



The Danish NAMEA Water Accounts

- with examples of its use

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1 Summary

This paper deals with the Danish NAMEA for water. The focal point is the Danish physical accounts for water and, to a lesser extent, the monetary accounts for water.

The paper presents the Danish water accounts and shows examples of the Danish water accounts' use. Currently, the use of the water accounts falls into the categories:

- The water accounts provide tables describing the industries' and households' extraction and use of ground and surface water.
- The water accounts provide tables showing industry specific water intensities, i.e. the industries' final use of water compared to the industries' output.
- The monetary accounts for water and waste water are used as input in the supply-use tables, which provide the cornerstone of the Danish national accounts.
- In addition to this, the water accounts are used as input in input-output analysis. The input-output modeling results show how the industries' final use of water is related to final demand and how the private consumption of certain kinds of products is related to the use of water.

Moreover, the paper provides an overview of how the Danish NAMEA for water is established. The most important issue is how economic data are used to break down the use of water by the industries.

2 Introduction

The Danish NAMEA system The Danish NAMEA water system was established in the years 1999-2000. The NAMEA is constructed as a satellite account to the national accounts, or to be more concrete as satellite accounts to the input-output table of the national accounts, and as such the first requirement is compliance of the *supply-equals-use* identity. That is, the total supply of a commodity is determined by the domestic output plus imports. The total use consists of changes in stocks, losses, exports, or use by one of the 130 industries or the households that constitute the Danish national accounting system.

A physical and a monetary part The Danish NAMEA system consists of a physical and a monetary part. Currently, the physical accounts are by far the most refined and developed accounts. The aim of the Danish water system is to construct a water NAMEA covering the Danish economy as a whole.

Currently, the Danish NAMEA water accounts are published in Statistics Denmark's yearly publication on Environmental accounts. This publication is in Danish. However, data from the Danish NAMEA water accounts are also available in Statistics Denmark's on-line databank. An English version of the on-line databank can be found at www.statbank.dk.

Three dimensions The structure of the Danish water figures is actually three-dimensional when we consider the physical amounts. The first dimension is the water type, i.e. tap water, ground water, surface water and seawater. The second dimension is the grouping of NACE industries into 130 industries and households. The third dimension is regional, and is a categorization according to municipalities.

The third dimension is important because the price of water-related services varies between the municipalities. Therefore, this information is especially important during the calculation of the Danish NAMEA water accounts, whereas the regional dimension is not reflected in the standard Danish NAMEA water tables.

The paper is structured into the following chapters.

The third chapter offers a presentation of the Danish NAMEA water accounts. The fourth chapter gives examples of the Danish water accounts use, whereas the fifth chapter describes in greater detail how the Danish water accounts are established.

3 The Danish NAMEA water tables

This chapter offers a presentation of the current information in the Danish NAMEA water tables. Here, the results are aggregated from 130 industries plus households into eight industries plus the households. * indicates that the figures are provisional.

3.1 The physical water accounts

| | |
|---|---|
| <i>Ground water is the central resource</i> | The share of the water extraction from the ground water reserves is, compared to most other countries in the world, very high in Denmark. Conversely, the extraction of surface water from lakes or the like is very limited, e.g. surface water only made up 3 pct. of the total water extraction in 2001. |
| <i>Who extracts ground water?</i> | The common waterworks account for the greatest extraction of ground water. The water distributed by the water supply industry is referred to as <i>tap water</i> . The Danish water supply industry uses close to 100 percent ground water in producing tap water. It is only in dry periods during summer, additional surface water may be used as input. The water is transported through water pipes to the final users, i.e. the households and industries. |
| <i>Own extraction</i> | In addition to this extraction, especially agriculture accounts for a large extraction of water. Moreover, some households and enterprises are allowed to extract ground water from their own drillings. Thus, concerning ground water, a distinction has to be made between on the one hand water extracted and distributed by the water supply industry, and on the other hand water extracted within, for instance, agriculture or manufacturing for own uses. |
| <i>Surface water</i> | Furthermore, there is some use of surface water within agriculture for watering of fields, within manufacturing industry and in the electricity sector relevant to the Danish NAMEA. Such commercial uses of surface water are recognized in the Danish water NAMEA. The use of rivers and lakes for recreational purposes or serving as drinking water for domestic animals are not considered relevant for inclusion into the NAMEA. |
| <i>Seawater</i> | The geography of Denmark allows, practically, almost unlimited use of seawater. The totally dominant use is cooling. Besides, <i>desalination</i> of seawater takes place in considerable quantities at certain power plants, resulting in water qualities suitable for production purposes or as transport for district heating, i.e. as a substitute for tap water or ground water. In 2001, 3 970 mill. m ³ seawater was used. The use of seawater does not appear from the tables in this paper. However, it is mentioned to complete this presentation. |

3.1.1 Extraction of water

Table 1 shows a breakdown of the extraction of ground and surface water. The water supply industry accounts, of course, for the largest amount, but *agriculture, fishing and quarrying* also extracts a large amount of water for own use.

Table 1 Extraction of ground water and surface water broken down by households and industries 1999-2001*

| | Ground water | | Surface water | | Total ground and surface water | |
|---|----------------------|--------------|---------------|-------------|--------------------------------|--------------|
| | 1999 | 2001* | 1999 | 2001* | 1999 | 2001* |
| | Mill. m ³ | | | | | |
| Total | 689.6 | 689.8 | 20.1 | 17.8 | 709.7 | 707.6 |
| Households | 11.0 | 12.4 | 0.0 | 0.0 | 11.0 | 12.4 |
| Total industries | 678.6 | 677.4 | 20.1 | 17.8 | 698.7 | 695.3 |
| 1 Agriculture, fishing and quarrying | 179.3 | 196.2 | 3.4 | 4.4 | 182.7 | 200.6 |
| 2 Manufacturing | 46.1 | 50.6 | 12.1 | 8.0 | 58.2 | 58.6 |
| 3 Electricity, gas and water supply | 442.4 | 423.8 | 4.6 | 5.3 | 447.0 | 429.1 |
| of this water supply | 439.7 | 421.4 | 3.7 | 4.5 | 443.4 | 426.0 |
| 4 Construction | 6.7 | 1.2 | 0.0 | 0.0 | 6.7 | 1.2 |
| 5 Wholesale and retail trade; hotels, restau. | 0.4 | 0.3 | 0.0 | 0.0 | 0.4 | 0.3 |
| 6 Transport, storage and communication | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 7 Financial intermediation, business activit. | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 8 Public and personal services | 3.7 | 5.4 | 0.1 | 0.1 | 3.7 | 5.4 |

The water supply industry The difference between what was supplied to the final users of tap water and the extraction of 426.0 mill. m³ in 2001, is shown in table 2. There is a loss in the water pipe lines. In addition to this, water is used for *filter backwashing* on the common waterworks, and finally water is used as a consequence of *protectionary drillings* to protect the ground water reserves against pollution. Thus, the final users received a total of 382.0 mill. m³ in 2001.

Table 2 Connection between extraction and supply of water from the water supply industry 1999-2001*

| | 1999 | 2000* | 2001* |
|--|----------------------|--------------|--------------|
| | Mill. m ³ | | |
| Total extraction (1) | 443.4 | 436.3 | 426.0 |
| of this extraction of ground water | 439.7 | 432.0 | 421.4 |
| extraction of surface water | 3.7 | 4.4 | 4.5 |
| Losses etc. (2) | 30.3 | 27.2 | 26.3 |
| Use for filter backwashing (3) | 8.8 | 8.9 | 8.0 |
| Protectionary drillings (4) | 8.5 | 8.3 | 9.7 |
| Total tap water (5)=(1)-(2)-(3)-(4) | 395.8 | 391.9 | 382.0 |

3.1.2 Use of water

Tap water In 2001, the households used 246.8 mill. m³ corresponding to 65 pct. of the total use of tap water, cf. table 3. The breakdown by the industries shows that *public and personal services, manufacturing and agriculture, fishing and quarrying* accounts for the largest use of tap water. These three industries account separately for approximately a quarter of the use of tap water in the industries.

Table 3 Consumption of tap water broken down by industries and households 1999-2001*

| | 1999 | 2000* | 2001* | 2000-2001 |
|---|----------------------|--------------|--------------|-------------|
| | Mill. m ³ | | | Pct. |
| Total | 395.8 | 391.9 | 382.0 | -2.5 |
| Households | 259.6 | 255.5 | 246.8 | -3.4 |
| Total industries | 136.2 | 136.4 | 135.2 | -0.9 |
| 1 Agriculture, fishing and quarrying | 32.6 | 32.4 | 32.5 | 0.3 |
| 2 Manufacturing | 35.0 | 36.2 | 37.0 | 2.3 |
| 3 Electricity, gas and water supply | 3.5 | 3.5 | 3.5 | -0.5 |
| of this water supply | 0.2 | 0.2 | 0.1 | -31.1 |
| 4 Construction | 0.6 | 0.8 | 0.8 | 9.4 |
| 5 Wholesale and retail trade; hotels, restaurants | 12.5 | 12.9 | 12.2 | -4.9 |
| 6 Transport, storage and communication | 4.2 | 4.4 | 4.5 | 1.9 |
| 7 Financial intermediation, business activities | 3.2 | 3.4 | 3.3 | -1.1 |
| 8 Public and personal services | 44.6 | 43.0 | 41.4 | -3.7 |

Final use of water

The final use of water corresponds to the amount of water the households and industries extract for their own use and the amount of tap water they consume. The final use of water in 2001 appears from table 4, which is a comparison of the data on water extraction in table 1 and the use of tap water in table 3. The second column shows the water industry's supply of tap water. The third column contains the households and industries consumption of tap water. The final use of water is the total of the total extraction in column 1 and the industries' and households' consumption in the third column. To avoid double counting of the water industry's supply this is subtracted in column 2.

In 2001, the households' final consumption of water was 259,2 mill m³. Agriculture etc. consumed 52 pct. of the final use of water in the industries, whereas they cf. table 4, only accounted for 24 pct. of the industries consumption of tap water. The difference lies in the agriculture's large extraction of ground water for own use.

Table 4 Final use of water 2001*

| | Extraction of ground and surface water | Supply of tap water | Received from the water supply industry | Final use of water |
|---|--|---------------------|---|--------------------|
| | (1) | (2) | (3) | (1)-(2)+(3)=(4) |
| | Mill. m ³ | | | |
| Total | 707.6 | 382.0 | 382.0 | 707.6 |
| Households | 12.4 | 0.0 | 246.8 | 259.2 |
| Total industries | 695.3 | 382.0 | 135.2 | 448.4 |
| 1 Agriculture, fishing and quarrying | 200.6 | 0.0 | 32.5 | 233.1 |
| 2 Manufacturing | 58.6 | 0.0 | 37.0 | 95.6 |
| 3 Electricity, gas and water supply | 429.1 | 382.0 | 3.5 | 50.6 |
| of this water supply | 426.0 | 382.0 | 0.1 | 44.1 |
| 4 Construction | 1.2 | 0.0 | 0.8 | 2.0 |
| 5 Wholesale and retail trade; hotels, restaura. | 0.3 | 0.0 | 12.2 | 12.6 |
| 6 Transport, storage and communication | 0.0 | 0.0 | 4.5 | 4.5 |
| 7 Financial intermediation, business activities | 0.0 | 0.0 | 3.3 | 3.3 |
| 8 Public and personal services | 5.4 | 0.0 | 41.4 | 46.8 |

3.1.3 Waste water discharges caused by the consumption of tap water

In addition to the physical water accounts shown above, the Danish NAMEA water accounts also include a physical waste water balance.

Waste water The physical waste water balance describes only a subset of the total discharge of waste water, namely the discharge caused by the consumption of tap water and as such, the waste water balance is primarily used as a key to the breakdown of the payments for the services of the sewage industry, cf. chapter 3.2.

The amount of sewage is closely related to the amount of tap water supplied. The waste water caused by the industries' and households' consumption of tap water is therefore calculated from the breakdown of the industries' and households' use of tap water. However, to comply with the fact that some of the water use is incorporated, e.g. in the industries' products, some of the use of tap water is deducted.

For more information on the methods used concerning waste water, see chapter 5.3.2.

Table 5 **Consumption of tap water and discharge of related waste water broken down by industries and households 1999-2001***

| | Consumption of tap water | | Discharge of related waste water | |
|---|--------------------------|--------------|----------------------------------|--------------|
| | 1999 | 2001* | 1999 | 2001* |
| | Mill. m ³ | | | |
| Total | 395.8 | 382.0 | 346.2 | 332.2 |
| Households | 259.6 | 246.8 | 249.2 | 236.9 |
| Total industries | 136.2 | 135.2 | 97.0 | 95.2 |
| 1 Agriculture, fishing and quarrying | 32.6 | 32.5 | 3.6 | 3.6 |
| 2 Manufacturing | 35.0 | 37.0 | 31.4 | 33.0 |
| 3 Electricity, gas and water supply | 3.5 | 3.5 | 1.8 | 1.8 |
| 4 Construction | 0.6 | 0.8 | 0.6 | 0.8 |
| 5 Wholesale and retail trade; hotels, restaurants | 12.5 | 12.2 | 11.5 | 11.2 |
| 6 Transport, storage and communication | 4.2 | 4.5 | 3.9 | 4.1 |
| 7 Financial intermediation, business activities | 3.2 | 3.3 | 3.0 | 3.0 |
| 8 Public and personal services | 44.6 | 41.4 | 41.2 | 37.7 |

3.2 The monetary water accounts

The Danish NAMEA monetary water accounts contain information on the payments to the water supply industry and the sewage industry. The monetary accounts are established in connection with the final national accounts.

Tap water and tap water taxes Tap water is the only type of water that has a positive price among the four mentioned earlier. Tap water is sold as a commodity, thereby generating income for the waterworks. Besides having a positive price tap water has been subject to taxation in Denmark since 1994, the revenue being collected by the state. This is not the case concerning ground water extracted and used on an individual basis; the price is zero and there is no tax levied on these extractions of ground water. Therefore, tap water is the only type of water to be considered with a monetary aspect.

Payments to the water supply industry The price of tap water can be split up into three parts, namely the price of the water used, the fixed payment which has to be paid whenever someone is connected to the water supply system, and thirdly there is the connection fee which is a payment to be paid whenever someone wants to connect to the water supply system.

Payments for sewage Another important part of the monetary part is a service closely related to the consumption of tap water, namely the sewage service. In Denmark the two matters are treated separately as data are available on the price of sewage at the level of municipality.

Table 6 Payments in basic prices for water related services 1999

| | Price on water | Fixed payments | Connection fee | Total payment to the water supply industry | Payment for sewage | Total payment for water related services |
|---|-------------------|-------------------|-------------------|--|-----------------------|--|
| | Mill. DKK | | | | | |
| Total | 733 | 756 | 295 | 2 784 | 4 421 | 7 205 |
| Households | 1 134 | 612 | 180 | 1 925 | 3 190 | 5 115 |
| Total industries | 600 | 144 | 115 | 858 | 1 231 | 2 090 |
| 1 Agriculture, fishing and quarrying | 96 | 25 | 6 | 128 | 52 | 180 |
| 2 Manufacturing | 155 | 20 | 17 | 192 | 383 | 575 |
| 3 Electricity, gas and water supply | 18 | 2 | 1 | 21 | 25 | 46 |
| 4 Construction | 3 | 11 | 2 | 16 | 8 | 24 |
| 5 Wholesale and retail trade; hotels, restaurants | 68 | 35 | 16 | 119 | 140 | 259 |
| 6 Transport, storage and communication | 22 | 7 | 0 | 30 | 49 | 78 |
| 7 Financial intermediation, business activities | 17 | 18 | 60 | 95 | 37 | 132 |
| 8 Public and personal services | 220 | 26 | 12 | 258 | 539 | 797 |

4 Examples of the Danish water accounts use

4.1 Final use of water compared to output

By using the information on the industries' output described in the national accounts it thus becomes possible to illustrate the differences between the industries' water intensities, i.e. the amount of water the industries use per output.

Water intensity The water intensity for the final use of water is shown in table 7. In 2001, agriculture etc. used 2 560 m³ water per mill. DKK output. That makes it by far the most water intensive industry.

Table 7 Final use of water and water intensity 1999-2001*

| | Final consumption of water | | | Water intensity | | |
|---|----------------------------|--------------|--------------|---|------------|------------|
| | 1999 | 2000* | 2001* | 1999 | 2000* | 2001* |
| | Mill. m ³ | | | m ³ per mill. DKK ¹ | | |
| Total | 709.7 | 730.0 | 707.6 | | | |
| Households | 270.6 | 266.9 | 259.2 | | | |
| Total industries | 439.1 | 463.2 | 448.4 | 234 | 236 | 224 |
| 1 Agriculture, fishing and quarrying | 215.3 | 233.7 | 233.1 | 2 503 | 2 566 | 2 560 |
| 2 Manufacturing | 93.2 | 105.8 | 95.6 | 203 | 221 | 196 |
| 3 Electricity, gas and water supply | 54.7 | 51.2 | 50.6 | 1 497 | 1 561 | 1 608 |
| 4 Construction | 7.3 | 6.2 | 2.0 | 58 | 47 | 15 |
| 5 Wholesale and retail trade; hotels, restau. | 12.8 | 13.3 | 12.6 | 48 | 50 | 46 |
| 6 Transport, storage and communication | 4.2 | 4.4 | 4.5 | 23 | 21 | 21 |
| 7 Financial intermediation, business activit. | 3.2 | 3.4 | 3.3 | 9 | 9 | 8 |
| 8 Public and personal services | 48.3 | 45.3 | 46.8 | 132 | 124 | 125 |

¹ Output at 1995-prices

4.2 Input in the Danish supply-use tables

Another important use of the NAMEA water accounts is as input in the supply-use tables.

From the physical water accounts to the national accounts

The physical water accounts are used to establish the monetary water accounts implying that the physical water accounts are related directly to the national accounts. The monetary accounts are used directly as input in the Danish system of supply and use tables, which is the cornerstone of the Danish national accounts.

The direct connection is thus established between, on the one hand, the physical water use and, on the other hand, the monetary values relating to the use of water.

4.3 Input-output analysis

The Danish NAMEA water tables find its most extensive use as input in input-output analyses.

The input-output modeling results are based on the input-output table for the Danish economy. The input-output table is established after the completion of the final national accounts.

Generally, the input-output modeling results show the final use of water broken down by final demand. Furthermore, this breakdown can again be broken down by groups of consumption and whether the use of water is direct or indirect, in Denmark or abroad.

Use of water by final demand

The industries' final consumption of water in 1999 of 439.1 mill. m³ can be attributed to the four categories of final demand. That is, private consumption, government consumption, gross fixed capital formation etc. and exports. The result is shown in table 8. The biggest share of the industries' use of water is caused by exports. This can be explained by the fact that a large share of the agricultural production is ultimately exported, and that the agricultural production is characterized by the fact that it is very water intensive.

Table 8 **The industries' final use of water broken down by final demand 1999**

| | Private consumption | Government consumption | Gross fixed capital formation etc. | Exports | Total |
|---|----------------------|------------------------|------------------------------------|--------------|--------------|
| | Mill. m ³ | | | | |
| Total industries | 122.2 | 53.2 | 20.6 | 243.0 | 439.1 |
| 1 Agriculture, fishing and quarrying | 42.8 | 3.3 | 0.0 | 169.1 | 215.3 |
| 2 Manufacturing | 21.6 | 3.3 | 8.4 | 59.9 | 93.2 |
| 3 Electricity, gas and water supply | 41.9 | 4.4 | 1.5 | 6.9 | 54.7 |
| of this water supply | 37.8 | 3.8 | 1.1 | 5.1 | 47.8 |
| 4 Construction | 0.1 | 0.0 | 7.1 | 0.0 | 7.3 |
| 5 Wholesale and retail trade; hotels, restaura. | 5.5 | 0.8 | 2.0 | 4.5 | 12.8 |
| 6 Transport, storage and communication | 1.9 | 0.5 | 0.3 | 1.5 | 4.2 |
| 7 Financial intermediation, business activities | 1.2 | 0.5 | 0.9 | 0.6 | 3.2 |
| 8 Public and personal services | 7.1 | 40.2 | 0.4 | 0.5 | 48.3 |

The estimation is based on model calculations on the input-output table for 1999.

Table 9 offers an even more disaggregated presentation of the input-output modeling results.

| | |
|--|--|
| <i>Direct use of water</i> | The first column shows for each category of private consumption the use of water that is directly related to the private consumption, i.e. the use of water which takes place directly as a consequence of the households' use of water. It appears from the tables that the only direct use of water is in relation to the consumption of <i>Housing</i> , i.e. <i>Water supply and sewerage services</i> . |
| <i>Direct and indirect use of water</i> | The third column shows the total Danish direct and indirect use of water in 1999 caused by final demand. The direct and indirect use of water for a given final demand indicates the direct consumption of water (the first column) and the use of water caused by all the production activities necessary for complying with the final demand. |
| <i>Direct and indirect global use of water</i> | If an expression is wanted with respect to the total use of water caused by the Danish final demand, the use of water used abroad to the production of the Danish imports must be added to the Danish direct and indirect use of water. The global direct and indirect use of water is shown in the fifth column. The interpretation of the direct and indirect global use of water complies with the corresponding Danish interpretation. |

Table 9 Final use of water caused by private consumption and other final demand 1999

| | Direct use of water | | Direct and indirect use of water | | | |
|---|----------------------|---|----------------------------------|---|----------------------|---|
| | | | In Denmark | | Globally | |
| | Mill. m ³ | Mill. m ³ per DKK ¹ | Mill. m ³ | Mill. m ³ per DKK ¹ | Mill. m ³ | Mill. m ³ per DKK ¹ |
| Total final demand | 270.6 | 2 418 | 709.7 | 453 | 994.5 | 634 |
| Total private consumption | 270.6 | 2 418 | 392.9 | 711 | 481.8 | 871 |
| 10 Food | - | - | 42.3 | 684 | 75.9 | 1 227 |
| 20 Beverages and tobacco | - | - | 11.1 | 325 | 20.9 | 614 |
| 30 Clothing and footwear | - | - | 1.4 | 48 | 12.5 | 438 |
| 40 Housing | 270.6 | 2 418 | 308.1 | 2 753 | 310.9 | 2 778 |
| 4430 of this water supply and sewerage services | 270.6 | 48 716 | 304.1 | 54 741 | 304.3 | 54 786 |
| 45 Electricity, gas and other fuels | - | - | 4.3 | 144 | 5.4 | 179 |
| 50 Furnishing, household equipment etc. | - | - | 2.8 | 86 | 8.2 | 253 |
| 60 Medical products, health services | - | - | 1.0 | 72 | 2.3 | 161 |
| 71 Purchase of vehicles | - | - | 0.6 | 18 | 3.7 | 115 |
| 79 Other transport and communication | - | - | 3.8 | 73 | 7.3 | 139 |
| 91 Recreation and culture | - | - | 7.6 | 117 | 15.6 | 240 |
| 97 Other goods and services | - | - | 16.3 | 192 | 31.4 | 370 |
| 998 Consumption of non-residents on the economic territory | - | - | -6.9 | 280 | -13.2 | 535 |
| Non-profit institutions serving households (NPISH) | - | - | 0.6 | 69 | 0.8 | 98 |
| Other final demand | - | - | 316.8 | 312 | 512.7 | 505 |
| Individual market government consumption | - | - | 0.9 | 59 | 2.8 | 184 |
| Individual non-market government consumption | - | - | 44.5 | 248 | 51.9 | 290 |
| Collective government consumption | - | - | 7.8 | 85 | 11.8 | 129 |
| Total gross fixed capital formation | - | - | 23.4 | 96 | 49.9 | 205 |
| Changes in stocks | - | - | -3.8 | 1 794 | - 4.8 | 2 283 |
| Exports | - | - | 243.0 | 535 | 399.5 | 879 |
| Financial intermediation services indirectly measured (FISIM) | - | - | 1.0 | 28 | 1.6 | 45 |

¹The estimation is based on model calculations on the input-output table for 1999. The value of the water consumption compared to the value of the consumption of products is estimated at 1995 prices.

Out of a total final use of water of 709.7 mill. m³ in 1999 in Denmark, cf. table 7, 392.9 mill. m³ was caused by private consumption (the households) and 316.8 mill m³ by other final demand, c.f. table 9. Out of the 392.9 mill. m³ related to private consumption, 270.6 mill. m³ are caused by the households' direct use of water. In addition to this there is an indirect use of water of 122.2 mill. m³ in the industries caused by the households' demand for the industries' products, c.f. table 8.

By comparing the Danish use of water with the global direct and indirect use of water the total use of water increases from 709.7 mill. m³ to 994.5 mill. m³. The difference of 284.8 mill. m³ corresponds to the use of water, which the production of the Danish imports direct and indirect has caused abroad.

Exports The inclusion of the use of water abroad is especially in relation to the Danish exports of importance, as the direct and indirect use of water increases from 243.0 mill. m³ to 399.5 mill. m³.

5 Data and method

The fact that tap water is being taxed at a uniform rate can be utilized for statistical purposes in calculating the industries' use. On the other hand, determining the industries' individual extractions and use of ground water requires a combination of data from a wide range of sources.

5.1 Data and method in relation to the physical water accounts

The Danish water NAMEA is based on the physical data on the water extraction obtained from The Danish Water and Waste Water Association (DANVA) and Geological Survey of Denmark and Greenland (GEUS).

5.1.1 Data on extraction of water

A traditional or real balancing between supply and use is involved only with respect to tap water - the remaining three types of water are characterized by having the supply side determined by the total use of industries and households.

The use determines the supply Ground water is dealt with from a perspective of use or extraction. By adding the quantities extracted by different sectors, the *total supply* is determined at the same time.

Data Many sources of data are used in computing the extraction of ground water, but three of them are of major importance. The first concerns the water supply industry's extractions, where data from DANVA are used. The data from DANVA also includes information on economic and administrative conditions. The data from DANVA covers almost all of the water supply industry. However, to fully cover all municipalities a special calculation generalizing the data from DANVA to all municipalities in Denmark is carried out.

The second source is GEUS, and concerns almost all other extractions.

Finally, as the third data source, special computations are used to account for the extraction that is not covered 100 percent by GEUS.

Additional sources are large companies' green accounts and the survey conducted by Statistics Denmark on products used in the industries.

Link to the 130 national accounts industries GEUS divides the units extracting the water into 25 categories. The GEUS categories are then assigned to the 130 national accounts industries by Statistics Denmark. *Watering of fields* requires special permits and is, as such, a specific GEUS category. In the national accounts and thus the NAMEA, however, it is part of the total extraction within agriculture.

5.2 Method

This chapter offers a short description of how the Danish NAMEA water accounts are established. The water supply industry is the only industry not extracting water for own use. What is left is thus to break down this supply of tap water to the households and industries, since all other uses of ground and surface water are allocated to the industries or households extracting the water.

5.2.1 Breakdown of the tap water consumption

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| <i>Tap water is primary water "transformed" into a commodity</i> | Tap water is defined as the ground water and surface water extracted, filtered and otherwise treated, and distributed by the water supply industry. There is a fine line, of course, between ground water and tap water - the distinction in the present context being that the latter is distributed and sold as a commodity. |
| <i>"Industries + Institutions" = the industries of the national accounts</i> | DANVA operates in their statistics with three consumer types plus losses, i.e. losses in distribution, plus own uses, i.e. water used for <i>filter backwashing</i> and <i>protectionary drillings</i> . DANVA's definition of households is directly compatible with the national accounts. What remains to be dealt with concerning the NAMEA is the water used by institutions and industries. These two groups are unfortunately not well defined in relation to the national accounts, i.e. the NAMEA set-up. As a consequence, these two groups' tap water use is to be distributed among the 130 industries of the NAMEA. |
| <i>Two sources of information</i> | Basically, two sources of information are used. The first one utilizes the facts that tap water since 1994 has been subject to taxation in Denmark, and that VAT-paying industries, with some known exceptions, are having their water taxes reimbursed from the tax authorities. The second source of information is employment statistics by industries, modified to reflect the actual industry's <i>true</i> nature with respect to water use. The two sources are used simultaneously on each their block of industries to fully exhaust the (enumerated) water supply to the two DANVA categories, <i>industries</i> and <i>institutions</i> . |
| <i>VAT-paying companies</i> | Studying the law concerning the water tax, 98 out of the 130 industries of the national accounts are entitled to reimbursement of their water tax. The method applied for these industries follows, in short, the procedure listed below: <ol style="list-style-type: none">1. From the central tax authorities, year-specific data on each of 300,000 VAT-registered companies' reimbursed water taxes are obtained. The key variable is the unique company registration number, the so-called <i>CVR-number</i>;2. Making use of the size of the water tax, measured in DKK per m³, for each company the reimbursed water taxes are converted into physical amounts of consumed water;3. Matching the VAT-registers' approximately 300,000 companies with the Central Register of Enterprises and Establishments of Statistics Denmark <i>by the CVR-number</i>, each company is assigned an (NACE-) industry code;4. Aggregating the companies' use of tap water by industry to the national accounts industry level. |
| <i>Entities not paying VAT</i> | Only VAT-paying entities are entitled to reimbursement of their water taxes. Industries dominated by public institutions, e.g. hospitals and schools, are not VAT-registered. Besides, certain liberal professions, e.g. architectural and engineering consultancies are due to the legislation not entitled to have their water taxes reimbursed. |

For these remaining 32 industries, each industry's employment has been multiplied by a yearly unit consumption of 10 m³ per employee. In this way, a minimum

consumption of water for kitchens and bathrooms is obtained. However, the consumption of hospitals, primary schools, secondary schools and other industries among the 32 in question must clearly exceed this minimum. To compensate for this, the relevant number of persons, e.g. patients or pupils are added to the employment number before being multiplied by the unit consumption.

Proportionate distribution of the difference As described above, distributing the total amount of tap water between industries is undertaken in two independent steps. The residual is then distributed among all 130 industries, in proportion to the employment number. This residual accounts for less than a few percentages of the total.

Some uncertainty involved The reimbursement method is evaluated as fairly good. However, big companies engaged in different industries have often only one (common) reimbursement, which may cause one industry's consumption to appear too high and another one's too low. Also, some reimbursement actually takes place within industries dominated by public institutions. However, the *take-it-or-leave-it* option, which characterizes the reimbursement data, has implied that one has to ignore this fact.

Another important issue involving uncertainty is connected to the periodizing of the payment of the reimbursement. The payment for use during a specific time period, e.g. a month, a quarter or half a year, takes place in the following period. Weighing the reimbursement data has solved this problem.

5.3 Establishing the monetary water accounts

Calculation of payments In the Danish national accounts system the water supply industry and sewage removal and disposal industry are clearly separated. However, the NAMEA system is constructed in such a way that the activities of the sewage removal and disposal industry are based on payments collected together with the payments related to the service provided by the water supply industry.

The reason for this is, of course, that for any unit, households as well as companies, the amount of sewage is closely related to the amount of tap water supplied.

5.3.1 Payments to the water supply industry

Three price parts The total payment to the water supply industry is made up of the payments for three different services related to the water supply industry. Therefore, calculating the monetary water accounts calls for a number of data sources and is, all in all, a rather complex procedure. Therefore, this presentation does not tend to give a complete overview on how we actually calculate the monetary accounts but tends instead to point out the sources necessary for establishing the monetary water accounts.

Since the water price, connection fee and fixed payments vary from municipality to municipality it is important to have a regional dimension in the data, i.e. information on the price parts according to municipalities. However, in addition to the regional dimension you must also have something by which you can allocate the payments to the water supply industry to the 130 national accounts industries.

The price of water follows from the calculations of the physical accounts for water whereas fixed payments are based on information on the number and types of buildings and the level of the fixed fees in the different municipalities. In relation to the payments of the connection fee one thus not only need to know the type and amount of new buildings, but also where these buildings are built and by which NACE industry. The connection fee is calculated by using information on the ongoing construction works broken down by type of buildings and municipality. The calculated values of the connection fee are then attributed to the 130 national

accounts industries by using information on the industries' investments in new buildings.

Balancing procedure We have exogenously given a total value of the payments to the water supply industry. Therefore, the total of the three price parts are balanced to the total payment to the water supply industry obtained from the national accounts.

5.3.2 Payments for sewage

Sewage payments The concept sewage payment covers the purchase of a service, namely the service provided by the possibility of discharging used water into the sewer system. The service is purchased by households and by industries. In the national accounts system this service is: Sewage removal and disposal.

The payments for sewage are as such highly connected to the use of tap water which means that the breakdown of payments to sewage is based directly on the physical discharge of waste water.

There are, of course, exceptions to this rule-of-thumb. Companies using great amounts of water in their production, such as breweries, will discharge significantly less water than the amount supplied, and therefore these companies are treated differently. We simply rescale the product of the amount of water used with their payment of sewage to a lower level. Examples of groups where this applies are:

- Private households, we assume that the value of their disposed water equals 0.96 times the water use times the price of sewage.
- Baker's shops, we assume that 0.65 times the water use times the sewage price equals the price of the disposed water.

The resulting distribution is then used to break down the payments for sewage.

Balancing procedure The total value of the payments for the service sewage is exogenously given in the national accounts system.

6 References

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