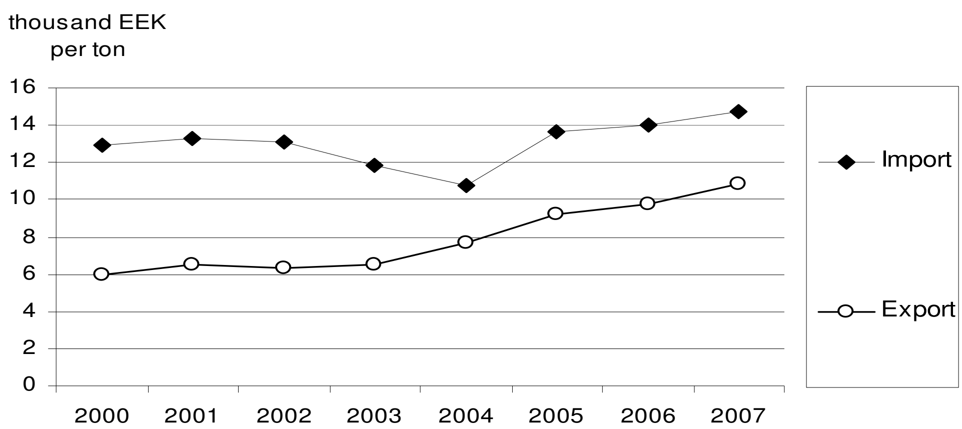
Figure 6.16. Comparison of physical and monetary trade 2000-2007





The next figure illustrates the prizes of traded commodities over the years 2000-2007. The value of on ton of imported material is almost twice higher than the value of same quantity of exported material. This means, that Estonia imports the commodities of higher value and exports the commodities of lower value. Nevertheless the value of one ton of physical exported is constantly increasing since 2003 and difference between values per ton of exported and imported material is slightly diminishing.

Figure 6.17. The value of the one tons of the import and export materials, 2000-2007



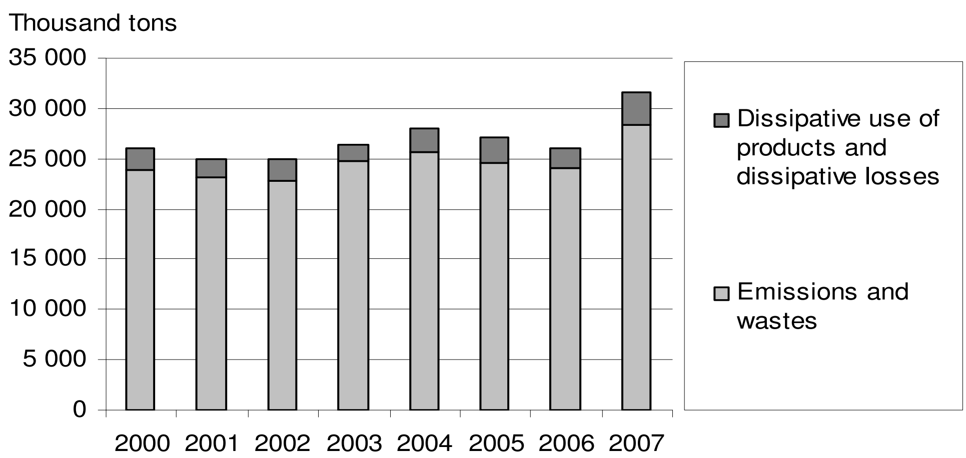
6.4. Output indicators

The increase of the material inflow in 2000- 20007 brought not only the addition to stocks but also the increase of the outflow: both the production and consumption activities in Estonia increased much in this period. The outflow, which accounted for materials used in the economy and subsequently left it either in the form of emissions and waste or in the form of exports increased also. The following chapter provides an overview of the four output indicators which highlight one or another aspect of the occurred increase of the outflow.

6.4.1. Domestic processed output (DPO)

Domestic processed output, which is the total quantity of the materials (extracted and imported), which flows to the environment after been used in domestic economy has increased slightly in 2000-2007. These material flows are emissions to air and to water arising during the production and consumptions, wastes disposed into landfills and materials dispersed into the environment during use of the products (dissipative use and dissipative losses). Following figure 6.18 illustrates Estonian domestic processed output in the period 2000-2007. Emissions and waste made up more than 90% of domestic processed output and emissions to air made up the majority of the latter. The share of dissipative flow is rather small at the same time.

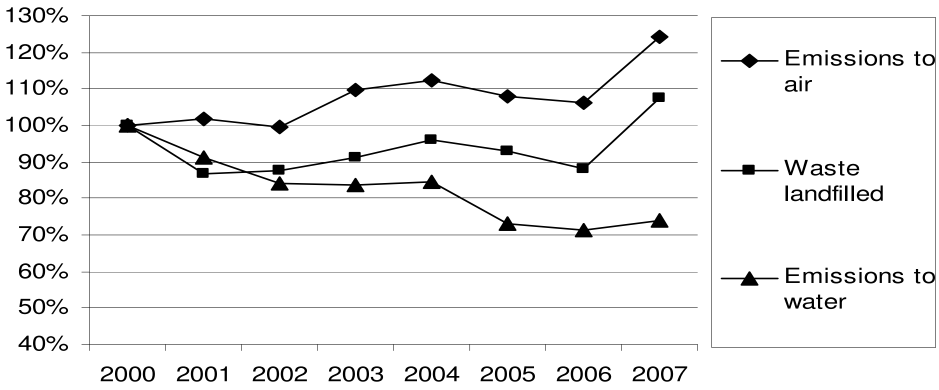
Figure 6.18 Domestic Processed Output 2000-2007, thousand tons



Both the bigger emission flows and smaller dissipative flows have increased. The trends of the emissions to the the different environments are illustrated on the following figure 6.19.: quantities of emissions to air were constantly increasing, at the same time emissions to water

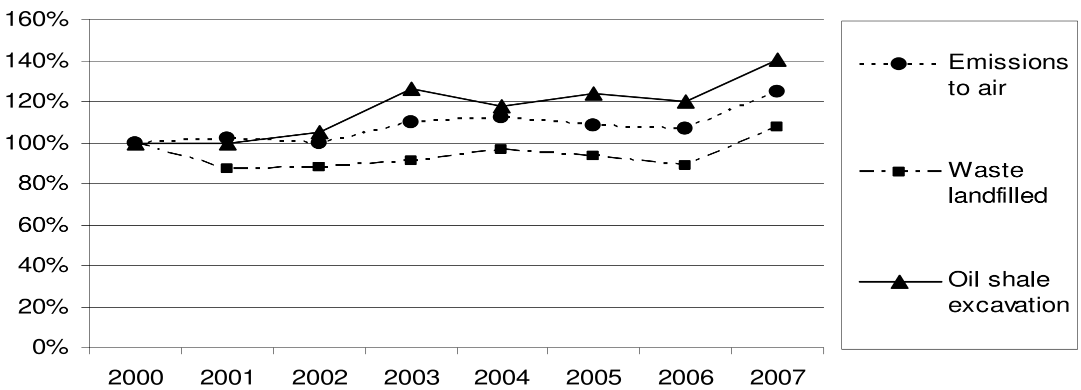
were constantly decreasing. With the exception of the last year, the quantity of waste disposed to landfills is decreasing as well.

Figure 6.19. Changes of emissions into different environments, 2000=100%



The majority of the air emissions originated from electricity production based on oil shale burning. Oil shale excavation and electricity production from oil shale gives also rise to huge quantity of wastes (excavation wastes and oil shale ashes). The next figure compares the changes in quantities of oil shale excavation with the changes of quantities of air emissions and landfilled wastes.

Figure 6.20. Changes in oil shale excavation, air emissions and landfilled wastes, 2000=100%

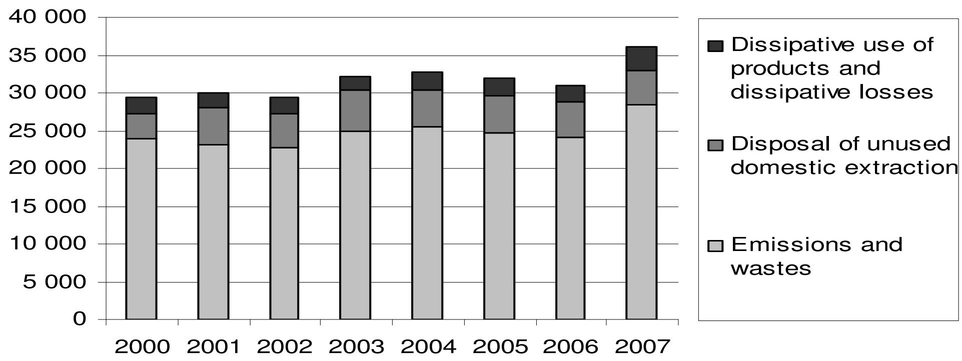


Noticeable increase of oil shale excavation (electricity production) is accompanied with noticeable increase of emissions to air, at the same time increase of air emissions is smaller than increase of oil shale excavation, which indicates that emissions due to oil shale burning are decreasing. Quantity of landfilled waste was decreasing during considered time period (with exception of 2007 due to drastic increase of oil shale excavation in this year) as the result of the increase of recycling of oil shale connected wastes.

6.4.2. Total Domestic Output (TDO)

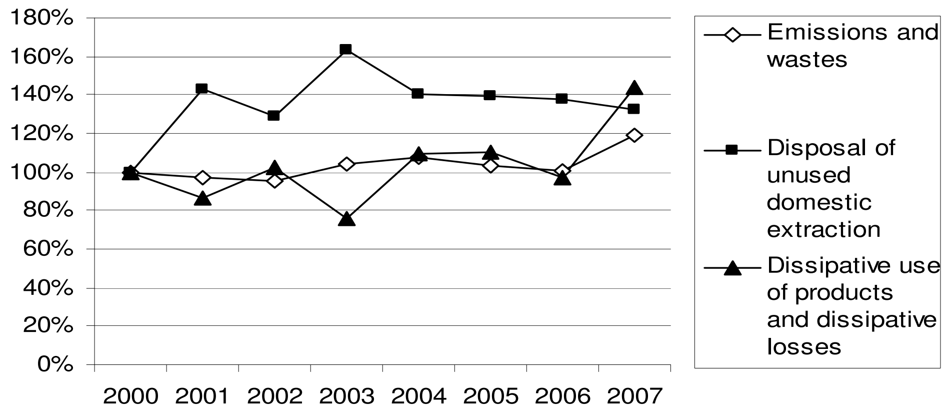
The total quantity of material output to the domestic environment caused by human's activity is represented by another output indicator - total domestic output (TDO) as the latter analysed indicator: domestic processed output does not cover the disposal of unused extraction. Total domestic output in years 2000-2007 is presented on the figure 6.21. and it's trend is mainly following the trend of the previous indicator domestic processed output , as the share of the disposal of unused extraction is rather low.

Figure 6.21 Total Domestic Output 2000-2007, thousand tons



Next figure illustrates how the different components of total domestic output had changed during given time period.

Figure 6.22. Changes in total domestic output, 2000=100%

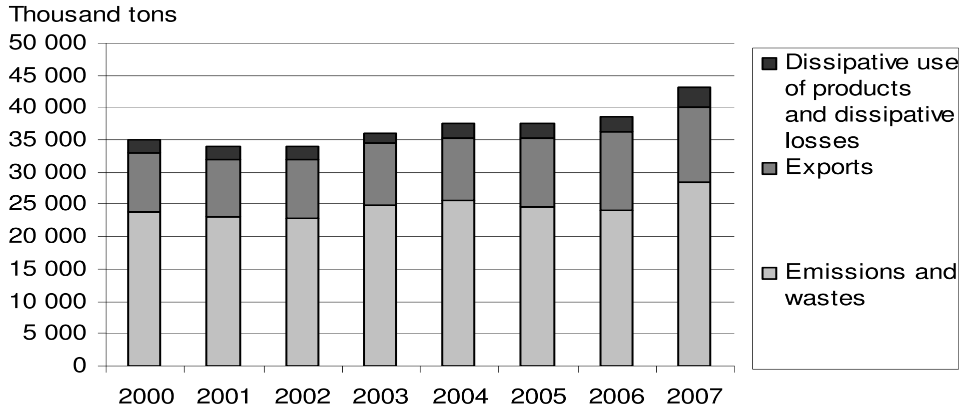


It is seen, that disposal of unused domestic extraction increased the most at the beginning of the period. At the same time disposal of unused domestic extraction has constantly decreased since 2003; other components of total domestic output are slightly increasing.

6.4.3. Direct Material Output (DMO)

Principally the materials could flow out from economy/society not only as the emissions and wastes to environment but also to the rest of the world as exported commodities. Direct material output is indicator describing the total quantity of material leaving the economy after use either towards environment or towards the rest of the world. Direct material output per capita has increased during given time period from 26 tons per capita in 2000 to 32 tons per capita in 2007. The increase of export had the biggest share in increase of direct material output. Figure 6.23 shows the Estonian direct material output in years 2000-2007.

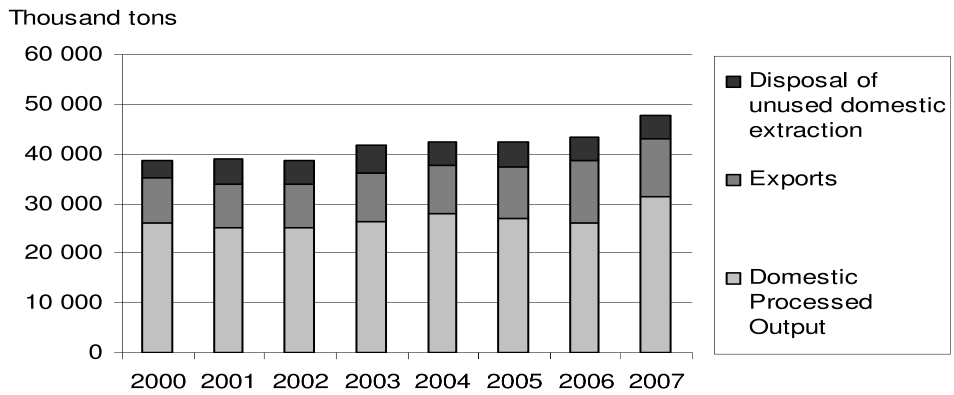
Figure 6.23. Direct Material Output 2000-2007, thousand tons



6.4.4. Total material output (TMO)

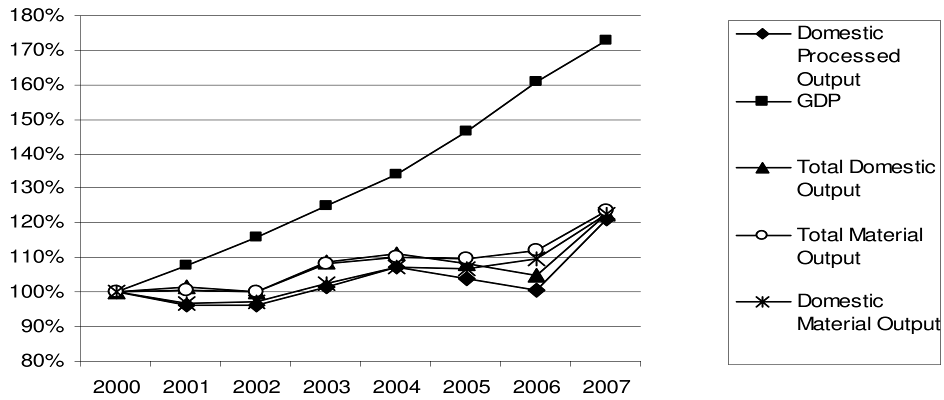
Direct material output does not include the disposal of unused domestic extraction. The total quantity of material that leaves the economy is measured by total material output. Total material output (TMO) is defined as sum of total domestic processed output and export. Estonian total material output for years 2000-2007 is presented on figure 6.24.

Figure 6.24. Total material output 2000-2007, thousand tons



Next figure illustrates the changes of different output indicators compared with change of the gross domestic product. The substantial decoupling of GDP and quantities of output of materials could be observed. The growth of GDP was not accompanied with the growth of quantity of output materials.

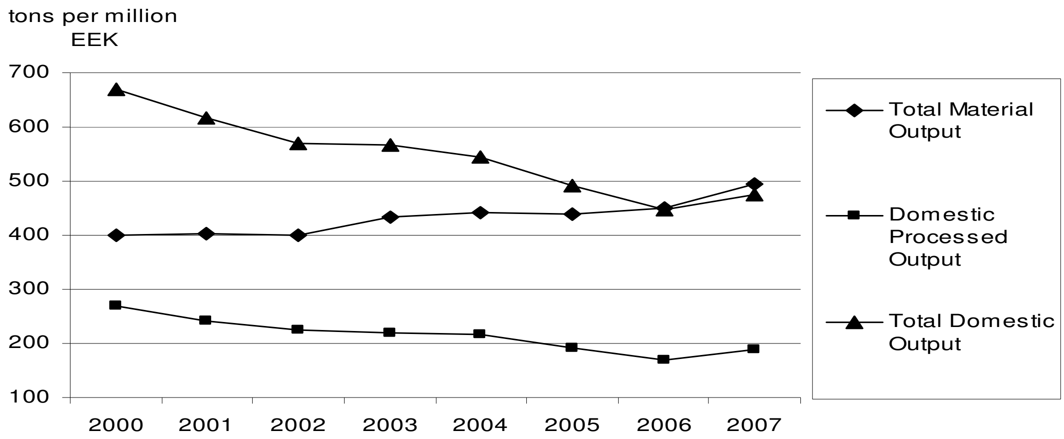
Figure 6.25 Changes in GDP*, and different output indicators, 2000=100%



*GDP calculated through final uses and in constant prizes of 2000

Figure 6.26 illustrates the quantities of output materials per GDP expressed by different output indicators. Trends of output indicators, which characterize material outputs (mostly emissions and wastes) to domestic environment (DPO and TDO) per GDP is decreasing, whereby TMO/GDP is decreasing more quickly than DPO/GDP. Trend of total material output per GDP is increasing in one hand due to the increase of the quantity of exported materials and in other hand due the vast growth of the GDP during the “financial boom”.

Figure 6.26 Material output per GDP* 2000-2007, tons per million EEK



6.5. Productivity indicators

From the three main productivity indicators Direct Material Productivity, Domestic Materials Productivity and Total Material Productivity, the last one which includes the indirect flows associated with foreign trade, was not calculated during this project. GDP calculated through final uses and in constant prizes of 2000 were used as macro economical indicator.

The reasons why the total resource productivity in Estonia is decreasing are substantial: increase of oil shale excavation from one side and very low resource productivity of fossil fuels from other hand. As far as electricity production will be based on oil shale, the Estonian resource productivity stays very low compare to other EU Member States. Total resource productivity is hence not the best characteristic for Estonian economy and the productivity analysis should rather be done on the material type bases.

As the main reason behind low resource productivity in Estonia is oil shale based electricity production and considering that more than 90% of electricity is produced from oil shale and in turn, oil shale is mostly used for elecrticity production, the resource productivity for fossil fuels was calculated. Value added generated in electricity, gas and water supply was used as denominator for domestic material productivity of fossil fuels[1]. Peat was included to domestic extraction of fossil fuels, but it's share was irrelavent. Domestic material productivity of fossil fuels which is presented on the next figure 10, is extreamly low. The reason behind is that fossil fuels made up 40-50% of total domestic extraction and at the same time energy sector generates only 2-3% of GDP. This means, that use of oil shale for electricity production has

[1] This indicator was calculated using GDP by expenditure approach in chain-linked volume (reference year 2000).

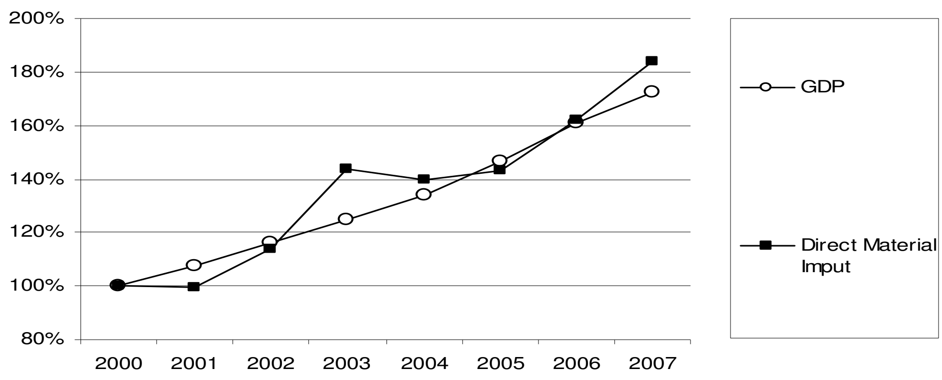
hudge impact on the Estonian total resourse productivity and also until electricity production will be based on oil shale, the Estonian resource productivity stays very low compared to other EU Member States.

From the other hand, the high influence of the one particular flow on Estonia's total resource productivity indicates that this indicator is not the best characteristic for Estonian total economy and the further productivity analysis should rather be done on the material type of bases. The work in this field will be the task for future development. The major problem in carrying out the productivity analysis on the material type of bases for us would be the compilation of appropriate economic data.

6.5.1. Direct Material Productivity

Direct material productivity represents the amount of materials used as inputs in the economy to generate one unit of gross domestic product. The next figure illustrates the changes in direct material input (DMI) and GDP during years 2000-2007. The both indicators are constantly increasing, but increase of DMI is a little quicker than increase of DGP.

Figure 6.27. Changes in direct material input and GDP, 2000=100%



Direct material productivity for years 2000-2007 is shown on the figure 6.28. It is seen that during this period the overall trend of direct material productivity was declining. Regardless of slight increase of direct material productivity in years 2000-2001 and 2003-2005, the direct material productivity in 2007 was 6% smaller than in 2000. About 3400 EEK was generated per one ton of DMI in 2000 and about 3200 EEK in 2007.

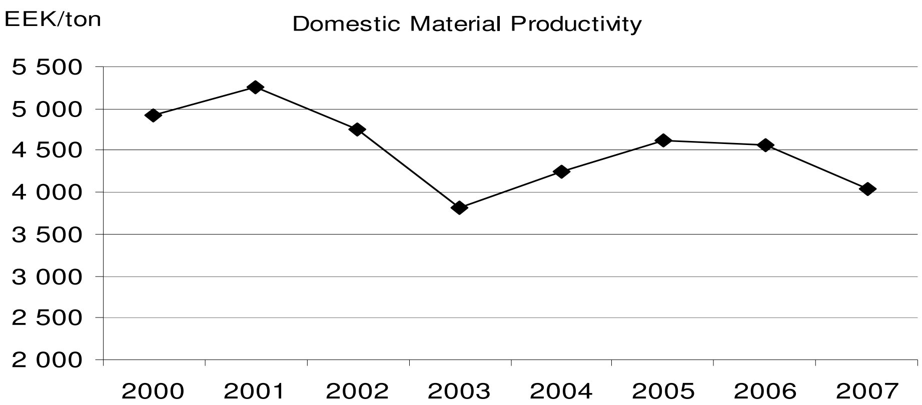
Figure 6.28 Direct Material Productivity 2000-2007, EEK per ton

6.5.2. Domestic Material Productivity

GDP per DMC indicates the domestic materials productivity. Domestic material productivity represents the amount of materials used to generate one unit of gross domestic product (GDP/DMC). Difference between direct material productivity and domestic material productivity is that exported materials are included for calculation of the direct material productivity but are excluded from domestic material productivity.

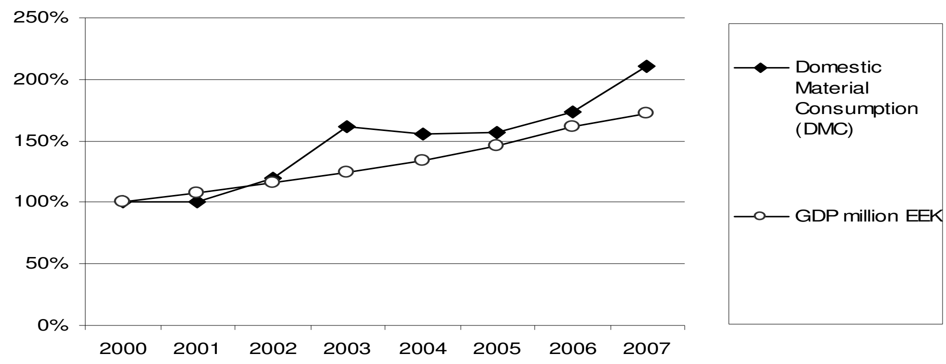
Domestic materials productivity expressed as GDP per domestic material consumption (DMC) for years 2000-2007 is presented on the figure 6.29. The overall trend of domestic material productivity during this time period is declining also. Domestic materials productivity is considerably higher than direct material productivity; at the same time decreasing of domestic materials productivity during time period under discussion is more noticeable – about 22%. In 2000 4.9 thousand EEK (315 EURO) was generated per one ton of consumed materials; in 2007 only 4.0 thousand EEK (259 EURO).

Figure 6.29. Domestic Material Productivity 2000-2007, EEK per ton



The next figure illustrates the changes in domestic material consumption (DMC) and GDP during years 2000-2007. It is clearly seen, that domestic material consumption increases quicker than GDP.

Figure 6.30. Changes in domestic material consumption and GDP, 2000=100%

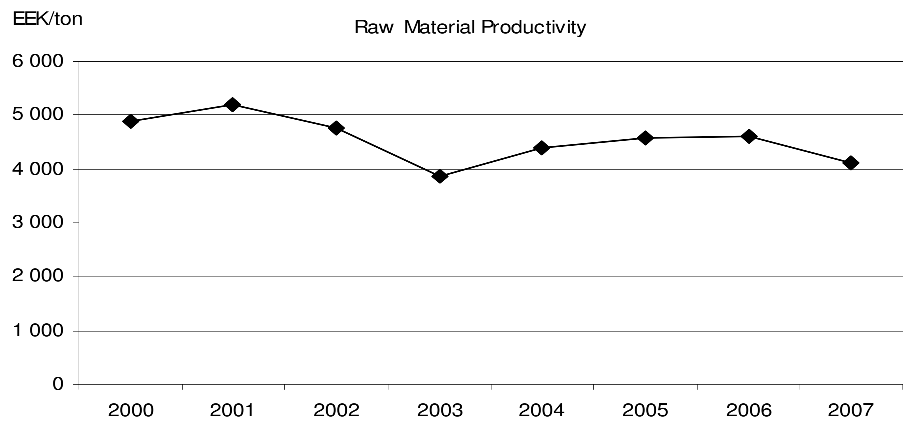


6.5.3. Raw material productivity

Raw material productivity represents the raw material inputs, i.e. sum of raw materials extracted in the country (actually used) and imported raw materials, used to generate one unit of gross domestic product (GDP/RMI). It describes the efficiency with which raw materials are used in the national economy.

Raw material productivity during years 2000-2007 is shown on the figure 6.31.

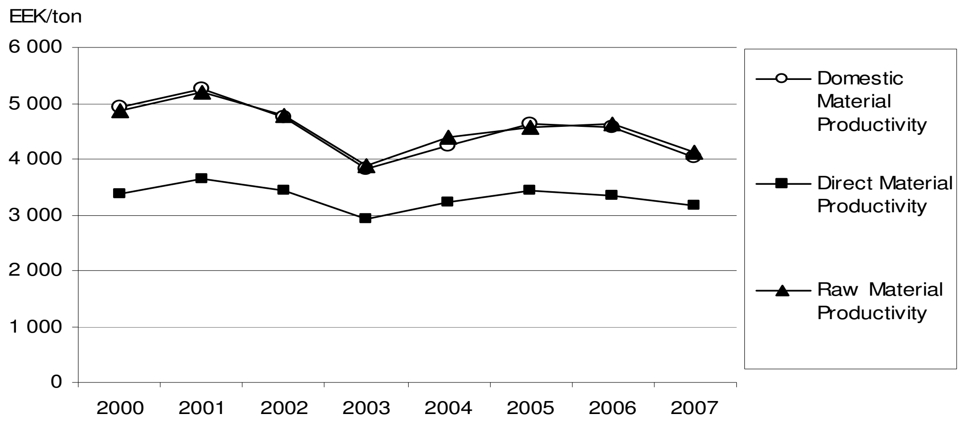
Figure 6.31 Raw Material Productivity 2000-2007, EEK per ton



The next figure compares the material productivities calculated using different MFA indicators. Raw material productivity is almost the same as domestic material productivity, which is understandable, as Estonian economy is dependent mostly on domestic raw

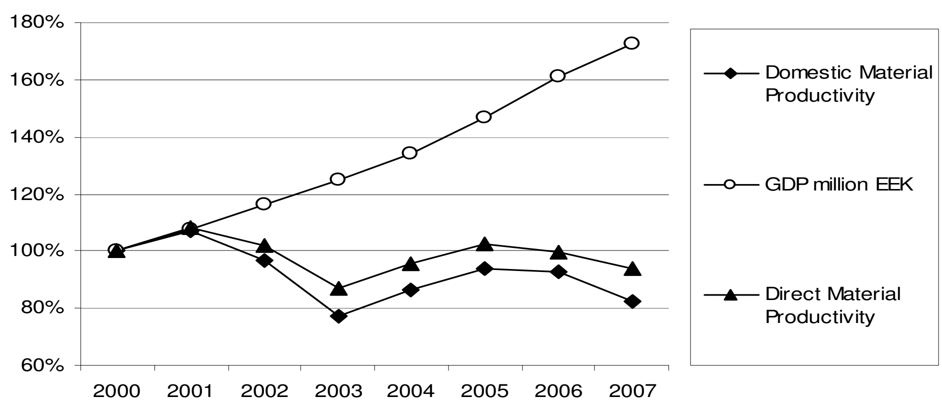
materials. Both import and export of raw materials are small compared to used domestic extraction.

Figure 6.32 Raw Material Productivity 2000-2007, EEK per ton



Changes of GDP and productivity indicators during considered time period compared to 2000 are shown on the figure 6.33. It is seen, that there were not big changes in direct material productivity during this time period, although trend is slightly decreasing at the last years. At the same time domestic material productivity has noticeable decreasing trend; in 2007 DMP has decreased by about 20% compared to 2000.

Figure 6.33 Raw Material Productivity 2000-2007, EEK per ton

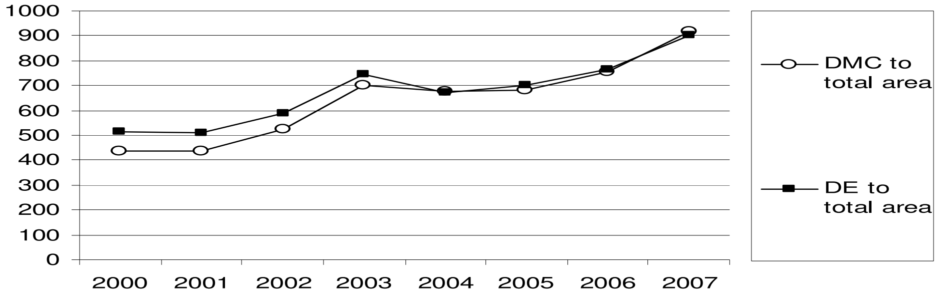


6.6. Intensity indicators

6.6.1. Area Intensity

The ratio between material flows and total land area indicates the pressure of the physical economy to its natural environment. Area intensity is expressed as ratio of domestic extraction (DE) or domestic material consumption (DMC) and total land area. Area intensities in years 2000-2007 are presented on the figure 6.35. It is seen that area intensity is constantly increasing. In 2000 domestic extraction per one km^2 was about 500 tons; in 2007 almost twice more materials were extracted from one km^2 (900 tons).

Figure 6.34. Area Intensity 2000-2007, ton/km2



7. Main findings

1. In Estonia during investigated time period 2000-2007 direct material input has increased almost twice – from 28.7 million tons in 2000 to 52.7 million tons in 2007. Increase had happened in both used domestic extraction and imports.

2. The domestic extraction makes up the majority of direct material input. Though quantity of imports is rather small, the share of imports in direct material input is quickly increasing.

3. Used domestic extraction of construction minerals has increased tremendously during the period 2000-2007. This is understandable as construction activity has increased remarkably in these years also.

4. Quantity of unused extraction has not changed considerably during the years 2000-2007, at the same time the used domestic extraction has increased by 75%. This shows that important positive change has occurred in generation of unused domestic extraction during these years. In 2000-2003 the unused domestic extraction was increasing quicker than the used extraction. Since 2003 the quantity of unused domestic extraction is declining although used domestic extraction is increasing. Oil shale excavation wastes made up about 90% of unused domestic extraction; recycling of oil shale excavation wastes has increased in the resent years which had a positive effect on generation of total unused extraction.

5. Domestic material consumption constantly increased during the years 2000-2007. The increase of DMC has been quicker than increase of gross domestic product at the same period.

6. In 2000 the fossil fuel use made up more than half of DMC; the share of fossil fuels in DMC has considerably decreased during this time. The share of minerals (of which construction minerals make up more than 90%) increased remarkably. Minerals were the most used material type in 2007, which was probably caused by very high construction activity in these years.

7. The quantity of domestic consumption of biomass has not changed over the years.

8. In 2000 all input of fossil fuels (excavated and imported) are consumed in domestic economy. Also majority of minerals (78% of input) are consumed domestically. In 2007 the share of domestic consumption of minerals has increased; at the same time share of domestic consumption of fossil fuels has slightly decreased, still the majority of both these materials' types were consumed inside the country.

9. The big changes occur in domestic consumption of biomass; only 30% of biomass input was consumed inside the country in 2000, the biggest share of biomass was exported. In 2007 the export of biomass has declined and the majority (64%) of direct material input of biomass was consumed inside the country also.

10. There were not big changes in direct material productivity during the time period 2000-2007 although the overall trend of direct material productivity was declining. Regardless of slight increase of direct material productivity in years 2000-2001 and 2003-2005, the direct material productivity in 2007 was 6% smaller than in 2000. About 3400 EEK was generated per one ton of DMI in 2000 and about 3200 EEK in 2007.

11. Domestic materials productivity is considerably higher than direct material productivity; at the same time decreasing of domestic materials productivity during time period under discussion is more noticeable – about 22%. In 2000 4.9 thousand EEK (315 EURO) was generated; in 2007 per one ton of consumed materials only 4.0 thousand EEK (259 EURO) was generated.

12. The substantial changes have occurred in physical trade balance during 2000-2007. Physical trade balance has considerably increased and shiffted from deficit at the beginning of period to surplus since 2006.

13. In 2000 raw materials made up the biggest part of imports; in 2007 relative importance of raw material decreased and semi-manufactured products dominated among imports.

14. The main reason for change of PTB from deficit to surplus is PTB of biomass. In 2000 biomass made up 59% of total physical exports and 24% of total physical import; 4 times more of biomass was exported than imported. Raw biomass from forestry shared to 83% of exported biomass. In 2007 biomass shared to 36% of total physical exports and 33% of total physical imports. Quantity of exported biomass still exceeded the quantity of imported biomass by 30%, but has considerably decreased since 2000.

15. The value of one ton of imported material is almost twice higher than the value of same quantity of exported material. This means, that Estonia imports the commodities of higher value and exports the commodities of lower value. Nevertheless the value of one ton of physical exports is constantly increasing since 2003 and difference between values per ton of exported and imported material is slightly diminishing.

16. NAS per capita is grew much quicker than NAS per GDP during 2000-2007. Big share in increase of NAS is connected with construction activity of households and purchasing of private cars and household appliances.

17. Although net addition to stock is grew very quickly, it is still much smaller than domestic processed output.

18. The substantial decoupling of GDP and quantities of output of materials could be observed. The growth of GDP was not accompanied with the substantial growth of quantity of output materials.

19. Direct material output per capita has increased during given time period from 26 tons per capita in 2000 to 32 tons per capita in 2007. The increase of export had the biggest share in increase of DMO.

20. Quantities of emissions to air were constantly increasing, at the same time emissions to water were constantly decreasing. With the exception of the last year the quantity of waste disposed to land fills is decreasing as well.

21. The emissions and wastes make up the majority of domestic processed output. The biggest share of emissions and wastes is originated from electricity production of oil shale.

22. At the same time increase of air emissions is smaller than increase of oil shale excavation, which indicates that emissions due to oil shale burning are decreasing. Quantity of landfilled waste was decreasing during considered time period (with exception of 2007 due to drastic increase of oil shale excavation in this year) as the result of considerable increase of recycling of oil shale connected wastes.

23. Quantities of dissipative flows are not big, but are increasing; mainly by considerable increase of dissipative use on agricultural land (especially increase of use of farmyard manure).

24. Trend of total material output per GDP is increasing due to substantial increase of quantity of exported materials

25. Area intensity of domestic extraction is constantly increasing. In 2000 domestic extraction per one km^2 was about 500 tons; in 2007 almost twice more materials were extracted from one km^2 (900 tons).

26. Estonian economy is very small and change in activity even of one enterprise might have a considerable influence on the total economy.

27. In 2007 the direct material flow was about 70% bigger than in 2000.

28. The increase of material input flow has occurred mainly due to substantial increase of excavation of minerals and also increased excavation of fossil fuels. Balancing item oxygen for combustion has noticeably increased also, which is natural consequence of increased use of fossil fuels.

29. The increase of output material flow has occurred mainly due to substantial increase of net additions to stock. Considerable increase occurred also in quantity of air emissions and balancing item (water vapor for combustion).

30. It could be concluded, that material flow into and out from domestic economy in Estonia has increased in 2007 compared to 2000 due to substantial increase of domestic extraction of construction minerals and consequent increase of stock (buildings). Another considerable factor of increase of material flow is increased domestic extraction of oil shale (increase of production of electricity) and consequent increase of air emissions.

8. Problems encountered

Domestic extraction

Some of data about domestic extraction of biomass are not covered:

1) Only fruits and berries grew for markets are taken into consideration by agricultural statistics fruits and berries are grown by households and were not considered. At the same time quantities of fruits and berries grown and consumed by households may be of equal or even bigger quantity than fruits and berries grown for market.
2) Data about recreational catch are not available.
3) Quantity of agarik extraction was available only for some years.

Total quantities of not covered materials are marginal compared to total domestic extraction of biomass and statistical data of these material flows are not collected. In order to get missing data the estimation methods should be developed, for which also the experts from Ministry of Agriculture and Ministry of Environment should be involved.

Some data of domestic extraction of biomass are of questionable quality. It concerns first data about used crops residues and grazed biomass. As it was already discussed of this report, for both indicators the estimation tool included to Eurostats MFA Questionnaire 2009 gives higher results than agricultural statistics data.

From the one side coefficients used in estimation tools of 2009 MFA questionnaire might cause overestimation in Estonian case as geographical conditions in Estonia are not as favorable for biomass growth as in Middle and South Europe. From the other side, small agricultural holdings, which produce only for their own consumption and are classified under households, are not covered by statistical survey for producing animal feeding balance sheet, which means, that statistical data may be somehow underestimated. In case of straw additional aspect is important. Usage for animal feeding is not the only way of use for straw. It is used also as biofuel and as additive material in compost production etc. This means that estimated data might be more correct if they would be based on the quantity of generated straw.

In future probably the best solution will be working out of the country specific coefficients for Eurostats estimation tools. Specialist from agricultural research institutes and Estonian University of Life Sciences should be consulted in future, in order to decide the most suitable coefficients for Estonia.

Another data problem is connected with quantity of firewood. Data about firewood are of low quality as statistical data about felling (use) of firewood are not collected and estimation of quantity of firewood was quite approximate. Data from energy statistics and household budget survey should be examined and experts from Centre of Forest Protection and Silviculture and Energy statistics should be consulted for additional information and improving the estimation method. The coefficients for recalculation of cubic meters of solid volume into tons should be adjusted also.

Quantity of gathered mushrooms and wild berries were based on the results of research made by specialists of Ministry of Environment. Although yield of mushrooms and wild berries differ from year to year, the same average yield (see table 3.5.) was used for all years. The estimation methods should be adjusted, although due to marginal quantity of this material flow, this is second-rate problem.

Physical trade balance

Intra EU foreign trade data are based on statistical survey. and enterprises with low foreign trade turnover are not covered by survey. For these enterprises the estimations which are based on additional information are made by foreign trade statistics. These estimations are calculated on 2-digit commodity code and are made for monetary value only. Missing physical quantities were estimated using monetary data estimations. The next pragmatic assumptions were made:

1) Share of missing physical quantity of commodities on 2-digit commodity code level is the same as the share of estimated monerary value of the same 2-digit code level commodity.
2) The commodity breakdown on 6-digit commodity level of survyed and unsurvyed (estimated) part is the same.

In fact there is necessarily no correlation between prise and quantity – commodity with small physical weight might be with big value (jewellery, art) and low value commodity might have large physical weight (waste for disposal). Therefore estimations of weight on the bases of monetary value might be misleading.

Enterprises which are not covered by intrastat statistical survey are usually small enterprises and products imported by these enterprises may be different from products of big enterprises. Splitting the total of 2-digit commodity level estimates to 6-digit codes level with the same shares as in case of survyed enterprises might be inaccurate.

Experts of foreign trade statistics and methodolodical department should be envolved for improving the estimations of physical trade estimations.

Another problem of physical trade is missing data about quantity of packages. Estimation of packages qyantities and also estimation of indirect flows connected to foreign trade is topic for future development.

Domestic output

In case of air emissions residential principle was not exactly followed. NAMEA-Air , which is suggested to be the bases for compilation of MFA air emission data, is not compiled in Estonia. That for administrative data of Estonian Environmental Information Centre was used. Data in the Administrative Air Emissions Database of EEIC and data in the Estonian report under the UNECE convention on long range transboundary air pollutants as well are compiled according to the territorial principles.

Estonian National Inventory Report under the UNFCCC includes only the estimations about greenhouse gases emissions due to international bunkers for aviation and marine. Estimations of air emissions due to international land transportation are not made.

Also no data are available about Estonian residents fuel use and caused air emissions outside the country.

Proper adjusting of the air emissions data according to residential principles is one of the tasks for the future development. As establishment of Air Emissions Accounting is one of priorities of Estonian environmental statistics, the following of residential principle for air emissions will be introduced together with Air Emissions Accounting in the near future.

Dissipative use of products on agricultural land

Dissipative use of products on agricultural land made up the biggest share of the dissipative flows. This flow is not big (in 2007 dissipative use on agricultural land made up about 4% of total material output) but is quickly increasing. Data about dissipative use on agricultural land are unrecovered and due to quite low quality:

1) statistical data are available only for quantities of used nutrients; use of mineral fertilizers in total masses should be estimated;
2) no data were available referring to the water content of used manure, which in fact may differ a lot quantities and influence the considerably the data quality;
3) only agricultural holdings were surveyed regarding the use of fertilizers, non-agricultural use of mineral fertilizers (for example households and recreational and sport facilities like golfing fields) is not included;
4) households are not surveyed in case of usage of farmyard manure also;

5) use of compost was estimated via generation, assuming, that all generated compost was also used at the same year. It is not necessarily true and may be the source of over or underestimation.

Unused extraction

No data were available about unused extraction of agricultural production. At the same time in some years due to unfavorable weather conditions losses in agriculture may be considerable. Foe example it was supposed that in 2008 about half of cereal yields was lost (Ain Avela). Estimation of agricultural losses is one of the tasks of future developments.

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