SIXTH FRAMEWORK PROGRAMME

PRIORITY [policy-oriented research priority SSP 5A]

SPECIFIC TARGETED RESEARCH OR INNOVATION PROJECT

FORWAST

Overall mapping of physical flows and stocks of resources to forecast waste quantities in Europe and identify life-cycle environmental stakes of waste prevention and recycling

Contract number: 044409

Deliverable n° 3-1

Data Processing and Validation for

Austria, Denmark, France and Germany

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Introduction

1   Introduction

This subreport describes data processing and validation within WP 3-1. The objective of WP3 is to obtain detailed, validated data for four specific countries. Germany, Austria, Denmark and France. The data mining in WP3 contains the following steps:

- Definition of the operational data structure in relation to WP1 und WP2.

- Collection of statistics and other data in Germany, Denmark, Austria and France.

- Comparison and verification of the acquired data.

- Identification of missing data.

- Collection / substitution of missing data for individual sectors.

- Check for plausibility and perform data reconciliation.

- Elaboration of coefficients and indicators for subsequent working packages (esp. WPs investigating scenarios and forecastings).

- Identification of potentials and difficulties for completing the data collection.

The deliverables within WP 3 are:

- D3-1: Report chapter describing data processing and validation.

- D3-2: Databases of material flows and stocks for the four countries.

- D3-3: Report chapter containing indirect procedures for estimations of transfer coefficients.

- D3-4: Report chapter describing potentials and difficulties for completing the data collection.

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Context within FORWAST

2 Context within FORWAST

As mentioned in the previous chapter, the objective of WP3 is to obtain detailed, validated data for the specific countries: Austria, Denmark, France and Germany. The ambition is to create a core of data which will be more detailed than for the EU 27. Within the project structure of FORWAST, WP3 interacts with the other working packages as shown in Figure 1.
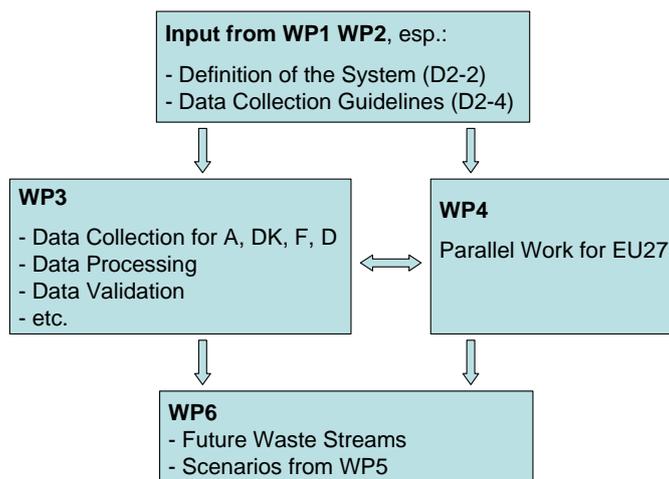
Figure 1: Project Structure

Relevant outcomes for WP3 (and WP4 as well) - resulting from WP1 and WP2 – are, among others:

- Overall Calculation Model

- Identification of relevant Materials and Products

- Definition of Terms

- Definition of Data Structure

- Definition of System Boundaries

- Harmonisation of Data

Interaction between WP3 and WP4 is necessary in order to ensure a congruent and coherent data base for EU27. Therefore partners of WP3 and WP4 exchange experiences within periodical project meetings and data mining-workshops. Exchange of experiences and syn-

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Context within FORWAST

ergetic effects result from the interaction not only within WP3 and WP4 but also by giving feedback to WP2.

Outcome of WP3 is a verified and coherent data base for the above mentioned four countries suitable to be used for the estimation of future waste streams (WP6) within scenarios elaborated in WP5.

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Austria: Data Processing

3   Austria: Data Processing

In Austria official supply-use tables based on macroeconomic accounting are available at a level of 60 activities x 60 commodities. The data availability of supply-use tables, emissions tables and resource information is good and the supply-use table covers supply. A few sectors are not covered due to confidential reasons. Furthermore the conversion of monetary into physical information is poor due to lack of information concerning price information.

3.1.1   Sources of data used for developing Supply and Use Matrices

In Austria detailed official input-output-calculations based on macroeconomic accounting are available since the year 1995. The national macroeconomic accounting ("Volkswirtschaftliche Gesamtrechnung; VGR") is based on the European system of macroeconomic accounting (ESVG).

- Primary source of monetary supply and use tables (MSUT)
- Reference year: 2003
- Monetary values (Mio. EUR)
    - Supply-table in basic prices, Transformation in purchasers´ prices
    - Use-table in purchasers´ prices (the transformation into basic prices is calculated with the provided tool "Basic price converter" [1])
- 59x59 activities/goods (NACE 01 to 95)
    - the NACE categories 13 "Mining of uranium and thorium ores" and NACE 95 "Private households with employed persons" are neglected)
- Imports/Exports are implemented
- Manually disaggregation is needed to expand the EUROSTAT-Matrix (59x59 activities/goods) into the FORWAST-Format (117x117 activities/goods)

3.1.2   Monetary Supply- und Use-Matrix (EUROSTAT)

- Primary source of monetary supply and use tables (MSUT)
- Reference year: 2003
- Monetary values (Mio. EUR)
    - Supply-table in basic prices, Transformation in purchasers´ prices

- o Use-table in purchasers´ prices (the transformation into basic prices is calculated with the provided tool "Basic price converter"[2])
- 59x59 activities/goods (NACE 01 to 95)
  - o the NACE categories 13 "Mining of uranium and thorium ores" and NACE 95 "Private households with employed persons" are neglected)
- Imports/Exports are implemented
- Manually disaggregation is needed to expand the EUROSTAT-Matrix (59x59 activities/goods) into the FORWAST-Format (117x117 activities/goods)

[EUROSTAT, 2003b]

PRODCOM ("PRODuction COMmunautaire")

- Additional information concerning detailed data of supplied commodities
- NACE-based
- Sectors: mining, industry and services
- Lack of information in Austria due to confidential data

[EUROSTAT, 2008b]

Structural Business Accounts

- National source for MSUT
- Specific data on industry, services and construction
- Higher exactness than MSUTs from EUROSTAT (4-digits; NACE 10 to 74)
- Problem with confidential data – no information within categories less than 4 members due to liability of secrecy within the Austrian legislation
- Includes information about the production (supply-table)
- Includes information about the intermediate production (use-table)
- No physical data provided

[Statistik Austria, 2006b]

Agricultural Accounts [Statistik Austria, 2006a]

- Source for disaggregating the MSUT and PSUT
- Comprehensive information about agriculture and forestry

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Austria: Data Processing

- Consists of monetary and physical information

Agriculture and Forestry in Austria „Grüner Bericht" [BMLFUW, 2004]

- Source for disaggregating MSUT and PSUT
- Comprehensive information about agriculture and forestry
- Additional monetary and physical information is available

Austrian Federal Economic Chamber [WKO, 2008]

- Source for disaggregating the MSUT and PSUT
- Monetary and physical information provided by several trade associations

3.1.3   Resources

European Mineral Statistics 2001-05 [Hetherington et al., 2007]

- Source for PSUT and resource data (R-Matrix)
- data according to the physical supply table and the Resource table

The Mineral Industry of Austria 2003 [Newman, 2006]

- Source for PSUT and resource data (R-Matrix)
- data according to the physical supply table and the Resource table

Mining in Austria [BMWA, 2004]

- Source for PSUT and resource data (R-Matrix)
- Physical data about mining, energy carriers and resources are available

3.1.4   Emissions

EPER [European Pollutant Emissions Register, 2008]

- Source for emission data (B-Matrix) for Austria and the other European countries (EU-25)
- data is NACE-based
- data is more detailed than data from NAMEA
- Reporting year: 2001 and 2004

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Austria: Data Processing

- Inconsistency because of the system boundaries; only enterprises beyond a defined threshold are reportable

NAMEA Air Survey 2006 [EUROSTAT, 2008a]

- Core data for air emissions
- 8 pollutants and three aggregated impact categories are available
- 3 different aggregated levels:
  - A10 – 10 industries and 1 household category
  - A36 – 36 industries and 3 household categories
  - A60 – 60 industries (NACE 2-digit), and 3 household categories
- Provided data of all 27 members of the European Union
- Wide range of completeness between the countries
- Lack of information in Austria regarding important emissions to air

Integrated NAMEA Austria 1999-2003 [Baud, 2006]

- Source for emission data (B-Matrix)
- Core database for the 8 most important emissions to air (e.g. CO_2, CH_4)
- NACE-based, but on a high level of aggregation

Austria's Greenhouse Gas Inventory 1990-2006 [Anderl et al., 2008]

- Source for emission data (B-Matrix)
- Core database of the „Österreichischen Luftschadstoff-Inventur (OLI)"
- Codes based on the IPCC Common Reporting Format (CRF) – incompatible with NACE

Austria's National Inventory Report 2005 [Anderl et al.]

- Submission under the United Nations Framework Convention on Climate Change (UNFCCC)
- Emissions data based on the "Common Reporting Format" (CRF) under the submission of the
- Core data base to fill in the emission's matrices (B-Matrix, G_c-, G_w- and G_r-Matrix) within the Matrix Master

3.1.5 Prices

Prices for commodities in agriculture and forestry [Statistik Austria, 2005b]

- Source for price matrix (P-Matrix)
- Prices of agricultural products

3.1.6 Physical Supply and Use Tables

Short Term Statistics [Statistik Austria, 2004]

- Source for disaggregating the MSUT and PSUT
- Data is available in monetary and physical units
- Lack of information due to confidential data

3.1.7 Waste Statistics

Federal Waste Management Plan [Federal Ministry of Agriculture and Forestry, 2006]

- Core data for the "Residual distribution Matrix" (J-Matrix)
- Federal waste treatment management plan provides data to generate the J-Matrix

3.1.8 Methodology and Data Quality

The MSUTs from EUROSTAT are the starting point to fill the FORWAST model with information. The difficult part is to obtain additional data for the FORWAST-specific disaggregated categories. Most of the categories are disaggregated by using NACE 4-digit codes, but there are some cases, where a FORWAST-specific redistribution is obliged. It is very difficult to obtain information according to those disaggregated categories.

Data quality in Austria generally is on a high level. The core database (Structural business accounts; short term statistics), provided by the Statistics Austria, has a good reliability and statistical depth. But there is a serious problem with confidential data. In Austrian statistics it is usual to keep data confidential, if there are less than 4 enterprises within one economic category. Unfortunately there are lots of confidential data, because of the fact, that Austria has a small structured economy. After consultation of Statistics Austria there is no way of getting this information. So this research has to be done by using other sources or to make own assumptions, which bares a certain potential of inaccuracies.

Another problem with data mining in Austria is that information often is not available based on NACE. Some sources use national codes, others international codes that are not compatible with NACE (e.g. UN-codes). A conversion is necessary, which bares a high potential of inaccuracies.

A further problem is the comparability of statistical data, i.e. even the most reliable data, which are used for calculations or comparisons, need not to fit. This leads to the fact that even data sets from the same statistical bureau, which are obviously produced under individual preconditions and objectives, hence are not a priori compatible. This inconsistency even increases, when trying to connect data sets of different statistical units.

If data from different sources do not match the decision has to be made, which data are more reliable and consequently the other data have to be adjusted manually. This procedure seems to be questionable and favours a calculated loss of information.

A good example for this malfunction is the use of emission factors within FORWAST. The total supply of emission produced by one activity is calculated by using emission factors in connection with the use of fuels of any given activity. It would be not surprising if the values of the calculation and the data from NAMEA do not match, although the sources are basically reliable.

In recent years it becomes more and more standard in Austrian statistics to provide data in monetary units. This leads to a lack in information on physical data. To obtain physical data price information are needed to run this calculation. Unfortunately the price information usually and accordingly is not user-friendly. In most cases only index-based price information are provided. This data are not feasible to calculate physical data via price information. Furthermore categories consisting of more than one product/good do have the problem of the necessity of an average price. By using a weighted mean possible inconsistencies can be left on an acceptable level. The assumption that every good produced or used by an activity has the same price level leads to inconsistencies due to the fact that a price is nothing more than a variable influenced by many factors. Summing up, the calculation of physical values by using price information is a quite poor way of data generation as it bares a high potential of inaccuracies. The data would be more consistent and reliable if primary physical data are provided by the statistical units.

The NAMEA is a good starting point to obtain data concerning air emissions for B-Matrix and G-Matrix. The tables are NACE-based and because of that easy to connect to the activities in the FORWAST project. This benefit occurs only regarding the aggregated activities (e.g.

rubber and plastic production). For the user-defined FORWAST categories a disaggregation based on additional information has to be done. In Austria the use of energy carriers from energy statistics is taken into account. That is suitable within the industry, but there is no information concerning agriculture and services. The other way of obtaining emissions for the aggregated activities by using emission factors is even difficult. It is most likely that the calculated result and the aggregated sum obtained from the NAMEA do not match, because they are probably generated under different preconditions. Furthermore the NAMEA includes no information concerning emissions to water or soil. Additional information is needed to obtain the recommended 53 emissions within the FORWAST project. This information is not available for Austria. To prevent such unreliability an additional tool was provided by 2.0LCA-consultants. This tool is able to balance the use of (fossil) fuels and the related emissions. The respiratory of humans and animals is also taken into account.

The problem of the "internal flows" occurs due to the system boundaries of a census, i.e. only flows from one enterprise to another are detected. The goods and activities that appear within an enterprise are out of sight. Due to that, the total monetary turnover is underestimated. Therefore the "internal flow" has to be taken into account to picture the reality in a better and entire way. It needs more additional information to calculate this "internal flow" and add it to the original value of the MSUT (the procedure is explained in D2-4 [Daxbeck et al., 2008]). This procedure bares a high potential of inaccuracies.

A further problem regarding the conversion from monetary to physical units is the fact that a lot of commodities are given in non-weight units (e.g. square meters, cubic meters, pairs, pieces and so on). Conversion factors are needed to calculate the physical output of an activity. Mainly in inhomogeneous activities (e.g. machinery n.e.c.) this procedure is linked to inconsistencies of the result. Hence this procedure bares a high potential of inaccuracies as well.

3.1.9   Data processing

Due to facts mentioned above a lot of inaccuracies appear within the Austrian tables. By using the data sources obtained from the sources mentioned above, it was possible to generate a balanced MSUT for Austria, i.e. a balanced 117x117 matrix was created. Due to lack of information few aspects are not implemented. There's less information concerning the use of products in Austria. Without this information an accurate disaggregation of the relevant FORWAST categories was not possible. To reach the goals of the FORWAST model, it was assumed that there's the same distribution within the use of products like the supply of products. But that's no reference to the reality. Supplied goods, within one group of commodities, do not have the same proportional use of intermediate goods.

E.g. The activity "Bovine meat and milk" produces 35 percent of the NACE 01 group "Agricuture". Regarding the use of intermediate goods this proportion is critical. Using the same proportion within the use of products this would lead to the fact, that the activity "Bovine meat and milk" uses 35 percent of all of the fossil fuels within the agricultural sector, 35 percent of all used animal feeds, and so on. That's no reflection of the reality. But due to lack of information this is the best way to reach the recommendations of the FORWAST model. There's no information on this level of detail to obtain data for the Austrian economy.

Nevertheless it was possible to create a balanced monetary matrix within the Matrix Expander. The basis for the next stage of calculation was set. One of the main goals of FORWAST is the creation of physical supply and use tables. Due to the fact that there's less information concerning physical values of the Austrian economy calculations and assumptions have to be made to obtain the objected goals. The calculation of physical values by using price information bares lots of problems. Price information is often provided based on indices. Within FORWAST prices of aggregated commodity groups are needed. But it is not that easy to obtain meaningful price information of aggregated commodities. It was often necessary to choose the price of one single commodity as reference for the whole group of products. But this leads to variations of the calculated physical output and is responsible for the inconsistencies within the Austrian data.

Inconsistencies within in the Austrian data lead to a huge number of so-called "yellow cells". These yellow cells represent negative waste. In terms of the FORWAST model this means that within one activity the supply of products is too high or the use of products is too low. Or in terms of a MFA – the output is bigger than the input. That's impossible. Adjustments of the price information have to be done to get rid of the "yellow cells". This calculation is not difficult to be done but has a great influence on the data research done before. In the end a huge number of cells are adjusted manually and have no more connection to the values obtained from statistical sources. Under guidance from 2.0LCA-consultants RMA was able to erase all "yellow cells", which represent negative waste. From this point of view the Austrian table is mathematically valid. Due to thematically inconsistencies with the FORWAST model 2.0LCA-consultants insisted that the Austrian data could not be implemented. This would lead to strange results.

Nevertheless RMA provided a well-funded basis of statistical data of Austria, regarding the whole economy, environmental aspects and solid waste management. But these sources stand one for one alone and cannot be combined as wanted. RMA was in close contact with the Austrian Statistics. They congratulated the FORWAST consortium on this ambitious project, but from their point of view it will be tricky to reach the expected goals with the Austrian data.

The following table gives an overview of the investigated product groups supplied and used – connected to the FORWAST-code. For each product group, the data availability and the

selected methodology for the data processing is reported. Several of the transactions of flows of product groups as provided by statistical agencies need to be disaggregated to fit with FORWAST classification. In the table below the data sources used for this purpose are described. The calculation steps and balancing exercise when disaggregating are described in deliverable D2.2: Data collection guideline and forms for WP3 and WP4. For several of the activities, it is specified how much of the feedstock that ends up in the supply of products by the activity, e.g. that 98% of the use of rapeseed by the vegetable oil industry becomes oil and oil meal. These feedstock efficiencies are a result of the data collection of physical flows combined with the calculation of waste flows (see deliverable 6.4: Documentation of the final model used for the scenario analyses).

The first column in the table below contains the FORWAST-codes, the second names the corresponding products and industries (NACE/CPA), the third column shows short descriptions regarding data availability and data processing. Generally monetary and physical supply-use and import/export information is obtained directly from the detailed Danish supply-use table. When this is the case, nothing is mentioned in the table below.

Table 1:   Investigated Categories and Data Processing

FORWAST code	NACE/CPA Products / Industries	Data availability, processing and estimation
01 – 06	Products of Agriculture, hunting and related service activities **(01)** *1.Bovine meat and milk* *2. Pigs* *3. Poultry and animals n.e.c.* *4. Grain crops* *5. Crops n.e.c* *6. Agriculture services*	SUPPLY of agricultural products: The agricultural sector was disaggregated via using additional national information [Statistik Austria, 2006a]; Internal (hidden) supply of grain crops used directly in integrated crop/animal farms is based on own assumptions; there is no data concerning these internal flows due to the fact that these goods are not traded on the market. USE of products by agricultural activities: Disaggregation coefficients for the agricultural sector are based on information in national agricultural statistics [Statistik Austria, 2006a]
07	Products of forestry, logging and related service activities **(02)**	SUPPLY: Physical supply is based on Austrian Statistics; In Austria forestry and agriculture do have the same data sources [Statistik Austria, 2006a] There is no available

	07. Forest products *08. Recycling of waste wood*	statistical data concerning recycling of waste wood. The activity: 'recycling of waste wood is left empty in the Austrian SUT.
09	Fish and other fishing products; services incidental of fishing **(05)**	Physical supply is based on Statistics Austria [Statistik Austria, 2010]
11	Crude petroleum and natural gas; services incidental to oil and gas extraction excluding surveying **(11)**	Physical supply is based on USGS [Newman, 2006]
12 - 15	Metal ores **(13)** *11. Iron ores from mine* *12. Bauxite from mine* *13. Copper from mine* *14. Metals from mine n.e.c.*	SUPPLY: Confidential data in Austria; data was obtained by using other international sources [Newman, 2006] [Hetherington et al., 2007] There is no mining of copper and bauxite in Austria USE: Confidential data
10,16 -18	Other mining and quarrying products **(10,14)** *9. Coal and lignite; peat* *15. Sand, gravel and stone from quarry* *16. Clay and soil from quarry* *17. Minerals from mine n.e.c.*	SUPPLY: Physical supply of mining and quarrying products is based on Statistics Denmark (2009b). 'Coal and lignite; peat' is included in the product group 'Other mining and quarrying products' in the data from statistics Denmark. Therefore, this product group is present here. USE of products by the mining activities: Due to lack of information in physical units in Austria, the same disaggregation coefficients like for the supply were used
19	Meat and fish products **(15.1-15.2)**	SUPPLY: Disaggregation coefficients obtained from Austrian short term statistics [Statistik Austria, 2006b] USE: Disaggregation coefficients for the use of agricultural products by the food industries are based on own assumptions
20	Dairy products **(15.5)**	SUPPLY: Disaggregation coefficients obtained from Austrian short term statistics [Statistik Austria, 2006b] USE: Disaggregation coefficients for the use of agricultural products by the food industries are based on own assumptions
21	Fruits and vegetables, pro-	SUPPLY: Disaggregation coefficients obtained from Aus-

	cessed **(15.3)**	trian short term statistics [Statistik Austria, 2006b] USE: Disaggregation coefficients for the use of agricultural products by the food industries are based on own assumptions
22	Vegetable and animal oils and fats **(15.4)**	SUPPLY: Disaggregation coefficients obtained from Austrian short term statistics [Statistik Austria, 2006b] USE: Disaggregation coefficients for the use of agricultural products by the food industries are based on own assumptions
23,25,26	Mfr. of starch, chocolate and sugar products **(15.6-15.8)** *23. Flour* *25. Animal feeds* *26. Food preparations n.e.c.*	SUPPLY: Disaggregation coefficients obtained from Austrian short term statistics [Statistik Austria, 2006b] USE: Disaggregation coefficients for the use of agricultural products by the food industries are based on own assumptions
24	Sugar **(15.83)**	SUPPLY: Disaggregation coefficients obtained from Austrian short term statistics [Statistik Austria, 2006b] USE: Disaggregation coefficients for the use of agricultural products by the food industries are based on own assumptions
27	Beverages **(15.9)**	SUPPLY: Disaggregation coefficients obtained from Austrian short term statistics [Statistik Austria, 2006b] USE: Disaggregation coefficients for the use of agricultural products by the food industries are based on own assumptions
28	Tobacco products **(16)**	SUPPLY: Data obtained from Austrian short term statistics [Statistik Austria, 2006b] USE: No physical data available
29	Textiles **(17)**	SUPPLY: Data obtained from Austrian short term statistics [Statistik Austria, 2006b] USE: No physical data available
30	Wearing apparel; furs **(18)**	SUPPLY: Disaggregation coefficients obtained from Aus-

		trian short term statistics [Statistik Austria, 2006b] USE: No data available; Disaggregation coefficients for the use of goods by the wearing apparel industry are based on own assumptions
31	Leather and leather products **(19)**	SUPPLY: Data obtained from Austrian short term statistics [Statistik Austria, 2006b] USE: No physical data available
32	Wood and products of wood and cork (except furniture); articles of straw and plaiting materials **(20)**	SUPPLY: Disaggregation coefficients obtained from Austrian short term statistics [Statistik Austria, 2006b] USE: No physical data available
33 - 35	Pulp, paper and paper products **(21)** *33. Pulp, virgin* *34. Recycling of waste paper* *35. Paper and paper products*	SUPPLY: Disaggregation coefficients obtained from Austrian short term statistics [Statistik Austria, 2005a]; special attention at the internal flow within the integrated pulp production; internal flow was estimated based on own assumptions. USE: No data available; Disaggregation coefficients for the use of goods by the pulp and paper industry are based on own assumptions
36	Printed matter and recorded media **(22)**	SUPPLY: Data obtained from Austrian short term statistics [Statistik Austria, 2006b] USE: No physical data available
37-38	Coke, refined petroleum products and nuclear fuels **(23)** *37. Coke, refined petroleum products* *38. Recycling of waste oil*	Physical supply is based on USGS [Newman, 2006]
39-40	Manufacture of fertilizers etc. **(24.15)** 39. Fertiliser, N 40. Fertiliser, other than N	SUPPLY: Disaggregation coefficients obtained from Austrian short term statistics [Statistik Austria, 2006b] USE: No data available; Disaggregation coefficients for the use of goods by the fertilizer industry are based on own assumptions
41-42	Mfr. of plastics and syntethic	SUPPLY: Disaggregation coefficients obtained from Aus-

	rubber **(24.16)** 41. Plastics basic, virgin 42. Recycling of plastics basic	trian short term statistics [Statistik Austria, 2006b] USE: No data available; Disaggregation coefficients for the use of goods by the rubber industry are based on own assumptions
43	Chemicals, chemical products and man-made fibres nec **(24)** *43. Chemicals, n.e.c.*	SUPPLY: Disaggregation coefficients obtained from Austrian short term statistics [Statistik Austria, 2006b] USE: No data available; Disaggregation coefficients for the use of goods by the chemicals industry are based on own assumptions
44	Rubber and plastic products **(25)**	SUPPLY: Disaggregation coefficients obtained from Austrian short term statistics [Statistik Austria, 2006b] USE: No data available; Disaggregation coefficients for the use of goods by the rubber and plastic industry are based on own assumptions
45-46	Mfr. of glass and ceramic goods etc. **(26.1)** *45. Glass, mineral wool and ceramic goods, virgin* *46. Recycling of glass, mineral wool and ceramic goods*	SUPPLY: Disaggregation coefficients obtained from Austrian short term statistics [Statistik Austria, 2006b] USE: No data available; Disaggregation coefficients for the use of goods by the glass and ceramic goods industry are based on own assumptions
47,48,51-52	Mfr. of cement, bricks, tiles, flags etc. **(26.3, 26.4, 26.5)** *47. Cement, virgin* *48. Recycling of slags and ashes* *51. Bricks* *52. Recycling of bricks*	SUPPLY: Disaggregation coefficients obtained from Austrian short term statistics [Statistik Austria, 2006b] USE: No data available; Disaggregation coefficients for the use of goods by the cement industry are based on own assumptions
49-50	Other non-metallic mineral products *49. Concrete, asphalt and other mineral products, virgin* *50. Recycling of concrete, asphalt and other mineral products*	SUPPLY: Disaggregation coefficients obtained from Austrian short term statistics [Statistik Austria, 2006b] USE: No data available; Disaggregation coefficients for the use of goods by the non-metallic mineral industry are based on own assumptions

53-54	Mfr. of basic ferrous metals **(27.1)** 53. *Iron basic, virgin* 54. *Recycling of iron basic*	SUPPLY: Disaggregation coefficients obtained from Austrian short term statistics [Statistik Austria, 2006b] USE: No data available; Disaggregation coefficients for the use of goods by the basic ferrous metals industry are based on own assumptions
61	First processing of iron and steel **(27.2,27.3)** 61. *Iron, after first processing*	SUPPLY: Disaggregation coefficients obtained from Austrian short term statistics [Statistik Austria, 2006b] USE: No data available; Disaggregation coefficients for the use of goods by the first processing of iron and steel industry are based on own assumptions
55-60	Mfr. of basic non-ferrous metals **(27.4)** 55. *Aluminium basic, virgin* 56. *Recycling of aluminium basic* 57. *Copper basic, virgin* 58. *Recycling of copper, basic* 59. *Metals basic, n.e.c., virgin* 60. *Recycling of metals basic, n.e.c.*	SUPPLY: Disaggregation coefficients obtained from Austrian short term statistics [Statistik Austria, 2006b] USE: No data available; Disaggregation coefficients for the use of goods by the manufacture of basic non-ferrous metals are based on own assumptions
62-64	Casting of metal products **(27.5)** 62. *Aluminium, after first processing* 63. *Copper, after first processing* 64. *Metals n.e.c., after first processing*	SUPPLY: Disaggregation coefficients obtained from Austrian short term statistics [Statistik Austria, 2006b] USE: No physical data available; Disaggregation coefficients for the use of goods by the manufacture of basic non-ferrous metals are based on own assumptions
65	Fabricated metal products, except machinery and equipment **(28)**	SUPPLY: Data obtained from Austrian short term statistics [Statistik Austria, 2006b] USE: No physical data available
66	Machinery and equipment n.e.c. **(29)**	SUPPLY: Data obtained from Austrian short term statistics [Statistik Austria, 2006b] USE: No physical data available

67	Office machinery and computers **(30)**	SUPPLY: Disaggregation coefficients obtained from Austrian short term statistics [Statistik Austria, 2006b] USE: No data available; Disaggregation coefficients for the use of goods by the office machinery and computers are based on own assumptions
68	Electrical machinery and apparatus n.e.c. **(31)**	SUPPLY: Data obtained from Austrian short term statistics [Statistik Austria, 2006b] USE: No physical data available
69	Radio, television and communication equipment and apparatus **(32)**	SUPPLY: Data obtained from Austrian short term statistics [Statistik Austria, 2006b] USE: No data available; Disaggregation coefficients for the use of goods by the radio, television and communication equipment and apparatus are based on own assumptions
70	Medical, precision and optical instruments, watches and clocks **(33)**	SUPPLY: Data obtained from Austrian short term statistics [Statistik Austria, 2006b] USE: No physical data available
71	Motor vehicles, trailers and semi-trailers **(34)**	SUPPLY: Data obtained from Austrian short term statistics [Statistik Austria, 2006b] USE: No physical data available
72	Other transport equipment **(35)**	SUPPLY: Data obtained from Austrian short term statistics [Statistik Austria, 2006b] USE: No data available
73	Furniture; other manufactured goods n.e.c. **(36)**	SUPPLY: Data obtained from Austrian short term statistics [Statistik Austria, 2006b] USE: No physical data available
74	Secondary raw materials **(37)**	No physical flows included: Defined as service product
75	Electrical energy, gas, steam and hot water **(40.1,40.3)**	SUPPLY: Data obtained from national statistics [Statistik Austria, 2009] USE: Data obtained from national statistics [Statistik

		Austria, 2009]
76	Gas **(40.2)**	Data obtained from national statistics [Statistik Austria, 2009]
77	Water, fresh **(41)**	No physical flows included: Defined as service product
78-80	Construction **(45)** *75. Buildings, residential* *76. Buildings, non-residential* *77. Infrastructure, excluding buildings*	No physical flows included: Defined as service product
81	Trade and repair of motor vehicles; service stations **(50)**	
82	Wholesale trade **(51)**	
83	Retail trade and repair services **(52)**	
84	Hotels and restaurants **(55)**	
85	Land transport; transport via pipelines **(60)**	
86	Transport by ship **(61)**	
87	Air transport **(62)**	
88	Cargo handling, harbours; travel agencies **(63)**	
89	Post and telecommunication **(64)**	
90	Financial intermediation **(65)**	
91	Insurance and pension funding **(66)**	
92	Services auxiliary to financial intermediation **(67)**	
93	Real estate services **(70)**	
94	Renting of machinery and equipment etc. **(71)**	
95	Computer and related services	

	(72)	
96	Research and development **(73)**	
97	Business services n.e.c. **(74)**	
98	Public service and security **(75)**	
99	Education services **(80)**	
100	Health and social work **(85)**	
101-108	'Sewage removal and disposal' and 'Refuse collection and sanitation' **(90(disaggr.))** *98. Incineration of waste* *99. Manure treatment* *100. Biogasification of waste* *101. Composting of food waste* *102. Waste water treatment* *103. Landfill of waste* *104. Land application of waste*	All information is kept in one column and one row – the products/industries are disaggregated based on the waste module described in deliverable D5.4: Description of the environmental pressures from waste treatment
109	Membership organisations **(91)**	
110	Recreational and cultural services **(92)**	
111	Services n.e.c. **(93)**	
112	Household, to nourish (n.a.)	Information on household products/activities are kept in the final demand column in the use table. The specified household products/activities are defined in deliverable: D6.1 Documentation of the data consolidation,calibration, and scenario parameterisation
113	Household, to clean (n.a.)	
114	Household, to transport and communicate (n.a.)	
115	Household, to reside (n.a.)	
116	Household, home composting (n.a.)	
117	Household, unauthorised incineration (n.a.)	

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Denmark: Data Processing

4 Denmark: Data Processing

In Denmark detailed official supply-use tables based on macroeconomic accounting are available. The data availability of supply-use tables, emissions tables and resource information is good and the supply-use tables covers supply and use of approximately 2000 products by 134 sectors and most transactions are given in both monetary and physical unit.

4.1.1 Sources of data used for developing Supply and Use Matrices

The following national statistics purchased from Statistics Denmark are used for data processing (reference year 2003) within FORWAST:

- Detailed supply-use table covering approximately 2000 products by 134 sectors, 2003. All exports and imports are given in both monetary and physical values, and most of the domestic supply and use are also given in both monetary and physical units. The data are purchased from Statistics Denmark.
- The Danish Air Emissions Accounts specifying air emissions of CO_2, SO_2, NO_x, CO, N_2O, NH_3, CH_4, and NMVOC from 134 activities + four household activities in year 2003 (Statistics Denmark 2009a)
- Resource extraction of agricultural crops, forestry products, fish, aggregates, minerals, and fossil fuels are based on the Danish resource statistics (Statistics Denmark 2009b)

4.1.2 Methodology and Data Quality

Extraction of monetary and physical supply-use tables from the raw data from Statistics Denmark

In general data quality in Denmark has a very high level. The Danish 2000 products by 134 sectors supply-use table is first processed into a square 134x134 table by using categorisation provided by Statistics Denmark for the 2000 products. The monetary supply-use table can directly be extracted in this way. Before the physical (by mass) supply-use table can be created, it has to ensured that all physical products has a physical weight. The procedure for this is to calculate the average price (monetary transactions divided by physical transactions) for the products where physical information is available, and then use this price on the products where no physical information is available. This procedure is implemented as an excel macro.

Denmark: Data Processing

The 134 product categories in the Danish SUT does not fit with the FORWAST categories; some needs to be disaggregated (these are described in the data processing table presented later in this chapter), and some needs to be aggregated. The aggregated product categories are shown in the table below:

Product categories in Danish SUT to be aggregated	Aggregated product category (FORWAST categories)
Crops n.e.c. (agr) Horticulture, orchards etc.	Crops n.e.c.
Agricultural services; landscape gardeners etc. Public landscape gardeners	Agricultural services n.e.c.
Production etc. of meat and meat products Processing etc. of fish and fish products	Meat and fish products
Food preparations n.e.c. Mfr. of bread, cakes and biscuits Bakers' shops	Food preparations n.e.c.
Publishing of newspapers Publishing activities, excluding newspapers	Printed matter and recorded media
Mfr. of industrial gases and inorganic basic chemicals Mfr. of dyes, pigments and organic basic chemicals Manufacture of pesticides and other agro-chemical products Mfr. of paints, printing ink and mastics Mfr. of pharmaceuticals etc. Mfr. of detergents and other chemical products	Chemicals n.e.c.
Mfr. of rubber products and plastic packing goods etc. Mfr. of builders' ware of plastic Manufacture of other plastic products n.e.c.	Rubber and plastic products
Mfr. of construct. materials of metal etc. Mfr. of hand tools, metal packaging etc.	Fabricated metal products, except machinery
Machinery production for own use Mfr. af marine engines, compressors etc. Mfr. of other general purpose machinery Mfr. of agricultural and forestry machinery Mfr. of machinery for industries etc. Mfr. of domestic appliances n.e.c.	Machinery and equipment n.e.c.
Building and repairing of ships and boats	Transport equipment n.e.c.

Mfr. of transport equipment excl. ships, motor vehicles etc.	
Mfr. of furniture Mfr. of toys, gold and silver articles etc.	Furniture; other manufactured goods n.e.c.
Sale of motor vehicles, motorcycles etc. Repair and maintenance of motor vehicles Service stations	Trade and repair of motor vehicles; service stations
Retail trade of food etc. Department stores Re. sale of phar. goods, cosmetic art. etc. Re. sale of clothing, footwear etc. Other retail sale, repair work	Retail trade and repair services
Hotels etc. Restaurants etc.	Hotels and restaurants
Transport via railways Other scheduled passenger land transport Taxi operation and coach services Freight transport by road and via pipelines	Land transport; transport via pipelines
Cargo handling, harbours etc.; travel agencies Activities of other transport agencies	Cargo handling, harbours; travel agencies
Monetary intermediation Other financial intermediation	Financial intermediation
Life insurance and pension funding Non-life insurance	Insurance and pension funding
Real estate agents etc. Dwellings Letting of non-residential buildings	Real estate services
Computer activities exc. software consultancy and supply Software consultancy and supply	Computer and related services
Research and development (market) Research and development (other non-market)	Research and development
Legal activities Accounting, book-keeping, auditing etc. Consulting engineers, architects etc. Advertising	Business services n.e.c.

Industrial cleaning Other business activities	
General (overall) public service activities Regulation of public service activities exc. for business Regulation of and contribution to more efficient business operation Market-based surveillance, fire brigade, and emergency services Defence, police and lawcourts	Public service and security
Primary education Secondary education Higher education Adult and other education (market) Adult and other education (other non-market)	Education services
Hospital activities Medical, dental, veterinary activities etc. Social institutions for children Social institutions for adults	Health and social work
Sewage removal and disposal Refuse collection and sanitation	Incineration of waste
Recreational, cultural, sporting activities (market) Recreational, cultural, sporting activities (other non-market)	Recreational and cultural services
Service activities n.e.c Private households with employed persons	Services n.e.c.

Tourist and foreign expenditures

The Danish supply-use table includes the 'product';'Tourist and foreign expenditures'. The row representing this product accounts for two things;

1) Tourists: Danish citizen's purcheses abroad, and foreign turist's purchases in Denmark

2) Allowance for travelling expenses: Danish industries pay travelling expenses to their workers. This can be percieved as salery.

Because no information is available on which products tourists buy abroad, and on who (DK or foreign citizens) uses the products supplied in Denmark, the following assumption is introduced: The distribution of Danish citizen's purcheses abroad equals foreign turist's purchas-

es in Denmark. Thus, we can move the allowance for travelling expenses (i.e. the entries in domestic uses in the use table) to the 'Compensation of employees' row. Because of the assumption introduced above, we can eliminate the row and column representing 'Tourist and foreign expenditures'.

Primary factors

The monetary supply-use table extracted from the detailed Danish 2000 products by 134 sectors only include primary factors as one aggregated figure per activity, and not information on primary factors distributed on:

1) Gross compensation of employees
2) Other production taxes
3) Taxes on products
4) The gross operating surplus (i.e. net operating surplus + use of fixed capital) is calculated as

1) and 2) are obtained directly from the Danish IO-table (Statistics Denmark 2009c). 3) is extracted from the detailed Danish supply-use table using an excel macro, and 4) is calculated as the residual.

Human metabolism: respiratory emissions and mass balances

The human metabolism is included in the model in order to ensure that materials contained in food is coming out of the model as the correct flows: emissions, urine and faeces in waste water and food waste. The balance is based on Ortiz et al. (2007). Below, the balance is shown for one average person for one year. To have the total metabolism for the Danish population in 2003, the figures in the table are multiplied with 5,384,000 persons (Statistics Denmark 2009b).

Human metabolism (per person year)	Carbon (kg)	DM (kg)
Inputs		
Food	84.4	202.2
Body growth	0.2	0.6
Total	**84.6**	**202.7**
Outputs		
CH4	0.1	0.1

Urine (CH4ON2)	5.5	27.4
Faeces (C2H4O)	7.5	13.7
Respiration: C in CO2	71.2	71.2
Respiration: H2O	0.0	89.9
Total	**84.2**	**202.2**
Balance (input - output)	**0.5**	**0.5**

Animal metabolism: respiratory emissions and mass balances

Correspondingly to the human metabolism, it is ensured that materials contained in animal feed is coming out of the model as the correct flows: animal products at farm gate, emissions, and manure. Also, the balance is used to estimate the correct uses of feed inputs when knowing the output of animal products from statistics. In the tables below, the animal balances are shown normalised by the dry weight of animal products at farm gate (live weight + milk). The balance is based on physical information in the detailed Danish supply-use tables and figures in the National Environmental Research Institute's (NERI) reporting to the UNFCCC (Illerup et al. 2005). The relation between the dry matter balance and the carbon balance is based on the carbon contents in dry matter material in the table below.

Material	Feed/plant material (% C)	Bovines (% C)	Pigs (% C)	Other animals (% C)
Grass+silage	46.0%			
Cereals/conc.	46.0%			
Milk		57.0%		
Animal (live weight)		43.8%	41.8%	43.8%
Manure		44.5%	44.5%	46.5%

Bovine metabolism (per kg dry product output: milk and meat live weight)	Carbon (kg)	DM (kg)
Inputs		
Grass+silage	3.53	7.68
Cereals/conc.	1.17	2.54
Total	**4.70**	**10.22**
Outputs		
Milk	0.54	0.94
Meat live weight	0.03	0.06

CH4	0.15	0.20
Manure	0.96	2.16
Respiration: C in CO2	3.03	3.03
Respiration: H2O	0.00	3.83
Total	**4.70**	**10.22**
Balance (input - output)	**0.00**	**0.00**

Pig metabolism (per kg dry product output: meat live weight)	Carbon (kg)	DM (kg)
Inputs		
Cereals/conc.	1.54	3.35
Total	**1.54**	**3.35**
Outputs		
Meat live weight	0.42	1.00
CH4	0.01	0.01
Manure	0.56	1.24
Respiration: C in CO2	0.56	0.56
Respiration: H2O	0.00	0.54
Total	**1.54**	**3.35**
Balance (input - output)	**0.00**	**0.00**

Other animals metabolism (per kg dry product output: live weight)	Carbon (kg)	DM (kg)
Inputs		
Cereals/conc.	3.85	8.36
Total	**3.85**	**8.36**
Outputs		
Live weight	0.44	1.00
CH4	0.03	0.03
Manure	1.28	2.76
Respiration: C in CO2	2.10	2.10
Respiration: H2O	0.00	2.47
Total	**3.85**	**8.36**
Balance (input - output)	**0.00**	**0.00**

Emissions

Emissions (not originating from animal and human respiration) are obtained from the Danish Air Emissions Accounts specifying air emissions of CO_2, SO_2, NO_x, CO, N_2O, NH_3, CH_4, and NMVOC from 134 activities + four household activities in year 2003 (Statistics Denmark 2009a). The data from Statistics Denmark (2009a) follows FORWAST classification relatively good. In cases where FORWAST classification is more disaggregated, the emissions have been distributed using information on the physical use of different fuels in the physical use table (see description of data processing in the data processing table below).

Ressources

Resource extraction of agricultural crops, forestry products, fish, aggregates, minerals, and fossil fuels are based on the Danish resource statistics (Statistics Denmark 2009b). These resource uses have been cross checked with the physical supply of the resource extraction industries. In cases where the two data sources showed different figures, one of them has been chosed as the most reliable data source. The resource material composition is presented in deliverable D6-1 Documentation of data consolidation, calibration and scenario parameterisation.

4.1.3   Data processing

The following table gives an overview of the investigated product groups supplied and used – connected to the FORWAST-code. For each product group, the data availability and the selected methodology for the data processing is reported. Several of the transactions of flows of product groups as provided by statistical agencies need to be disaggregated to fit with FORWAST classification. In the table below the data sources used for this purpose are described. The calculation steps and balancing exercise when disaggregating are described in deliverable D2.2: Data collection guideline and forms for WP3 and WP4. For several of the activities, it is specified how much of the feedstock that ends up in the supply of products by the activity, e.g. that 98% of the use of rapeseed by the vegetable oil industry becomes oil and oil meal. These feedstock efficiencies are a result of the data collection of physical flows combined with the calculation of waste flows (see deliverable 6.4: Documentation of the final model used for the scenario analyses).

The first column in the table below contains the FORWAST-codes, the second names the corresponding products and industries (NACE/CPA), the third column shows short descriptions regarding data availability and data processing. Generally monetary and physical sup-

ply-use and import/export information is obtained directly from the detailed Danish supply-use table. When this is the case, nothing is mentioned in the table below.

Table 2:   Investigated Categories and Data Processing

FORWAST code	NACE/CPA Products / Industries	Data availability, processing and estimation
01 – 06	Products of Agriculture, hunting and related service activities **(01)** 1.Bovine meat and milk 2. Pigs 3. Poultry and animals n.e.c. 4. Grain crops 5. Crops n.e.c 6. Agriculture services	SUPPLY of agricultural products: Agriculture (one product) is disaggregated into the categories in column 2. Internal (hidden) supply of grain crops used directly in integrated crop/animal farms is estimated by comparing physical flows in supply-use table with physical statistics on the use of animal feed. The hidden flow is not recorded by the supply-use framework because internal use is not traded on the market. Monetary information is obtained by use of price information. The hidden internal flow is added to the original supply and use of agricultural products. USE of products by agricultural activities: Disaggregation coefficients for fuel consumption are based on physical information in LCAs (Nielsen et al. 2005), use of fertiliser is based on agricultural regulation on fertiliser use (Plantedirektoratet 2003), and use of resources (grass/ensilage), grain crops and animal feed is based on animal metabolism balances (tables in this chapter).
07	Products of forestry, logging and related service activities **(02)** 07. Forest products 08. Recycling of waste wood	SUPPLY: Physical supply is based on Statistics Denmark (2009b). There is no available statistical data concerning recycling of waste wood. The activity: 'recycling of waste wood is left empty in the Danish SUT.
09	Fish and other fishing products; services incidental of fishing **(05)**	Physical supply is based on Statistics Denmark (2009b)
11	Crude petroleum and natural gas; services incidental to oil and gas extraction excluding surveying **(11)**	Physical supply is based on Statistics Denmark (2009b)
12 - 15	Metal ores **(13)**	No extraction of metal ores in Denmark

	11. Iron ores from mine *12. Bauxite from mine* *13. Copper from mine* *14. Metals from mine n.e.c.*	
10,16 -18	Other mining and quarrying products **(10,14)** *9. Coal and lignite; peat* *15. Sand, gravel and stone from quarry* *16. Clay and soil from quarry* *17. Minerals from mine n.e.c.*	SUPPLY: Physical supply of mining and quarrying products is based on Statistics Denmark (2009b). 'Coal and lignite; peat' is included in the product group 'Other mining and quarrying products' in the data from statistics Denmark. Therefore, this product group is present here. USE of products by the mining activities: Disaggregation coefficients for fuel consumption are based on physical information in the ecoinvent database v2: sand, clay, salt, and peat (ecoinvent 2007).
19	Meat and fish products **(15.1-15.2)**	USE: Disaggregation coefficients for the use of agricultural products by the food industries are based on common sense: Meat and fish products uses bovines, pigs and other animals. Physical flow: Approximately 85% of the meat used by the 'Meat and fish products' industry is present in the products supplied.
20	Dairy products **(15.5)**	USE: Disaggregation coefficients for the use of agricultural products by the food industries are based on common sense: Dairy products uses milk. Physical flow: Approximately 95% of the raw milk used by the 'Dairy products' industry is present in the products supplied.
21	Fruits and vegetables, processed **(15.3)**	USE: Disaggregation coefficients for the use of agricultural products by the food industries are based on common sense: fruits and vegetables uses crops nec. Physical flow: Approximately 78% of the crops used by the 'Fruits and vegetables, processed' industry is present in the products supplied.
22	Vegetable and animal oils and fats **(15.4)**	USE: Disaggregation coefficients for the use of agricultural products by the food industries are based on common sense: vegetable oils uses crops nec. Physical flow: Approximately 98% of the crops used by the 'Vegetable and animal oils and fats' industry is present in the products supplied.
23,25,26	Mfr. of starch, chocolate and	SUPPLY: Disaggregation coefficients for the total supply

	sugar products **(15.6-15.8)** *23. Flour* *25. Animal feeds* *26. Food preparations n.e.c.*	of the products is based on the detailed Danish supply-use table. USE: Disaggregation coefficients for the use of agricultural products by the food industries are based on common sense: flour uses grain crops, sugar uses crops nec, and animal feeds uses grain crops and crops nec. Physical flow: Approximately 80% of the crops used by the 'Flour' industry is present in the products supplied, approximately 98% of the crops used by the 'Animal feeds' industry is present in the products supplied, and approximately 42% of the feedstocks used by the 'Food preparations n.e.c.' industry is present in the products supplied.
24	Sugar **(15.83)**	USE: Disaggregation coefficients for the use of agricultural products by the food industries are based on common sense: sugar uses crops nec. Physical flow: Approximately 67% of the crops used by the 'Sugar' industry is present in the products supplied.
27	Beverages **(15.9)**	USE: Disaggregation coefficients for the use of agricultural products by the food industries are based on common sense: beverages uses grain crops and crops nec. Physical flow: Approximately 72% of the crops used by the 'Beverages' industry is present in the products supplied.
28	Tobacco products **(16)**	
29	Textiles **(17)**	USE: Disaggregation coefficients for the use of agricultural products are based on common sense: textiles uses grain crops nec.
30	Wearing apparel; furs **(18)**	USE: Disaggregation coefficients for the use of agricultural products are based on common sense: wearing apperal; furs uses animals nec. (hides of fur animals)
31	Leather and leather products **(19)**	USE: Disaggregation coefficients for the use of agricultural products are based on common sense: leather products uses bovine meat and milk (hides of bovines)
32	Wood and products of wood and cork (except furniture);	

	articles of straw and plaiting materials **(20)**	
33 - 35	Pulp, paper and paper products **(21)** *33. Pulp, virgin* *34. Recycling of waste paper* *35. Paper and paper products*	SUPPLY: Disaggregation coefficients for the total supply of 'pulp' and 'paper and paper products' are based on the detailed Danish supply-use table. However, this does not register internal flow of pulp to paper production in integrated pulp and paper industries. Therefore, the internal flow has been estimated based on figures on the use of kg pulp per kg produced paper (Schmidt et al. 2007) and prices on pulp obtained from detailed Danish SUT. The monetary supply of recycling services is not included in the FORWAST SUT. The physical supply of recycling services (kg waste recycled) is calculated based on the off-diagonal supply of recovered products by the recycling activity and the ratio between output of recovered material and recycled waste. For recycling of waste paper the off-diagonal supply of pulp corresponds to the total domestic supply of pulp in Denmark, because there is no production of virgin pulp in Denmark. USE: Use of fuels by the pulp and paper industries is based on Schmidt et al. (2007). The use of 'Mfr. of paints, printing ink and mastics'by the pulp and paper industries is 100% allocated to the paper manufacturing. The use of pulp by the pulp and paper industry is 100% allocated to paper manufacturing, and the use of paper is distributed between the recycling and the paper industry based on monetary total supply of the two activities.
36	Printed matter and recorded media **(22)**	
37-38	Coke, refined petroleum products and nuclear fuels **(23)** *37. Coke, refined petroleum products* *38. Recycling of waste oil*	
39-40	Manufacture of fertilizers etc. **(24.15)** 39. Fertiliser, N	SUPPLY: According to supply-use, N-fertiliser contains 27% N and P fertiliser contains 100% P_2O_5

	40. Fertiliser, other than N	USE: The use of fuels and electricity by the fertiliser industries is based on ecoinvent (2007) processes: 'Ammonium nitrate, as N, at regional storehouse' (N-fertiliser) and 'Triple superphosphate, as P2O5, at regional storehouse' (P-fertiliser).
41-42	Mfr. of plastics and syntethic rubber **(24.16)** 41. Plastics basic, virgin 42. Recycling of plastics basic	SUPPLY: The monetary supply of recycling services is not included in the FORWAST SUT. The physical supply of recycling services (kg waste recycled) is calculated based on the off-diagonal supply of recovered products by the recycling activity and the ratio between output of recovered material and recycled waste. For recycling of plastics waste the off-diagonal supply of 'Plastics basic, virgin' corresponds to the total domestic supply of plastic in Denmark, because there is estimated that there is no or only insignificant production of virgin plastic in Denmark.
43	Chemicals, chemical products and man-made fibres nec **(24)** *43. Chemicals, n.e.c.*	
44	Rubber and plastic products **(25)**	
45-46	Mfr. of glass and ceramic goods etc. **(26.1)** *45. Glass, mineral wool and ceramic goods, virgin* *46. Recycling of glass, mineral wool and ceramic goods*	SUPPLY: The monetary supply of recycling services is not included in the FORWAST SUT. The physical supply of recycling services (kg waste recycled) is calculated based on the off-diagonal supply of recovered products by the recycling activity and the ratio between output of recovered material and recycled waste. For recycling of glass waste the off-diagonal supply of 'Glass, mineral wool and ceramic goods, virgin' corresponds to 38% of the monetary domestic supply of glass in Denmark. 62% of the monetary domestic supply of glass in Denmark is supplied by the activity: virgin production, and the remaining is supplied by recycling of glass waste. This proportion is based on the amount of recycled glass waste in Denmark (Miljøstyrelsen 2005, p 23,30,31) and the ratio between supplied recovered glass and recycled glass waste (Schmidt 2005, p 99). USE: The use of sand, clay, minerals, fuels and electricity

		by the glass industries are based on Schmidt (2005).
47,48,51-52	Mfr. of cement, bricks, tiles, flags etc. **(26.3, 26.4, 26.5)** 47. *Cement, virgin* 48. *Recycling of slags and ashes* 51. *Bricks* 52. *Recycling of bricks*	SUPPLY: The monetary supply of recycling services is not included in the FORWAST SUT. The physical supply of recycling services (kg waste recycled) is calculated based on the off-diagonal supply of recovered products by the recycling activity and the ratio between output of recovered material and recycled waste. For recycling of slags and ashes the off-diagonal supply of 'Cement, virgin' corresponds to 16% of the monetary domestic supply of cement in Denmark. This proportion is based on the amount of recycled slag and ashes in Denmark (Aalborg Portland 2004, p 16) and the ratio between supplied clinker substitute based on recovered slags and ashes (Estimated). USE: The use of sand (lime), fuels and electricity by the cement and bricks industries are based on Aalborg Portland (2004), and ecoinvent (2007) processes: 'Portland cement, strength class Z 52.5, at plant', 'Portland slag sand cement, at plant', and 'Brick, at plant'.
49-50	Other non-metallic mineral products 49. *Concrete, asphalt and other mineral products, virgin* 50. *Recycling of concrete, asphalt and other mineral products*	SUPPLY: The monetary supply of recycling services is not included in the FORWAST SUT. The physical supply of recycling services (kg waste recycled) is calculated based on the off-diagonal supply of recovered products by the recycling activity and the ratio between output of recovered material and recycled waste. For recycling of concrete the off-diagonal supply of 'Sand, gravel and stone' is 4,400 Gg (calculated based on mass balance of concrete industry). The ratio between the supplied sand and the recycled concrete is 0.99 (estimated). USE: The uses by the recycling activity are estimated based on the proportion between the total monetary supply by the concrete activity and the recycling activity.
53-54	Mfr. of basic ferrous metals **(27.1)** 53. *Iron basic, virgin* 54. *Recycling of iron basic*	SUPPLY: The monetary supply of recycling services is not included in the FORWAST SUT. The physical supply of recycling services (kg waste recycled) is calculated based on the off-diagonal supply of recovered products by the recycling activity and the ratio between output of recov-

		ered material and recycled waste. For recycling of iron, the off-diagonal supply of 'Iron basic, virgin' corresponds to 100% of the monetary domestic supply of basic iron in Denmark. For recycling of iron waste the off-diagonal supply of 'Iron basic, virgin' corresponds to the total domestic supply of basic iron in Denmark, because there is no production of virgin iron in Denmark.
61	First processing of iron and steel **(27.2,27.3)** *61. Iron, after first processing*	
55-60	Mfr. of basic non-ferrous metals **(27.4)** 55. *Aluminium basic, virgin* 56. *Recycling of aluminium basic* 57. *Copper basic, virgin* 58. *Recycling of copper, basic* 59. *Metals basic, n.e.c., virgin* 60. *Recycling of metals basic, n.e.c.*	SUPPLY: The monetary supply of recycling services is not included in the FORWAST SUT. The physical supply of recycling services (kg waste recycled) is calculated based on the off-diagonal supply of recovered products by the recycling activity and the ratio between output of recovered material and recycled waste. For recycling of alu and copper, the off-diagonal supplies of basic alu and copper correspond to 100% of the monetary domestic supplies of the respective materials. There is no supply of metals nec. The amounts of recycled waste of alu and copper are calculated based on the total supplies of recovered materials divided by the ratio between recovered material and recycled scrap. These ratios are 90% for both alu and copper, estimated based figures for aluminium in Schmidt (2005).
62-64	Casting of metal products **(27.5)** 62. *Aluminium, after first processing* 63. *Copper, after first processing* 64. *Metals n.e.c., after first processing*	
65	Fabricated metal products, except machinery and equipment **(28)**	
66	Machinery and equipment n.e.c. **(29)**	
67	Office machinery and comput-	

	ers **(30)**	
68	Electrical machinery and apparatus n.e.c. **(31)**	
69	Radio, television and communication equipment and apparatus **(32)**	
70	Medical, precision and optical instruments, watches and clocks **(33)**	
71	Motor vehicles, trailers and semi-trailers **(34)**	No physical flows included: Defined as service product
72	Other transport equipment **(35)**	No physical flows included: Defined as service product
73	Furniture; other manufactured goods n.e.c. **(36)**	
74	Secondary raw materials **(37)**	No physical flows included: Defined as service product
75	Electrical energy, gas, steam and hot water **(40.1,40.3)**	SUPPLY: The total supply of 'Electricity, steam and hot water' appears as supply from the activity 'Electricity, steam and hot water' in the detailed Danish SUT. This is not correct since some electricity and heat is supplied from: waste incineration, landfill gas, and biogasification of waste. Thus, a certain share of the total supply of 'Electricity, steam and hot water' is moved from the activity 'Electricity, steam and hot water' to 'Refuse dumps and refuse disposal plants'. In order to maintain balance, the redistribution in the supply table is counterbalanced as gross operating surplus in the use table. The physical supply (kWh) is based on data from Statistics Denmark (2009b) and Energistyrelsen (2004). USE: The data from Statistics Denmark (2009b) and Energistyrelsen (2004) follows FORWAST classification relatively good. In cases where FORWAST is more disaggregated, the energy uses has been distributed using the monetary information in the use table.
76	Gas **(40.2)**	
77	Water, fresh **(41)**	No physical flows included: Defined as service product
78-80	Construction **(45)** *75. Buildings, residential*	No physical flows included: Defined as service product

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	76. Buildings, non-residential *77. Infrastructure, excluding buildings*	
81	Trade and repair of motor vehicles; service stations **(50)**	The detailed Danish supply-use table does not include information on the trade margins of the eight included transport and trade margin activities. The Danish IO table (Statistics Denmark 2009c) contains data on the use of transport and trade margins of the eight different transport and trade margin products. Based on the detailed supply-use tables, the total margins of wholesale and retail can be calculated. The data in the IO-table is then used for distributing the two margins from the detailed SUT on the 8 margins in the tables to be filled. Having the eight trade activities, it is relatively straight forward aggregating the eight products/activities to the three categories in the FORWAST model.
82	Wholesale trade **(51)**	
83	Retail trade and repair services **(52)**	
84	Hotels and restaurants **(55)**	
85	Land transport; transport via pipelines **(60)**	
86	Transport by ship **(61)**	
87	Air transport **(62)**	
88	Cargo handling, harbours; travel agencies **(63)**	
89	Post and telecommunication **(64)**	
90	Financial intermediation **(65)**	
91	Insurance and pension funding **(66)**	
92	Services auxiliary to financial intermediation **(67)**	
93	Real estate services **(70)**	
94	Renting of machinery and equipment etc. **(71)**	
95	Computer and related services	

	(72)	
96	Research and development **(73)**	
97	Business services n.e.c. **(74)**	
98	Public service and security **(75)**	
99	Education services **(80)**	
100	Health and social work **(85)**	
101-108	'Sewage removal and disposal' and 'Refuse collection and sanitation' **(90(disaggr.))** *98. Incineration of waste* *99. Manure treatment* *100. Biogasification of waste* *101. Composting of food waste* *102. Waste water treatment* *103. Landfill of waste* *104. Land application of waste*	All information is kept in one column and one row – the products/industries are disaggregated based on the waste module described in deliverable D5.4: Description of the environmental pressures from waste treatment
109	Membership organisations **(91)**	
110	Recreational and cultural services **(92)**	
111	Services n.e.c. **(93)**	
112	Household, to nourish (n.a.)	Information on household products/activities are kept in the final demand column in the use table. The specified household products/activities are defined in deliverable: D6.1 Documentation of the data consolidation,calibration, and scenario parameterisation
113	Household, to clean (n.a.)	
114	Household, to transport and communicate (n.a.)	
115	Household, to reside (n.a.)	
116	Household, home composting (n.a.)	
117	Household, unauthorised incineration (n.a.)	

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5 France: Data Processing

5.1.1 Methodology and Data Quality

The disaggregation process, between the Eurostat matrix and the FORWAST SUT, requires either:

1. physical and monetary data on the FORWAST subcategories, or

2. monetary data AND product prices valid on the national market, allowing to calculate physical data, or

3. physical data AND product prices valid on the national market, allowing to calculate monetary data.

The triangulation concept is described in Deliverable n° 2-4. For France, 1 was followed as much as possible, then 2, while 3 was followed for missing data and crosschecks.

5.1.1.1 Supply matrix

For French data, the applicable cases of the above method are:

1. Agriculture, food and forestry subcategories (1 to 9, 19 to 28), coal, oil and gas (10, 11), coke, refined petroleum products and nuclear fuels (37): physical and monetary data; for chemical products (39 to 43), both monetary and physical data were available from SESSI but only from 2004 onwards. 2004 data were used;

2. For textiles and wood products (29 to 32), printed matter and recorded media (36), rubber and plastics (44) and machinery (65 to 73), monetary data and import prices were used;,

3. Ores and metals from mine (12 to 15) data were obtained from BGS/BRGM and import prices were used; sand, gravel and stone, clay and soil, and minerals from mine data (16 to 18) were obtained from BGS/BRGM and controlled from UNICEM data. Import prices were used for 17 and 18, and monetary data for 16 were then calculated by difference from the SUIOT data, as trade prices were not relevant;
paper and pulp (33 to 35) mass data were obtained from COPACEL and import prices were used.

Specific procedures had to be used for:

- the glass, cement, concrete and bricks sector (45 to 52): physical data were combined from INFOCIMENTS (2003) and SESSI (2004) and price data were obtained from SESSI;

- the basic metals sector (53 to 64): physical data were combined from BGS, MINERALINFO, ADEME and FEDEREC, and price data were averaged between import and export prices (53 to 61). For metals after first processing (62 to 64) no price was available. We used the ratio "after first processing/basic" of iron products on the respective prices of other basic metals to deduce prices of metals after first processing,

- physical data on gas (76) were calculated from energetic values (CPDP) and gas density published by GDF, the State provider for 2003. Electricity data from EuroStat were used instead of French data, as they matched better Forwast needs. Water supply data are not readily accessible countrywise as they are under confidentiality clauses, due to single or two-company operation. Furthermore, part of water supply escapes statistics as water is tapped by many industries from their own property, without any control;

- buildings and infrastructure (78 to 80) data were the subject of indirect calculations. Monetary data were available for residential buildings from Ministry sources (www.statistiques.equipement.gouv.fr), and for infrastructure from FNTP; monetary data for industrial buildings were subsequently obtained from SUIOT by difference. Price and mass for residential buildings were calculated from the estimated mass of one building (150 t), the market construction price (120k€) and from the number of individual buildings from Ministry sources. Global mass data on the sector were distributed according to Austrian disaggregation coefficients. Prices for each product were calculated from these data, and the consistency of these prices with the economy of each activity was verified using employment data for each sector (Ministry sources).

5.1.1.2 Use matrix

For French data, two cases were met:

- raw data are available,

- disaggregation of data was required.

5.1.1.2.1 Raw data available

This case was met for animal feed, for which French statistics were available (AGRESTE) in which the raw material used for animal feed production were detailed.

Raw data were available in NCE and NES114 formats (SESSI) for the energy needs of the main industrial sectors, with little disaggregation reqired. These data were complemented by EUROSTAT data (see below).

FAOstat and AGRESTE data are available for the wood sector. They are actually more detailed than the FORWAST category, and they allow to provide use data for specific uses of wood products, such as paper and pulp.

5.1.1.2.2 Disaggregation of data required

Energy data (see above) were complemented by EUROSTAT data, but only at the 59x59 level.

Use data for sand, stone and gravel are driven by the types of activities using them. This is obviously the case for domestic and industrial building, and infrastructure sectors. The direct needs of the cement and concrete sectors had also to be quantified, as well as some other large uses of sand, stone and gravel (for glass, basic iron, fertilisers and chemicals n.e.c.). No direct data being available for such uses, factors from process databases such as EcoInvent 2.0 were used on supply data to deduce actual uses.

The uses of the basic meal sectors were calculated from the composition and supply of concentrates. This allows to calculate the requirements of a given metal production, by adding process information. This approach is valid for countries producing metals from imported ores, while countries with active mining will use ore production and actual composition data.

Data on the uses of the paper industry were disaggregated similarly to the European industry using CEPI data.

The uses of the fertilisers industry were estimated from the chemical composition (Kc) of the main fertiliser types (P, N, K) along monetary data. The other chemical industries (chemicals n.e.c.) uses were estimated from PRODCOM categories supply data (aggregation by types of products) and using the confidential level of SESSI data. This allows to consolidate the requirements in each FORWAST commodity of each sector.

More generally, the manual aggregation of detailed PRODCOM categories, using product and process information, but also common sense, proved to be a very efficient approach to

missing statistics, as it allowed to distribute 80 to 90% of each sector. A limitation to this method is set by confidentiality in PRODCOM, but this may be overcomed at the national level if confidentiality can be waived.

5.1.1.3   Composition matrix (Kc)

Composition data were collected for the following categories during French data mining:

- Metals, basic and from first transformation,

- Machinery, mechanical and electrical, including transportation equipment.

Typical ore and metal compositions were taken from industrial standards compositions, as these standards were developed by the industry for the needs of production control. Steel compositions vary widely along use, and accurate averages would need to be weighted by sector data. Typical steel compositions (structural, stainless and sheet) were obtained from patent or academic sources.

Composition data on machinery are usually available only for end-of-life equipment through recycling statistics. This is easy for road vehicles and aircraft, and less so for railways or ships. As road vehicles are the main flow, the reliability of the figures is good. Recycling data for appliances and electronic equipment are widely available as a result of WEEE regulation. This led to the novel concept of using a recycling facility batch as one of the most accurate sampling and analysis procedures (Matsutoa et al., 2004; Morf et al., 2007).

It should be noted that end-of-life composition data imply a time lag of about 15 years and may hide technological changes. This time lag is shorter for electric appliances, and even more for electronic equipment and computer.

No weighted data could be found for the highly heterogenous category of medical, precision, optical equipment and clocks, as it is not a separate recycling flow.

Composition data for the other categories were obtained from the other partners (Minutes of the Stuttgart Meeting, 30th January – 1st February 2008), except when it was obvious that French data departed from EU average (aquaculture). The following adjusments were made:

- fish products from aquaculture are mainly sea shells in France, hence 25% of the wet mass of fish products, but 54% of its dry weight – most of it being minerals n.e.c, carbonate carbon and oxygen);

- ore data were assumed to be commercial concentrates, for instance iron ores (see above), to the opposite of mining countries (lower grades for ore). This can be normalised for all countries by expressing all data in metal oxide content (similarly to Infomine or BGS). However, this may lead to imbalances because monetary data are provided for ore commodities, regardless of grade;

- oil and natural gas composition data were adjusted according to supply sources for France. This approach should not be required for a standard commodity, but it actually led to improve balances,

- wood humidity rate was adjusted to 12%, using CNDB data.

5.1.1.4   Resources matrix (R)

For French data, the following cases were met:

- use of biomass, for which data were extracted from sector sources, or set equivalent to Supply. The resource use of grain crops led us to evaluate straw production using ARVALIS data, and its distribution between uses and return to soil, according to agricultural practice (60% and 40% respectively). The use of grass for animal production was calculated from sector information and ratios, extracted from AFICAR and CIV (Centre d'Information des Viandes), concurrently with detailed sector information from Denmark;

- use of mineral resources: due to the demise of mining, this applies mainly to sand, stone and gravel, and to industrial minerals, regardless of their use. Most of these being quarried, resource use comprises quarrying works (such as the removal of overburden, estimated to 10%) and raw commodity extraction. The commercial grade is highly variable and was averaged to 50%,

- similarly, water resources are used for the production of concrete (water is later immobilised) and for buildings (concrete produced in-situ). This accounts for 10 to 15% of the total mass supply of concrete. This resource use may be minor in monetary terms, as most of it is not from the water supply sector, but it is nevertheless a major use in physical terms. This use comes from direct resource tapping. It would be probably easier to observe at the aquifer or basin management level,

- coal, oil and gas, for which resource use/production ratios were extracted from international sources (USGS, USA Department of Energy),

- Non food fiber products, for which resource use was obtained by combining use data, compositions (Kc), wood energy data (DGEMP) and emissions data (UNFCCC) for heating from biomass. The result is a global figure for resource use by households. This figure could not be expected from monetary data, as most of it is a direct, non-market use, covering 81% of wood use for heating by households,

- Fertiliser and chemicals n.e.c industries using air for the production of industrial gases and N fertilisers. The resource use of these specific industries was evaluated from detailed PRODCOM data. This resource use might go unnoticed, as it is not monetarised, but it makes up to 25% of the supplies by the chemical industry (n.e.c.).

5.1.1.5 Emissions matrix (–B) and distribution (Go, Gw, Gr)

The sources for emission data are UNFCCC, EMEP CorinAir, and NAMEA inventory (from EUROSTAT).

CORINAIR CORe INventory of AIR emissions in Europe, is a work programme initiated by the European Commission, and continued by the European Environment Agency. Web: http://www.eea.europa.eu/publications/EMEPCORINAIR3/

EMEP (Co-operative Programme for Monitoring and Evaluation of the Long Range Transmission of Air Pollutants in Europe) is a monitoring programme led under the supervision of the United Nations. The EMEP Centre on Emission Inventories and Projections (CEIP) hosted by the Umweltbundesamt, the Austrian Environment Agency, started on 15 January 2008. Web site: http://www.ceip.at/

They are largely inconsistent and data reconciliation was led on the basis of global mass consistency with sector statistics and process information. This led to a 59x59 level emissions table. Further disaggregation was based on physical and energy use data. Most emissions are closely associated with energy use. However, in some sectors, other emissions may be significant: this is the case for agriculture (CH_4 and NH_3 emissions), and for other minerals and basic iron (emissions of carbonate C).

Distribution of emissions was carried out in G matrixes on the basis of energy use by each activity. Emissions without connection with energy use are distributed according to physical use data.

5.1.1.6 Detailed information per activity

The table 1 complements the above paragraphs per activity.

Table 3: Investigated Categories and Data Processing

FORWAST code	NACE/CPA Products / Industries	Data availability, processing and estimation
01 – 06	Products of Agriculture, hunting and related service activities **(01)** 1. *Bovine meat and milk* 2. *Pigs* 3. *Poultry and animals n.e.c.* 4. *Grain crops* 5. *Crops n.e.c* 6. *Agriculture services*	SUPPLY of agricultural products: Agriculture is disaggregated into the categories in column 2. Monetary and mass values are obtained by crossing data from AGRESTE and FAOSTAT. Internal supply of grain crops used directly in integrated crops animal farms is estimated by comparing physical supply, resource and use flows and data on use of grass from CIV. The hidden flow is not recorded by the supply-use framework because internal use is not traded on the market. USE of products by agricultural activities: use of resources (grass/ensilage), grain crops and animal feed is based on animal metabolism balances and sector association data.
07	Products of forestry, logging and related service activities **(02)** 07. *Forest products* 08. *Recycling of waste wood*	SUPPLY: Physical supply is based on Statistics from AGRESTE and ministry of energy estimation for use of heating wood by households (internal use) added to supply of forestry product. There is no available statistical data concerning recycling of waste wood. The activity: 'recycling of waste wood is left empty in the French SUT.
09	09. Fish and other fishing products; services incidental of fishing **(05)**	SUPPLY: Physical and monetary supply are based on FAO Statistics extracted from FISHSTAT (2008)
11	9. *Coal and lignite; peat* 11. *Crude petroleum and natural gas; services incidental to oil and gas extraction excluding surveying* **(11)**	SUPPLY: Physical supply is based on ministry of energy statistics (DGEMP) data and CPDP data (2007)
12 - 15	Metal ores **(13)** 12. *Iron ores from mine* 13. *Bauxite from mine*	SUPPLY: Extraction of metal ores in France is limited on bauxite and metals n.e.c. Physical supply are based on BGS (2007) and BRGM data which have been crossed.

	14 Copper from mine *15. Metals from mine n.e.c.*	Monetary information is obtained by use of price information. PRICE: prices are deduced from import and export data aggregated from Eurostat STIC 2003 database.
16 -18	Other mining and quarrying products **(14)** 16. *Sand, gravel and stone from quarry* 17. *Clay and soil from quarry* 18. *Minerals from mine n.e.c.*	SUPPLY: Physical supply is based on SESSI statistics data which are crossed with BGS (2007) data. Monetary information is obtained by use of price information. PRICE: prices are deduced from import and export data aggregated from Eurostat STIC 2003 database.
19	Meat and fish products **(15.1-15.2)**	SUPPLY: Physical and monetary supply are based on AGRESTE statistics data in PRODCOM format. Data are aggregated according to NACE categories and D 2.4 definitions.
20	Dairy products **(15.5)**	
21	Fruits and vegetables, processed **(15.3)**	PRICE: prices are deduced from import and export data aggregated from Eurostat STIC 2003 database and a cross check is made witch physical and monetary data.
22	Vegetable and animal oils and fats **(15.4)**	USE : physical data are obtained from AGRESTE and disaggregation coefficients are based on physical information in the ecoinvent database v2: (ecoinvent 2007).
23,25,26	Mfr. of starch, chocolate and sugar products **(15.6-15.8)** 23. *Flour* 25. *Animal feeds* 26. *Food preparations n.e.c.*	
24	Sugar **(15.83)**	
27	Beverages **(15.9)**	
28	Tobacco products **(16)**	SUPPLY: physical supply is based on AGRESTE statistics
29	Textiles **(17)**	SUPPLY: physical supply is based on SESSI statistics
30	Wearing apparel; furs **(18)**	SUPPLY: physical supply is based on SESSI statistics
31	Leather and leather products	SUPPLY: physical supply is based on SESSI statistics

	(19)	
32	Wood and products of wood and cork (except furniture); articles of straw and plaiting materials **(20)**	SUPPLY: physical supply is based on SESSI statistics and FAO statistic on wood products
33 - 35	Pulp, paper and paper products **(21)** *33. Pulp, virgin* *34. Recycling of waste paper* *35. Paper and paper products*	SUPPLY: physical supply is based on SESSI statistics, French sector association COPACEL data and ADEME for paper recycling supply. USE: Physical use are based on physical information delivered by CEPI (2003) association
36	Printed matter and recorded media **(22)**	SUPPLY: physical supply is based on SESSI statistics
37-38	Coke, refined petroleum products and nuclear fuels **(23)** *37. Coke, refined petroleum products* *38. Recycling of waste oil*	SUPPLY: physical supply is based on CPDP and DGEMP statistics. There is no data available for recycling of waste oil. USE: physical use is based on data from DGEMP and Eurostat. Physical use has been crossed with CO_2 emissions data.
39-40	Manufacture of fertilizers etc. **(24.15)** 39. Fertiliser, N 40. Fertiliser, other than N	SUPPLY: physical supply is based on SESSI statistics USE: physical use is based on physical information in the ecoinvent database v2: (ecoinvent 2007). PRICE: prices are deduced from import and export data aggregated from Eurostat STIC 2003 database. RESOURCE: there is an input in resource table of nitrogen from atmosphere
41-42	Mfr. of plastics and synthetic rubber **(24.16)** 41. Plastics basic, virgin 42. Recycling of plastics basic	SUPPLY: physical supply is based on SESSI statistics PRICE: prices are deduced from import and export data aggregated from Eurostat STIC 2003 database.
43	Chemicals, chemical products and man-made fibres nec **(24)** *43. Chemicals, n.e.c.*	SUPPLY: physical supply is based on SESSI statistics PRICE: prices are deduced from import and export data aggregated from Eurostat STIC 2003 database. RESOURCE: there is an input in resource table from atmosphere resulting of industrial gas production.
44	Rubber and plastic products	SUPPLY: physical supply is based on SESSI statistics

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	(25)	
45-46	Mfr. of glass and ceramic goods etc. **(26.1)** 45. *Glass, mineral wool and ceramic goods, virgin* 46. *Recycling of glass, mineral wool and ceramic goods*	SUPPLY: physical supply is based on SESSI statistics, and data from ADEME for recycling. USE: physical use is based on physical information in the ecoinvent database v2: (ecoinvent 2007), and data from ADEME for recycling. PRICE: prices are deduced from import and export data aggregated from Eurostat STIC 2003 database.
47,48,51-52	Mfr. of cement, bricks, tiles, flags etc. **(26.3, 26.4, 26.5)** 47. *Cement, virgin* 48. *Recycling of slags and ashes* 51. *Bricks* 52. *Recycling of bricks*	SUPPLY: physical supply is based on SESSI statistics Ecoinvent USE: physical use is based on physical information in the ecoinvent database v2: (ecoinvent 2007), and data from ADEME for recycling. PRICE: prices are deduced from import and export data aggregated from Eurostat STIC 2003 database. EMISSIONS: emissions of CO_2 are crossed between data from use of limestone and UNFCCC data.
49-50	Other non-metallic mineral products 49. *Concrete, asphalt and other mineral products, virgin* 50. *Recycling of concrete, asphalt and other mineral products*	SUPPLY: physical supply is based on SESSI statistics USE: physical use is based on physical information in the ecoinvent database v2: (ecoinvent 2007), and data from ADEME for recycling. PRICE: prices are deduced from import and export data aggregated from Eurostat STIC 2003 database. RESOURCE: there is a resource use of water for concrete production according to physical information in the Ecoinvent database v2: (ecoinvent 2007).
53-54	Mfr. of basic ferrous metals **(27.1)** 53. *Iron basic, virgin* 54. *Recycling of iron basic*	SUPPLY: physical supply is based on SESSI statistics, crossed with data from BGS. Physical data for recycling is based on statistics from French sector association FEDEREC and crossed with information from ADEME
61	First processing of iron and steel **(27.2,27.3)** 61. *Iron, after first processing*	USE: the totality of ore supply is assumed to be used by first processing metals production.
55-60	Mfr. of basic non-ferrous metals **(27.4)** 55. *Aluminium basic, virgin*	

	56. Recycling of aluminium basic *57. Copper basic, virgin* *58. Recycling of copper, basic* *59. Metals basic, n.e.c., virgin* *60. Recycling of metals basic, n.e.c.*	
62-64	Casting of metal products **(27.5)** *62. Aluminium, after first processing* *63. Copper, after first processing* *64. Metals n.e.c., after first processing*	
65	Fabricated metal products, except machinery and equipment **(28)**	SUPPLY: physical supply is based on SESSI statistics
66	Machinery and equipment n.e.c. **(29)**	SUPPLY: physical supply is based on SESSI statistics
67	Office machinery and computers **(30)**	SUPPLY: physical supply is based on SESSI statistics
68	Electrical machinery and apparatus n.e.c. **(31)**	SUPPLY: physical supply is based on SESSI statistics
69	Radio, television and communication equipment and apparatus **(32)**	SUPPLY: physical supply is based on SESSI statistics
70	Medical, precision and optical instruments, watches and clocks **(33)**	SUPPLY: physical supply is based on SESSI statistics
71	Motor vehicles, trailers and semi-trailers **(34)**	SUPPLY: physical supply is based on SESSI statistics
72	Other transport equipment **(35)**	SUPPLY: physical supply is based on SESSI statistics
73	Furniture; other manufactured goods n.e.c. **(36)**	SUPPLY: physical supply is based on SESSI statistics
74	Secondary raw materials **(37)**	*No physical flows included: defined as service product*
75	Electrical energy, gas, steam	SUPPLY: physical supply is based on DGEMP statistics

	and hot water **(40.1,40.3)**	USE: physical use is based on data from SESSI and Eurostat.
76	Gas **(40.2)**	SUPPLY: physical supply is based on DGEMP and CPDP statistics USE: physical use is based on data from SESSI and Eurostat. Physical use has been crossed with CO_2 emissions data.
77	Water, fresh **(41)**	*No physical flows included: defined as service product*
78-80	Construction **(45)** *75. Buildings, residential* *76. Buildings, non-residential* *77. Infrastructure, excluding buildings*	*No physical flows included: defined as service product*
81	Trade and repair of motor vehicles; service stations **(50)**	*No physical flows included: defined as service product*
82	Wholesale trade **(51)**	Physical supply is assumed to be equal to physical use
83	Retail trade and repair services **(52)**	*No physical flows included: defined as service product*
84	Hotels and restaurants **(55)**	*No physical flows included: defined as service product*
85	Land transport; transport via pipelines **(60)**	*No physical flows included: defined as service product*
86	Transport by ship **(61)**	*No physical flows included: defined as service product*
87	Air transport **(62)**	*No physical flows included: defined as service product*
88	Cargo handling, harbours; travel agencies **(63)**	*No physical flows included: defined as service product*
89	Post and telecommunication **(64)**	*No physical flows included: defined as service product*
90	Financial intermediation **(65)**	*No physical flows included: defined as service product*
91	Insurance and pension funding **(66)**	*No physical flows included: defined as service product*
92	Services auxiliary to financial intermediation **(67)**	*No physical flows included: defined as service product*
93	Real estate services **(70)**	*No physical flows included: defined as service product*

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94	Renting of machinery and equipment etc. **(71)**	*No physical flows included: defined as service product*
95	Computer and related services **(72)**	*No physical flows included: defined as service product*
96	Research and development **(73)**	*No physical flows included: defined as service product*
97	Business services n.e.c. **(74)**	*No physical flows included: defined as service product*
98	Public service and security **(75)**	*No physical flows included: defined as service product*
99	Education services **(80)**	*No physical flows included: defined as service product*
100	Health and social work **(85)**	*No physical flows included: defined as service product*
101-108	'Sewage removal and disposal' and 'Refuse collection and sanitation' **(90(disaggr.))** *98. Incineration of waste* *99. Manure treatment* *100. Biogasification of waste* *101. Composting of food waste* *102. Waste water treatment* *103. Landfill of waste* *104. Land application of waste*	
109	Membership organisations **(91)**	*No physical flows included: defined as service product*
110	Recreational and cultural services **(92)**	*No physical flows included: defined as service product*
111	Services n.e.c. **(93)**	*No physical flows included: defined as service product*
112	Household, to nourish (n.a.)	
113	Household, to clean (n.a.)	
114	Household, to transport and communicate (n.a.)	
115	Household, to reside (n.a.)	
116	Household, home composting (n.a.)	
117	Household, unauthorised in-	

	cineration (n.a.)	

5.2 References (France)

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AGRESTE: statitics database of the Ministry of Agriculture. http://agreste.maapar.lbn.fr/ReportFolders/ReportFolders.aspx (Accessed 2007)

ARVALIS: Specific data on grain crops and non-food crops, and their needs. www.arvalisinstitutduvegetal.fr

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CEPI (2003) European Pulp and Paper Industry. Annual Statistics. CEPI 2003 www.cepi.org

CIV: Centre d'Information des Viandes www.civ-viande.org

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CNDB: (Comité National pour le Développement du Bois) is the national organisation for the promotion of the wood sector.

www.cndb.org

CPDP: (Comité Professionnel Du Pétrole) trade association of oil operators on the French market. Statistical informations on oil products trade and use in France.

www.cpdp.org

COPACEL: Confederation of Paper and Board and Pulp Cellulose

www.copacel.fr/English.htm

DGEMP: Direction générale de l'énergie et des matières premières, now attached to environment ministry.

http://www.developpement-durable.gouv.fr/-Energie-et-Climat,123-.html

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UNFCCC (2007) United Nations Framework Convention on Climate Change. Inventory of GHG emissions 2003
http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/4771.php

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6 Germany: Data Processing

In Germany detailed official input-output-calculations based on macroeconomic accounting are available since the year 1995. The actual national macroeconomic accounting ("Volkswirtschaftliche Gesamtrechnung; VGR") is based on the European system of macroeconomic accounting (ESVG). A direct conformity to the categories of ESVG is available since the year 2000.

Input-Output-Tables – as well as Supply-Use-Tables - are an integral component of the macroeconomic accounting done by the Federal Statsitical Office ("Statistisches Bundesamt"). Main function is to show a detailed documentation and verification of the interdependencies of production and goods within Germany and the rest of the world.

Another important data source in the context of FORWAST esp. regarding disaggregation and processing of physical data, is the environmental-economic calculation ("Umweltökonomische Gesamtrechnung") where environmentally relevant material flows are aggregated by monetary and physical units.

6.1.1 Sources of Data used for developing FORWAST Matrices

Core database to generate monetary supply and use tables (SUT´s) are the matrices from EUROSTAT, based on "The European System of Accounts ESA95".

6.1.2 Monetary and physical Supply and Use Tables

EUROSTAT Supply- and Use-Tables [Eurostat, 2003a]

- Primary source for MSUT

- Monetary Values (Mio EUR)

    o Supply-Tables in basic prices, Transformation into purchasers prices

    o Use-Tables in purchasers prices

- 59x59 activities/goods (NACE 01 to 95)

- Imports / Exports implemented

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- Manual disaggregation necessary to expand the EUROSTAT-Matrices into FORWAST-Format (from 59X59 into 119x119 activities/goods)

The following national statistics provided by the Federal Statistical Office of Germany are used for data processing (reference year 2003) within FORWAST:

Macroeconomic Accounting, 2003 [Statistisches Bundesamt Deutschland, 2008b]

Monetary Input-Output- and Supply-Use-Tables

- Primary source for MSUT

- Monetary Values (Mio EUR)

    o Supply-Tables in basic prices

    o Use-Tables in purchasers prices

    o Transformation into purchasers prices

- 71x71 activities/goods (NACE 01 to 95) – not completely concordant with FORWAST-categories

- Imports / Exports implemented

- Preparatory Efforts implemented

- Manual disaggregation necessary to expand the EUROSTAT-Matrices into FORWAST-Format (from 71x71 into 119x119 activities/goods)

- Quality Report available [Statistisches Bundesamt, 2009]

Environmental-Macroeconomic Accounting, 2003 [Statistisches Bundesamt, 2007]

Physical Input-Output- and Supply-Use-Tables for environmentally relevant material flows, esp.: water, resources, energy, green-house emissions, air pollutants, waste water, waste, land allocation, environmental protection, traffic, agriculture, forestry

- Source for PSUT

- Monetary + Physical Values

- 69x69 activities/goods (NACE 01 to 92)

- Methodology according to macroeconomic accounting

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- Manual disaggregation necessary to expand the EUROSTAT-Matrices into FORWAST-Format (from 69x69 into 119x119 activities/goods)

Foreign Trade Statistic, 2003 [Statistisches Bundesamt Deutschland, 2004a]

- Source for Foreign Trade Data

- Monetary + Physical Values

Industry – Production, 2003 [Statistisches Bundesamt Deutschland, 2004c]

- Source for Production Data

- Monetary + Physical Values

Agriculture in Numbers, 2003 [Statistisches Bundesamt Deutschland, 2004b]

- Source for Data in Agriculture

- Monetary + Physical Values

6.1.3   Online Database

GENESIS-Online [Statistisches Bundesamt Deutschland.]

Statistical Information System of the Federal Statistical Agency (Registration + Fee necessary)

- Online research portal of the official national and regional statistics

6.1.4   Resources

European Mineral Statistics 2001-05 [Hetherington et al., 2007]

- Source for PSUT and resources matrix
- data according to the physical supply table and the Resource table

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United States Geological Survey [Newman, 2004]

The Mineral Industry of Germany 2003

- Source for PSUT and resources matrix
- data according to the physical supply table and the Resource table

6.1.5   Emissions

European Pollutant Emission Register (EPER) [European Environment Agency (EEA).]

- Source for emissions matrix
- emissions data for Austria and the other European countries (EU-25)
- NACE-based
- More detailed than NAMEA
- Reporting year: 2001 and 2004

6.1.6   Other Sources

In addition to the above mentioned data sources, specific information was directly requested from the Federal Statistical Office.

A already mentioned the initial datasets for the data processing are the Monetary Supply-Use-Tables from EUROSTAT. This Tables where used as a base for the subsequent disaggregation process by using national data sets. In order to ensure congruency, results from national data mining and processing have been verified by comparisons to the following international statistics:

- EUROSTAT

- FAOSTAT

- PRODCOM

- European Pollutant Emissions Register (EPER)

6.1.7 Methodology and Data Quality

Data Quality in Germany in general has a very high level. Uncertainties may occur during the data processing as the data available fits only partly to the FORWAST scheme. The monetary SUT available from EUROSTAT (59 activities/goods) has a direct correspondent monetary SUT in the macroeconomic accounting of the Federal Statistical Office of Germany. These SUT have a disaggregation level of 79 activities/goods. The target disaggregation level within FORWAST is 119 macro-economic groups. These 79 activities/goods had been aggregated by the Federal Statistical Agency to 59 activities/goods for creating the EUROSTAT-tables. By using the national macroeconomic accounting as primary dataset (instead of the EUROSTAT-tables) a higher level of monetary disaggregation could be used as starting point for data processing (however the 79 categories are not completely coherent with the FORWAST-scheme).

Regarding further disaggregation many of the additional activities/groups defined within the FORWAST-scheme can be found in different tables and reports within the above mentioned statistics (previous chapter). The Environmental-Macroeconomic Accounting for the year 2003 covers the matrices for resources and emissions. In opposition to the tables of the macroeconomic accounting, in the environmental-macroeconomic accounting physical <u>and</u> monetary units are available.

For the 79 groups of the macroeconomic accounting there is no direct corresponding data for physical units for the year 2003 (most actual physical SUT´s are available for the year 1995). Correlations by prices per units are not always possible.

Therefore it is quite difficult to create physical tables with the same data quality as available in monetary units, as this can only reached by indirect approaches, estimations, extrapolations etc..

Resulting from this position some indirect procedures have been chosen in order to generate a consistent and harmonized physical SUT as defined in WP1 and WP2. The most relevant are:

- Disaggregation from 79 to 133 groups by using selected eco-macroeconomic SUT´s

- Transformation from monetary to physical units by using several environmental-macroeconomic SUT´s

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- Processing of the remaining physical units by using several additional national statistics (see previous chapter)

- Verification and validation of final datasets by harmonization with national and international statistics

- Additional Research requested from the Federal Statistical Agency

Regarding data quality, there is a high data quality guaranteed for available data provided by the Federal Statistical Agency (detailed quality reports), esp.:

- Monetary Data for 79 macroeconomic activities/goods from the national macroeconomic accounting

- Monetary and physical data resulting from environmental macroeconomic accounting (e.g. emissions, resources).

- Production (monetary + physical data)

- Foreign Trade (monetary + physical data)

- Agriculture (monetary + physical data)

Disaggregated Data beyond the above mentioned statistics are less exact. Within the SUT´s, in most cases monetary data is more precise than the physical values for activities/goods not included in the statistics of high quality.

Missing data can partly be requested from the Federal Statistical Agency.

Table 4:   Investigated Categories and Data Processing

FORWAST code	NACE/CPA Products / Industries	Data availability, processing and estimation
01 – 06	Products of Agriculture, hunting and related service activities **(01)** *1.Bovine meat and milk* *2. Pigs* *3. Poultry and animals n.e.c.*	SUPPLY of agricultural products: The agricultural sector was disaggregated via using additional national information [Statistisches Bundesamt, 2007] [Statistisches Bundesamt Deutschland, 2004b]; Internal (hidden) supply of grain crops used directly in integrated crop/animal farms is based on own assumptions; there is no data con-

	4. Grain crops *5. Crops n.e.c* *6. Agriculture services*	cerning these internal flows due to the fact that these goods are not traded on the market. USE of products by agricultural activities: Disaggregation coefficients for the agricultural sector are based on information in national agricultural statistics [Statistisches Bundesamt, 2007] [Statistisches Bundesamt Deutschland, 2004b]
07	Products of forestry, logging and related service activities **(02)** *07. Forest products* *08. Recycling of waste wood*	SUPPLY: Physical supply is based on German statistics [Statistisches Bundesamt Deutschland, 2007] There is no available statistical data concerning recycling of waste wood. The activity: recycling of waste wood is left empty in the German SUT.
09	Fish and other fishing products; services incidental of fishing **(05)**	Physical supply is based on data from the Federal Statistical Office (Destatis) [Statistisches Bundesamt, 2007] [Statistisches Bundesamt Deutschland, 2008a]
11	Crude petroleum and natural gas; services incidental to oil and gas extraction excluding surveying **(11)**	Physical supply is based on data from the Federal Statistical Office (Destatis) [Statistisches Bundesamt, 2007] and cross-checked with data from USGS [Newman, 2004]
12 - 15	Metal ores **(13)** *11. Iron ores from mine* *12. Bauxite from mine* *13. Copper from mine* *14. Metals from mine n.e.c.*	SUPPLY: no data available in Germany. USE: no data available in Germany
10,16 -18	Other mining and quarrying products **(10,14)** *9. Coal and lignite; peat* *15. Sand, gravel and stone from quarry* *16. Clay and soil from quarry* *17. Minerals from mine n.e.c.*	SUPPLY: Physical supply of mining and quarrying products is based on the Federal Statistical Office (Destatis) [Statistisches Bundesamt, 2007] [Statistisches Bundesamt Deutschland, 2008a] USE of products by the mining activities: Due to lack of information in physical units in Germany, the same disaggregation coefficients like for the supply were used [Statistisches Bundesamt, 2007] [Statistisches Bundesamt Deutschland, 2008a]
19	Meat and fish products **(15.1-15.2)**	SUPPLY: Disaggregation coefficients obtained from the GENESIS Online Database [Statistisches Bundesamt Deutschland, 2008a]

		USE: Disaggregation coefficients for the use of agricultural products by the food industries are based on own assumptions
20	Dairy products **(15.5)**	SUPPLY: Disaggregation coefficients obtained from the GENESIS Online Database [Statistisches Bundesamt Deutschland, 2008a] USE: Disaggregation coefficients for the use of agricultural products by the food industries are based on own assumptions
21	Fruits and vegetables, processed **(15.3)**	SUPPLY: Disaggregation coefficients obtained from the GENESIS Online Database [Statistisches Bundesamt Deutschland, 2008a] USE: Disaggregation coefficients for the use of agricultural products by the food industries are based on own assumptions
22	Vegetable and animal oils and fats **(15.4)**	SUPPLY: Disaggregation coefficients obtained from the GENESIS Online Database [Statistisches Bundesamt Deutschland, 2008a] USE: Disaggregation coefficients for the use of agricultural products by the food industries are based on own assumptions
23,25,26	Mfr. of starch, chocolate and sugar products **(15.6-15.8)** 23. *Flour* 25. *Animal feeds* 26. *Food preparations n.e.c.*	SUPPLY: Disaggregation coefficients obtained from the GENESIS Online Database [Statistisches Bundesamt Deutschland, 2008a] USE: Disaggregation coefficients for the use of agricultural products by the food industries are based on own assumptions
24	Sugar **(15.83)**	SUPPLY: Disaggregation coefficients obtained from the GENESIS Online Database [Statistisches Bundesamt Deutschland, 2008a] USE: Disaggregation coefficients for the use of agricultural products by the food industries are based on own assumptions

27	Beverages **(15.9)**	SUPPLY: Disaggregation coefficients obtained from the GENESIS Online Database [Statistisches Bundesamt Deutschland, 2008a] USE: Disaggregation coefficients for the use of agricultural products by the food industries are based on own assumptions
28	Tobacco products **(16)**	SUPPLY: Disaggregation coefficients obtained from the GENESIS Online Database [Statistisches Bundesamt Deutschland, 2008a] USE: Disaggregation coefficients for the use of agricultural products by the tobacco industry are based on own assumptions
29	Textiles **(17)**	SUPPLY: Data obtained from the GENESIS Online Database [Statistisches Bundesamt Deutschland, 2008a] USE: Data obtained from the GENESIS Online Database [Statistisches Bundesamt Deutschland, 2008a]
30	Wearing apparel; furs **(18)**	SUPPLY: Data obtained from the GENESIS Online Database [Statistisches Bundesamt Deutschland, 2008a] USE: Data obtained from the GENESIS Online Database [Statistisches Bundesamt Deutschland, 2008a]
31	Leather and leather products **(19)**	SUPPLY: Data obtained from the GENESIS Online Database [Statistisches Bundesamt Deutschland, 2008a] USE: Data obtained from the GENESIS Online Database [Statistisches Bundesamt Deutschland, 2008a]
32	Wood and products of wood and cork (except furniture); articles of straw and plaiting materials **(20)**	
33 - 35	Pulp, paper and paper products **(21)** *33. Pulp, virgin* *34. Recycling of waste paper* *35. Paper and paper products*	SUPPLY: Data obtained from the GENESIS Online Database [Statistisches Bundesamt Deutschland, 2008a]; special attention at the internal flow within the integrated pulp production; internal flow was estimated based on own assumptions.

		USE: No data available; Disaggregation coefficients for the use of goods by the pulp and paper industry are based on own assumptions
36	Printed matter and recorded media **(22)**	SUPPLY: Data obtained from the GENESIS Online Database [Statistisches Bundesamt Deutschland, 2008a] USE: Data obtained from the GENESIS Online Database [Statistisches Bundesamt Deutschland, 2008a]
37-38	Coke, refined petroleum products and nuclear fuels **(23)** *37. Coke, refined petroleum products* *38. Recycling of waste oil*	Physical supply is based on USGS [Newman, 2004] and data from Federal Statistical Office (Destatis) [Statistisches Bundesamt, 2007]
39-40	Manufacture of fertilizers etc. **(24.15)** 39. Fertiliser, N 40. Fertiliser, other than N	SUPPLY: Disaggregation coefficients obtained the GENESIS Online Database [Statistisches Bundesamt Deutschland, 2008a] USE: No data available; Disaggregation coefficients for the use of goods by the fertilizer industry are based on own assumptions
41-42	Mfr. of plastics and synthethic rubber **(24.16)** 41. Plastics basic, virgin 42. Recycling of plastics basic	SUPPLY: Disaggregation coefficients obtained the GENESIS Online Database [Statistisches Bundesamt Deutschland, 2008a] USE: No data available; Disaggregation coefficients for the use of goods by the rubber industry are based on own assumptions
43	Chemicals, chemical products and man-made fibres nec **(24)** *43. Chemicals, n.e.c.*	SUPPLY: Disaggregation coefficients obtained the GENESIS Online Database [Statistisches Bundesamt Deutschland, 2008a] USE: No data available; Disaggregation coefficients for the use of goods by the chemicals industry are based on own assumptions
44	Rubber and plastic products **(25)**	SUPPLY: Disaggregation coefficients obtained the GENESIS Online Database [Statistisches Bundesamt Deutschland, 2008a]

		USE: No data available; Disaggregation coefficients for the use of goods by the rubber and plastic industry are based on own assumptions
45-46	Mfr. of glass and ceramic goods etc. **(26.1)** *45. Glass, mineral wool and ceramic goods, virgin* *46. Recycling of glass, mineral wool and ceramic goods*	SUPPLY: Disaggregation coefficients obtained the GENESIS Online Database [Statistisches Bundesamt Deutschland, 2008a] USE: No data available; Disaggregation coefficients for the use of goods by the glass and ceramic goods industry are based on own assumptions
47,48,51-52	Mfr. of cement, bricks, tiles, flags etc. **(26.3, 26.4, 26.5)** *47. Cement, virgin* *48. Recycling of slags and ashes* *51. Bricks* *52. Recycling of bricks*	SUPPLY: Disaggregation coefficients obtained the GENESIS Online Database [Statistisches Bundesamt Deutschland, 2008a] USE: No data available; Disaggregation coefficients for the use of goods by the cement industry are based on own assumptions
49-50	Other non-metallic mineral products *49. Concrete, asphalt and other mineral products, virgin* *50. Recycling of concrete, asphalt and other mineral products*	SUPPLY: Disaggregation coefficients obtained the GENESIS Online Database [Statistisches Bundesamt Deutschland, 2008a] USE: No data available; Disaggregation coefficients for the use of goods by the non-metallic mineral industry are based on own assumptions
53-54	Mfr. of basic ferrous metals **(27.1)** *53. Iron basic, virgin* *54. Recycling of iron basic*	SUPPLY: Disaggregation coefficients obtained the GENESIS Online Database [Statistisches Bundesamt Deutschland, 2008a] USE: No data available; Disaggregation coefficients for the use of goods by the basic ferrous metals industry are based on own assumptions
61	First processing of iron and steel **(27.2,27.3)** *61. Iron, after first processing*	SUPPLY: Disaggregation coefficients obtained the GENESIS Online Database [Statistisches Bundesamt Deutschland, 2008a]

		USE: No data available; Disaggregation coefficients for the use of goods by the first processing of iron and steel industry are based on own assumptions
55-60	Mfr. of basic non-ferrous metals **(27.4)** 55. Aluminium basic, virgin 56. Recycling of aluminium basic 57. Copper basic, virgin 58. Recycling of copper, basic 59. Metals basic, n.e.c., virgin 60. Recycling of metals basic, n.e.c.	SUPPLY: Disaggregation coefficients obtained the GENESIS Online Database [Statistisches Bundesamt Deutschland, 2008a] USE: No data available; Disaggregation coefficients for the use of goods by the manufacture of basic non-ferrous metals are based on own assumptions
62-64	Casting of metal products **(27.5)** 62. Aluminium, after first processing 63. Copper, after first processing 64. Metals n.e.c., after first processing	SUPPLY: Disaggregation coefficients obtained the GENESIS Online Database [Statistisches Bundesamt Deutschland, 2008a] USE: No data available; Disaggregation coefficients for the use of goods by the manufacture of basic non-ferrous metals are based on own assumptions
65	Fabricated metal products, except machinery and equipment **(28)**	SUPPLY: Data obtained from the GENESIS Online Database [Statistisches Bundesamt Deutschland, 2008a]
66	Machinery and equipment n.e.c. **(29)**	SUPPLY: Data obtained from the GENESIS Online Database [Statistisches Bundesamt Deutschland, 2008a]
67	Office machinery and computers **(30)**	SUPPLY: Data obtained from the GENESIS Online Database [Statistisches Bundesamt Deutschland, 2008a]
68	Electrical machinery and apparatus n.e.c. **(31)**	SUPPLY: Data obtained from the GENESIS Online Database [Statistisches Bundesamt Deutschland, 2008a]
69	Radio, television and communication equipment and appa-	SUPPLY: Data obtained from the GENESIS Online Database [Statistisches Bundesamt Deutschland, 2008a]

	ratus **(32)**	
70	Medical, precision and optical instruments, watches and clocks **(33)**	SUPPLY: Data obtained from the GENESIS Online Database [Statistisches Bundesamt Deutschland, 2008a]
71	Motor vehicles, trailers and semi-trailers **(34)**	SUPPLY: Data obtained from the GENESIS Online Database [Statistisches Bundesamt Deutschland, 2008a]
72	Other transport equipment **(35)**	SUPPLY: Data obtained from the GENESIS Online Database [Statistisches Bundesamt Deutschland, 2008a]
73	Furniture; other manufactured goods n.e.c. **(36)**	SUPPLY: Data obtained from the GENESIS Online Database [Statistisches Bundesamt Deutschland, 2008a]
74	Secondary raw materials **(37)**	No physical flows included: Defined as service product
75	Electrical energy, gas, steam and hot water **(40.1,40.3)**	SUPPLY: Data obtained from national statistics [Statistisches Bundesamt, 2007]
76	Gas **(40.2)**	Data obtained from national statistics [Statistisches Bundesamt, 2007]
77	Water, fresh **(41)**	No physical flows included: Defined as service product
78-80	Construction **(45)** *75.Buildings, residential* *76.Buildings, non-residential* *77.Infrastructure, excluding buildings*	No physical flows included: Defined as service product
81	Trade and repair of motor vehicles; service stations **(50)**	
82	Wholesale trade **(51)**	
83	Retail trade and repair services **(52)**	
84	Hotels and restaurants **(55)**	
85	Land transport; transport via pipelines **(60)**	
86	Transport by ship **(61)**	

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87	Air transport **(62)**	
88	Cargo handling, harbours; travel agencies **(63)**	
89	Post and telecommunication **(64)**	
90	Financial intermediation **(65)**	
91	Insurance and pension funding **(66)**	
92	Services auxiliary to financial intermediation **(67)**	
93	Real estate services **(70)**	
94	Renting of machinery and equipment etc. **(71)**	
95	Computer and related services **(72)**	
96	Research and development **(73)**	
97	Business services n.e.c. **(74)**	
98	Public service and security **(75)**	
99	Education services **(80)**	
100	Health and social work **(85)**	
101-108	'Sewage removal and disposal' and 'Refuse collection and sanitation' **(90(disaggr.))** *98. Incineration of waste* *99. Manure treatment* *100. Biogasification of waste* *101. Composting of food waste* *102. Waste water treatment* *103. Landfill of waste* *104. Land application of waste*	All information is kept in one column and one row – the products/industries are disaggregated based on the waste module described in deliverable D5.4: Description of the environmental pressures from waste treatment

109	Membership organisations **(91)**	
110	Recreational and cultural services **(92)**	
111	Services n.e.c. **(93)**	
112	Household, to nourish (n.a.)	Information on household products/activities are kept in the final demand column in the use table. The specified household products/activities are defined in deliverable: D6.1 Documentation of the data consolidation,calibration, and scenario parameterisation
113	Household, to clean (n.a.)	
114	Household, to transport and communicate (n.a.)	
115	Household, to reside (n.a.)	
116	Household, home composting (n.a.)	
117	Household, unauthorised incineration (n.a.)	

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