ECN

Energy research Centre of the Netherlands

# Explanation of the ECN-update of statistical energy balances for 1991-1994

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September 2005 ECN-C--05-071

## Acknowledgement/Preface

The analysis in this report has been performed on request of the agency SenterNovem and is registered under project no. 77664.

## Abstract

As part of the recalculation of $CO_2$ emissions from fuel combustion, Statistics Netherlands (CBS) revised energy consumption figures for 1990 and 1995-2002. For the years 1991-1994 ECN has been asked by SenterNovem to perform the revision in line with that of CBS, using the presentation- and analysis system MONIT that is based on CBS-statistics. These updated energy data should make it possible for CBS to calculate consistent $CO_2$ emissions from 1990 onwards, and to provide consistent energy figures and related greenhouse gas emissions for the next National Inventory Report 2005.

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# 1. Motive for the update by ECN

On behalf of the Ministry of VROM the agency SenterNovem took responsibility in 2004 for improvement of figures for $CO_2$ emissions from fuel combustion. A project to calculate and estimate $CO_2$-emisions based on energy statistics has been commisioned to Statistics Netherlands (CBS). During this project Statistics Netherlands concluded that energy consumption figures for 1990-2002 had to be revised too, to have full consistency between years in official energy statistics, and thus also for fuel related emissions.

In the National Inventory Report 2002 $CO_2$ emissions are reported based on energy balances without so-called statistical differences for individual fuel types for 1990 and for 1995-2002. As presented in that NIR 2002 the statistical differences include several elements: the statistical differences sec, improved data for the petrochemical sector, rearrangement of companies in the new coding system, change of the trade system and improved allocation of energy products in custom entrepots.

For the years 1991-1994 CBS cannot remove the statistical differences. It is difficult if not impossible to achieve the same level of quality in the modified national energy statistics ('NEH') as for the other years. This is due to, amongst others, changes in the economic sector coding system. However, this correction has been done earlier by ECN, as part of the set up of the presentation- and analysis system MONIT that is based on CBS-statistics. Although the ECN-corrections resembled the CBS-approach, the MONIT-figures cannot be regarded as official statistical information. However, both for national and international purposes the trends for all years from 1990 on should be consistent. E.g. the UNFCCC review of the 2004 submission stated: "when the Party implements the changes in the Energy sector methodology, it is essential that all reported years, including the years 1991-1994, be recalculated to ensure complete time-series consistency" (UNFCCC/WEB/IR/2004/NLD Paragraph 86).

On request of the agency SenterNovem the 1991-1994 energy figures have been updated in conformity with the CBS method for adjusting energy balances, in order to have an adjusted national energy statistics dataset for emission calculation purposes that is consistent over time.. These updated energy data should make it possible for CBS to calculate consistent $CO_2$ emissions from 1990 onwards, and to provide consistent energy figures and related greenhouse gas emissions for the next National Inventory Report 2005.

# 2. Approach for update

The main part of the work regards the ECN-update of the energy data for 1991-1994. Corrections were also made for energy consumption of the sub-sectors of 'Other end-users' that were not part of the statistical energy balance. The ECN-estimates for the sub-sectors have been checked with CBS. Before the update was undertaken, earlier ECN-corrections have been checked with that from CBS. These dealt with removing statistical differences and a number of other corrections/improvements. Finally the calculation of $CO_2$ emissions asks for a regrouping of statistical energy data for some specific sectors in MONIT. The following update tasks have been executed:

- check on removing statistical differences in MONIT (Section 3),
- check on past ECN-corrections (Section 4),
- applying CBS-updates to MONIT-data for 1991-1994 (Section 5),
- des-aggregating data for 'Other end-users' (Section 6),
- extra information for calculation of $CO_2$ emissions (Section 7).

In MONIT the so-called A-balance contains the original statistical data of CBS. The adapted figures have been specified in the B-balance. Most differences between A- and B-balance are specified in a number of input-sheets in MONIT, except where (transfer) formulas are used. Delivered data to CBS are based on the B-balance and the input-sheets in MONIT.

The detailed CBS-division of energy use to different fuels is aggregated to a limited number of fuels in MONIT (see Appendix A). So, adaptations and results in MONIT regard this aggregated level.

Further it should be mentioned that in 2003 environmental policy makers have chosen a subdivision of economic sectors (so-called $CO_2$-Streefwaarde or SW-sectors) that slightly differs from that of the CBS-subdivision for national statistics. This division, in line with formulated targets for $CO_2$ emissions, comprises the target-sectors Agriculture (excluding off-road mobile equipment), Buildings (households and services, excluding off-road mobile equipment), Transport (including all off-road mobile equipment) and Industry/energy (including Construction). The MONIT-figures in this format have been updated too, in line with the adaptations described in this note.

Finally the MONIT-data should fit the calculation of $CO_2$ emissions according to the National Inventory report (NIR). This means that some extra data, not present in the CBS-energy balance are provided. This refers to the allocation of off-road equipment, fisheries, inland shipping, military shipping and aviation. With these corrections and shifts the NIR-emission figures can be calculated (see Section 7).

# 3. Check on removing statistical differences in MONIT

In MONIT corrections are made to statistical data to remove statistical differences. Statistical differences are the differences between the sum of registered consumption per sector and net supply: import + extraction - export - bunkers - storage mutations. The earlier corrections have been checked with current insights of CBS and the following corrections have been applied in MONIT for the years 1991-94:

a. Coal(products): export has been decreased with a correction equal to the statistical difference; total coal consumption does not change.
b. Natural gas: extraction increases with the statistical difference; total gas consumption does not change.
c. Oil(products): statistical differences for crude oil and feedstocks (including natural gas liquids) are corrected for in exports. Statistical differences for oil products are added to export of oil products (50%) and to energetic oil use of the chemical industry (50%). This last correction could influence total oil use, industrial oil consumption and thus TPEC.
d. Secondary gases: as there is no extraction, import, storage or export of secondary gases the national consumption should be equal to 0. Statistical differences and non-zero national consumption are processed in refinery consumption (refinery gas), in chemical industry consumption (chemical gas) and in Basic Metal consumption (coke oven gas and blast furnace gas).
e. Other energy carriers: statistical differences for steam are processed in chemical industry, and for electricity in electricity production.

# 4. Check on past ECN-corrections

In the past a number of corrections to the CBS-statistics have been made in MONIT. These corrections have been checked with CBS and the following corrections have been made for the years 1991-1994 in balance B of MONIT:

a. A shift of small industry energy consumption from Services to Industry for 1991 and 1992; until 1993 this energy consumption was not part of industrial consumption in CBS-statistics. The shift for 1990 has been part of the CBS-update for that year.
b. Including printing industry into paper & printing for 1991 and 1992, in conformity with the CBS-approach from 1993 onwards.
c. In the chemical industry so-called MJA-oil corrections are applied, until 1996, for auxiliary gases (energetic) and oil products (non-energetic). The MONIT-corrections are in line with earlier information of CBS for 1991-1994 (see also overview in Section 8).
d. In the Basic Metal industry all coal and cokes for the blast furnace process (iron & steel subsector) are treated as feedstocks in MONIT. In earlier CBS-statistics until 1999 the consumption of these fuels, not attributed to the production of blast furnace gas, was regarded as fuel consumption for combustion. The new CBS-figures are in line with the MONIT-approach for 1990 and 1995-2003. Therefore for 1991-1994 the MONIT-figures can be preserved (see also Section 7).
e. In 1993 the CBS-format changed from special trade to general trade, which had consequences for energy-imports, -exports and bunkering. This has no direct consequences for TPEC (without bunkers) and for the 1991-1994 data to be delivered to CBS.

It must be remarked that corrections in MONIT data for the years 1990 and 1995-2003 have been removed because all relevant corrections are already accounted for in the revised CBS-data, e.g. treatment of inputs of blast furnaces.

# 5. Applying CBS-updates to MONIT-data for 1991-1994

In conformity with CBS updates the following adaptations have been made in the MONIT-data:

- The CBS-correction for auxiliary gases and natural gas in chemical industry for 1995 have been copied for the years 1991-1994.
- The CBS-corrections for auxiliary gases in refineries for 1991 and 1992 have been applied. (see also Section 8).

Some other adaptations have no practical consequences for the MONIT-data 1991-1994. For instance, the delivery of extracted natural gas condensate to chemical industry. Until 1999 the extracted condensate was (statistically) an input to refineries that put it through to chemical industry in the form of 'other oil products' in energy statistics. In present statistics the 'primary' condensate, instead of 'secondary' other oil products, is input to the chemical industry. However, this does not influence total oil use and oil use per sector.

For the years from 1995 on CBS has corrected coal use in PJ, due to better data on calorific factors (net energy content of coal used). In the sector central electricity production the corrections are minor, except for 1995. Therefore no corrections have been applied to power plant coal use for 1991-1994 in MONIT. The same holds for coal use in Basic Metal industry and Coke factories.

# 6. Des-aggregating data for ‘Other energy consumers’

Energy consumption for sub-sectors of ‘Other energy consumers’ (‘Overige afnemers’ in national statistics) has not been reported in the standard national energy balance of CBS. These data have been composed by ECN, based on various data sources. It regards the sub-sectors Agriculture (including horticulture), Construction and Services. The quantities regarded are:

- consumption of natural gas, electricity, oil products, heat and coal(products),
- final electricity- and heat demand,
- cogeneration input and outputs,
- renewable supply (own electricity production),
- use of diesel oil for off-road mobile equipment.

The sum of subsector consumption equals that of ‘Other energy consumers’ according to CBS-statistics. Data for Agriculture and Construction have been estimated in MONIT. To assure consistency with CBS the energy consumption of Services is taken as the remaining amount.

The available MONIT-data for all years in the period 1990-2003 have been checked with CBS; in a few cases adaptations were made to MONIT-data (energetic oil use for Agriculture and Services). The MONIT-data for 1991-1994 for the sub-sectors have been transferred in the format suitable for calculation of $CO_2$ emissions by CBS.

# 7. Extra information for calculation of greenhouse gas emissions

Until 2004 total energy consumption in MONIT was divided into (final) non-energetic use and the remainder, consisting of cogeneration, final energetic use and other conversions. As to calculate $CO_2$ emissions in conformity with IPCC guidelines from energy consumption data, total energy consumption has to be divided differently. Presently it has been divided by CBS into:

- energetic use of fuels and all gases for other conversions (except part of natural gas to the chemical industry),
- non-energetic use of coal, oil and gas,
- input excluding gases for other conversions.

In conformity with CBS the data for 1991-1994 in MONIT have also be regrouped. The data for 'remainder' have been replaced by the data for energetic use only (final and cogeneration). Energy consumption for other conversion is now equal to total energy consumption minus energetic and non-energetic use. However, in most sectors the figures do not change, as there is no other conversion. Other conversion is only relevant for the sectors Basic Metal, Chemicals, Other industry, Refineries, Coke plants, Extraction (1992) and Energy distribution (1991-1993).

Not all input of other conversion leads to $CO_2$ emissions. Therefore the inputs for 1991-1994 have been split in accordance with the CBS-approach. The fractions for 1991-1994 have been fitted to the known fractions for 1990 and 1995-2003 from CBS. Both other conversion inputs and fractions for 1991-1994 have been supplied to CBS.

For the NIR/CRF reporting the CBS data for the Basic Metal industry must be subdivided into iron & steel and non-ferro, as to facilitate the calculation of greenhouse gas emissions. To this end the non-ferro fractions of total energy consumption of Basic Metal industry have been specified for 1991-1994 in accordance with the known fractions for other years from CBS. Energy data in PJ for iron & steel and non-ferro have been delivered to CBS.

To be in line with the UNFCCC rules on calculating $CO_2$ emissions, as used in the NIR-reporting, the following corrections have been made to the MONIT data:

- separation of flaring of natural gas from total gas use in the sector Oil/gas-extraction,
- including use of gas oil and heavy fuel oil in fisheries in total oil use of Agriculture,
- including motor fuel for defense-applications from oil use of the sector Services,
- excluding part of motor fuel for airlines and shipping from oil use of Transport.

In Table 7.1 the placement of these applications is shown for CBS, NIR, MONIT and the data send to CBS (in January 2005). As can be seen MONIT data in the B2-balance fit as much as possible to the demands of the NIR-emission calculation. For reasons of clarity also oil use by other mobile equipment (not in agriculture and not in construction) is specified. Mobile equipment in the sector Construction is part of 'Other industry' as the NIR does not specify a separate sector Construction.

Table 7.1 *Placement of specific energy application with respect to emission calculations*

| | Energy balance CBS | National Inventory | MONIT (B2-balance) | Calculation CBS |
|---|---|---|---|---|
| Flaring natural gas | Extraction | Flaring (not energy) | x | Extraction |
| Fisheries | Bunkers | Agriculture, etc. | Agriculture | Bunkers |
| Defence, aviation/shipping | Bunkers | Others (1A5) | Services | Bunkers |
| Part of air traffic | Transport | Bunkers | Bunkers | Transport |
| Other air traffic | Transport | Transport | Transport | Transport |
| Part of shipping | Transport | Bunkers | Bunkers | Transport |
| Other shipping | Transport | Transport | Transport | Transport |
| Mobile equip. Agriculture | Agriculture | Agriculture, etc. | Agriculture | Agriculture |
| Mobile equip. Construction | Construction | Other Industry | Construction | Construction |
| Other Mobile equipment | Services | Other Industry | Services | Services |

# 8. Overview of updated energy data for 1991-1994

From the updated MONIT-version of February 2005 a file has been extracted with updated energy data for 1991-1994 to be used by CBS (see Appendix A). Data delivered to CBS regard:

- Sectors: Households, Food & Beverages, Basic Metal-iron & steel, Basic Metal-non-ferro, Chemistry, Paper & Printing, Other Metal, Construction materials, Other Industry, Agriculture & horticulture, Construction, Services, Transport, Refineries, Central Electricity production, Waste Incineration, Decentralized production (cogeneration), Coke factories, Extraction oil/gas and Distribution.
- Type of consumption: energetic (including cogeneration), non-energetic, other conversions and total energy consumption.
- Energy carriers: coal(products), oil(products), natural gas, other gases.

In Table 8.1 an overview is given of the sources of adaptations to the original CBS-data for 1991-1994. The codes refer to the preceding chapters and cases described. Some adaptations do not regard all years of the period 1991-1994. No data are supplied for electricity and heat, as these are not relevant for the calculation of greenhouse gas emissions.

Table 8.1 *Overview of adaptations to energy data for 1991-1994, described in the preceding chapters and cases*

| | Energetic use | | | | Non-energetic use | | | Other conversions | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sectors | Coal | Oil | Natural gas | Auxil. Gasses | Coal | Oil | Natural gas | Oil | Natural gas | Auxil. gasses |
| Food&beverages | 4a | 4a | 4a | | | | | | | |
| Base metal | | 4a | 4a | 3 | 4d | | | | | |
| Chemicals | 4a | 3 | 4a | 3+4c+5 | | 4c | 5 | 4c | 5 | 4c+5 |
| Paper | 4a | 4a+4b | 4a+4b | | | | | | | |
| Other metal | 4a | 4a | 4a | | | | | | | |
| Construction materials | 4a | 4a | 4a | | | | | | | |
| Other industry | 4a | 4a+4b | 4a+4b | | | | | | | |
| Agriculture | | 7 | | | | | | | | |
| Services | 4a | 4a+7 | 4a | | | | | | | |
| Transport | | 7 | | | | | | | | |
| Refineries | | | | 3+5 | | | | | | 5 |
| Extraction | | | 7 | | | | | | | |

In Table 8.2 an overview of the overall changes in the values for total energy consumption for 1991-1994 is given. The original data in the A-balance of MONIT refer to the statistical data of CBS before the update has started. The second line shows new data in CBS-format, including ECN-corrections. in line with the CBS-update. The third line shows the result of CBS-statistics including old ECN-corrections (B-balance of MONIT). Finally the new corrected values are given, now including the corrections to bring energy consumption in line with the NIR-format (see Table 7.1).

Table 8.2 *Total energy consumption 1991- 1994 for different cases*

| | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|
| Original MONIT-A data (old CBS) | 2854 | 2835 | 2861 | 2851 |
| Revised (delivered to CBS) | 2833 | 2821 | 2853 | 2854 |
| Original MONIT-B data | 2839 | 2815 | 2861 | 2856 |
| Revised (in NIR-format) | 2841 | 2832 | 2868 | 2867 |

## References

CBS (2001): *Energy balances for the Netherlands without statistical differences (in Dutch: Energiebalans Nederland zonder statistisch verschil)*. CBS Energiemonitor 2001/2, Page 51.

*Excel-file 'GegevensVoorCBS-11jan'* with data on energetic use, non-energetic use, other conversion and total consumption per fuel and year (1991-1994).

Olivier, J.G.J., L.J. Brandes, J.A.H.W. Peters and P.W.H.G. Coenen (2002): *Greenhouse Gas Emissions in the Netherlands 1990-2000.* National Inventory Report 2002, RIVM 2002, Section 5.1.1, Page 35-40.

UNFCCC (2004): *Report of the individual review of the greenhouse gas inventory The Netherlands submitted in the year 2004.* FCCC/WEB/IRI/2004/NLD, 8 December 2004.

# Appendix A

*Specification of energy carriers used in the update 1991-94 and as reported in the appendix*

- kolen (coal): solid fuels NIR (bituminous coal, cokes, lignite, tars, etc.), excluding blast furnace/coke oven gas,
- olie (oil): liquid fuels NIR (crude oil, natural gas liquids, oil products, lubricants, bitumen, etc.), excluding chemical/refinery gas,
- aardgas (natural gas),
- cokesovengas (coke oven gas),
- hoogovengas (blast furnace gas),
- chemisch restgas (chemical gas),
- raffinaderijgas (refinery gas).