



Universiteit Utrecht



**Physical indicators as a basis for
estimating energy efficiency developments
in the Dutch industry – update 2008**

Lex Roes, Martin K. Patel

This study is contracted by the Platform Monitoring Energy Savings via the Policy Studies unit of the Energy research Centre of the Netherlands (ECN) to the Copernicus Institute for Sustainable Development and Innovation.

The empirical part of this research was executed at the Centre for Research of Economic Micro data (CEREM) at Statistics Netherlands (CBS). The views expressed in this report, however, are those of the authors.

Report NWS-E-2008-28
ISBN 978-90-8672-031-6
May 2008

Contact person: Lex Roes
E-mail: a.l.roes@uu.nl

Copernicus Institute for Sustainable Development and Innovation
Department of Science, Technology and Society
Utrecht University
Heidelberglaan 2
3584 CS Utrecht
Phone: +31-30-2537600
Fax: +31-30-2537601

Table of content

- Table of content 1**
- 1 Introduction 3**
- 2 Data sources used 4**
 - 2.1 Production statistics 4
 - 2.2 Energy statistics 5
- 3 Results, discussion and conclusions 6**
 - 3.1 Remarks regarding reporting of the data..... 6
 - 3.2 Overall results, discussion and conclusions 7
 - 3.3 Chemical industry (excluding fertilisers)..... 14
 - 3.4 Fertiliser industry 16
 - 3.5 Iron and steel basic metals industry 18
 - 3.6 Food, beverages and tobacco industry 20
 - 3.7 Paper, printing and publishing industry 22
 - 3.8 Building materials industry 23
 - 3.9 Non-ferro, basic metals industry 25
- 4 References 27**

1 Introduction

With growing concern on the consequences of climate change and the depletion of fossil fuels, the importance of energy efficiency is globally recognized. In March 2007, the European Council set two key targets to reduce adverse effects of the use of fossil fuels: 1) A reduction of at least 20% in greenhouse gases (GHG) by 2020 and 2) a 20% share of renewable energies in EU energy consumption by 2020 (Commission of the European Communities, 2008). In this context, the monitoring of energy efficiency is of great importance.

In 2004, a method was developed for calculating energy efficiency developments in the Dutch manufacturing industry using physical indicators of production. The method and its application to calculate energy efficiency developments in the Dutch manufacturing industry for the time period 1993-2001 are described in a report by Neelis et al. (2004). The method is used as part of the yearly calculation of energy savings in the Netherlands according to the Protocol Monitoring Energy Savings performed by the Platform Monitoring Energy Savings (e.g. Boonekamp et al., 2004). On request of this platform, the calculations done in 2004 have been updated in 2005 for the years 2002 and 2003 (Neelis et al., 2005). In 2007, an update was made for the years 2004 and 2005 (Roes et al. 2007). In this report, an update is made for the year 2006. We present the results of the extended calculations for the years 1995-2006.

In Chapter 2 of this report, we give an overview of data sources that were used in this study. In Chapter 3, we discuss changes compared to the analysis from 2007 and we present the results.

It should be emphasised that in this report, we do not give any background on the method applied for which we refer to the 2004 report. Furthermore, we focus in this report on presenting the results of the calculations and only give minor attention to analysing, explaining and interpreting the results found.

2 Data sources used

2.1 Production statistics

The main sources for production statistics are the production statistics collected by Statistics Netherlands according to the PRODCOM 8-digit product classification. Two databases have been used:

- The PRODCOM database for 1995-2006 at the level of PRODCOM numbers.
- The PRODCOM database for 1995-2006 containing production values at the level of individual companies.

Both databases are confidential and are accessed via the CEREM (Centre for Research of Economic Microdata) framework at Statistics Netherlands. The spreadsheet tool with results is stored at Statistics Netherlands for future use. For some products, production data other than the PRODCOM databases are used. The data sources for 2006, the additional year of this analysis compared to the analysis of 2007, are summarised in Table 2.1.

Table 2-1 Non-PRODCOM production statistics used in the calculations

	Year	Source
Iron and steel, basic metals industry		
All products	2006	IISI (2007) ¹
Food, beverages and tobacco industry		
Beef	2006	PVE (2008)
Mutton and Lamb, pigmeat, poultry meat	2006	PVE (2008)
Rendering	2006	FAO (2008)
Dairies, except casein	2006	PZ (2008)
Sugar beet	2006	FAO (2008)
Cocoa beans	2006	UN (2008)
Paper, printing and publishing industry		
All products	2006	VNP (2006)
Building materials industry		
Clinker	2006	Mergelsberg (2007)
Glass	2006	Beerkens (2008)
Bricks & Paving bricks	2006	KNB (2006)
Non-ferro basic metals industry		
Anode production at Pechiney, Vlissingen	2006	Frijlink (2007)
¹ The production of cold rolled products is not reported in the IISI statistical yearbook. For 2003-2006, we therefore assumed the same ratio of cold rolled products vs. hot rolled products as in 2002.		

2.2 Energy statistics

For the calculation of the realized energy use, we used the energy statistics from Statistics Netherlands (CBS, 2006) that were downloaded from www.cbs.nl/statline. For non-energy use in the chemical industry, Neelis (2006b) discovered mistakes in the energy statistics as reported by CBS. In this study, we use the modified time-series according to the corrections described in Neelis (2006b). Since they cover only the period 1995 - 2004, an assumption had to be made for the years 2005-2006: We use the same correction in 2005-2006 as for 2004 (51 PJ).

3 Results, discussion and conclusions

3.1 Remarks regarding reporting of the data

In few cases, the data that form the basis of the calculations have changed. Below, the changes compared to the calculations conducted for 2005 are summarised.

Food, beverages and tobacco industry

Mutton and Lamb: Data on the amount of mutton and lamb in 2006 are only given in number of slaughterings and not in weight. We therefore estimated the assumed weight of mutton and lamb, by dividing the amount of mutton and lamb in 2005 (expressed in tonnes) by the amount of slaughterings in 2005 (provided by PVE, 2008). Next we multiplied this value with the amount of slaughterings in 2006 (provided by PVE, 2008).

Cocoa beans: In the previous FYSI update, we used data made available by Eurostat (2007). However in all previous years data from the United Nations Commodity Trade Statistics Database were used. Therefore we adapted the data in 2004 and 2005 with data from this database (UN, 2008) and we used this database as well for 2006. As a result, data of all years are from the same data source again.

Caseins: For the year 2005, caseins were taken from maison-du-lait (2007). However, during this FYSI update, data for 2006 had not yet been made available. Therefore, we used casein data under PRODCOM 15515300.

Non-ferro basic metals industry

Secondary aluminium: In 2006, a company producing secondary aluminium went bankrupt. As a result, no production from this company has been reported anymore and total secondary aluminium production in 2006 is about half of that in 2005.

Zinc: Until the preliminary data for 2005, zinc was reported under PRODCOM number 27431230. However, from the final 2005 data onwards, zinc is reported as 'non-alloyed zinc' under PRODCOM number 27431230 and as 'alloyed zinc' under PRODCOM number 27431250.

Production statistics 2005

The PRODCOM data for 2005 that were used in the calculations in 2007 were preliminary. In the meantime, CBS has updated these data. We used the updated 2005 data in our present calculations.

3.2 Overall results, discussion and conclusions

On the next pages, we will summarise the results of our calculations. In Table 3.1 we give an overview of numerical values of the development of the reference energy use in the seven industrial sectors analysed, using 1995 as the base year of analysis (reference energy use = 1). The reference energy use is the development of the energy use assuming frozen energy efficiency. In Table 3.2, we summarise the development of the Energy Efficiency Indicator (EEI) for each sector. This indicator is calculated by dividing the realised energy use (from energy statistics) by the reference energy use, assuming frozen energy efficiency. An EEI below 1 indicates that an industry has become more energy efficient compared to 1995 level; an EEI above 1 indicates that an industry has become less energy efficient compared to 1995 levels. In Tables 3.3 and 3.4, we summarise the results for the total of the industries analysed in the years 2005 and 2006 respectively. We present the results for the year 2005 again because due to a miscommunication during the preparation of the FYSI-update 2007 report (Roes et al. 2007), the absolute values in this table for realized and reference energy use were a bit too high (the reported EEI's were correct, though). Furthermore, the production data for 2005 have been updated compared to the previous analysis (influencing the reference energy use).

In Figures 3.1 to 3.32, we give a graphical representation of the results showing for each industry:

- The development of reference energy use, realised energy use and EEI for non-energy use.
- The development of reference energy use, realised energy use and EEI for fuels/heat use.
- The development of reference energy use, realised energy use and EEI for electricity use.
- The development of reference energy use, realised energy use and EEI for primary energy use (static primary units)¹, excluding non-energy use.²
- The development of reference energy use, realised energy use and EEI for total primary energy use (static primary units).

As stated in the introduction, the focus of this report is on presenting the results of our calculations, rather than on analysing, interpreting and explaining the results. We will therefore only very general discuss the main trends in the results. For the sum of all sectors, the overall reduction in the EEI for total primary energy use between 1995-2006 is 11% (Table 3-4), excluding the chemical industry, which has a high uncertainty. This is 4% more efficient than the value calculated in 2007 for the period between 1995 and 2005. At the level of individual sectors, we can conclude, that for the period 2005-2006, the EEI for total primary energy use decreased for all sectors (between 1% and 9%), except for the iron and steel, basic metal industry (EEI remained equal) and the paper, printing and publishing industry (EEI increased by 2%).

The reference energy use in the fertiliser industry (especially electricity) increases significantly in 2006. This is due to a doubling of the category 'mineral or chemical nitrogen fertilisers (100% N)' (PRODCOM 24.15.30.90) in 2006 compared to 2005. We checked with the Statistics Netherlands (Centraal Bureau voor de Statistiek) whether this is not a mistake but they confirmed it reflects reality.

¹ Final energy use is converted to primary energy use using static conversion factors of 2.5 for electricity and 1 for fuels/heat and non-energy use. We refer to Neelis et al. (2004) for details regarding the methodology.

² For the food, beverages and tobacco industry and for the paper, printing and publishing industry, the results for primary energy use, excluding non-energy use are not given, because non-energy use is negligible (food, beverages and tobacco industry) or non-existing (paper, printing and publishing) in those industries.

Table 3-1 Overview of development reference energy use

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Chemical industry												
Reference use, electricity	1.00	1.01	1.10	1.12	1.13	1.21	1.12	1.25	1.31	1.33	1.31	1.34
95% confidence interval, +/-	0.0%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%
Reference use, fuels/heat	1.00	0.97	1.04	1.05	1.12	1.13	1.21	1.25	1.36	1.33	1.34	1.32
95% confidence interval, +/-	0.0%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%
Reference use, non-energy use	1.00	0.96	1.00	1.00	1.06	1.02	1.10	1.16	1.36	1.29	1.30	1.25
95% confidence interval, +/-	0.0%	12.0%	12.0%	12.0%	12.0%	12.0%	12.0%	12.0%	12.0%	12.0%	12.0%	12.0%
Reference use, total primary, excl. non-energy use	1.00	0.98	1.05	1.07	1.12	1.15	1.19	1.25	1.35	1.33	1.33	1.32
95% confidence interval, +/-	0.0%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%
Reference use, total primary	1.00	0.97	1.03	1.04	1.09	1.09	1.15	1.21	1.35	1.31	1.32	1.29
95% confidence interval, +/-	0.0%	9.0%	9.0%	9.0%	9.0%	9.0%	9.0%	9.0%	9.0%	9.0%	9.0%	9.0%
Fertiliser industry												
Reference use, electricity	1.00	0.95	1.02	1.02	0.97	1.04	0.99	0.85	0.90	0.87	0.90	1.48
95% confidence interval, +/-	0.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%
Reference use, fuels/heat	1.00	0.95	1.01	1.03	1.02	1.06	0.93	0.88	0.83	0.86	0.86	1.03
95% confidence interval, +/-	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%
Reference use, non-energy use	1.00	0.99	1.04	1.04	1.03	1.06	0.94	0.89	0.84	0.91	0.91	0.90
95% confidence interval, +/-	0.0%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%
Reference use, total primary, excl. non-energy use	1.00	0.95	1.02	1.02	1.01	1.05	0.94	0.87	0.85	0.86	0.87	1.13
95% confidence interval, +/-	0.0%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%
Reference use, total primary	1.00	0.98	1.03	1.04	1.02	1.06	0.94	0.88	0.85	0.89	0.90	0.98
95% confidence interval, +/-	0.0%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%
Iron and steel, basic metal industry												
Reference use, electricity	1.00	0.98	1.05	1.00	0.96	0.99	1.04	1.08	1.16	1.22	1.21	1.19
95% confidence interval, +/-	0.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Reference use, fuels/heat	1.00	1.00	1.07	1.02	0.98	0.97	1.04	1.06	1.15	1.20	1.19	1.14
95% confidence interval, +/-	0.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
Reference use, non-energy use	1.00	1.00	1.05	1.01	0.96	0.90	0.96	0.97	1.06	1.09	1.09	0.98
95% confidence interval, +/-	0.0%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%
Reference use, total primary, excl. non-energy use	1.00	0.99	1.06	1.02	0.97	0.98	1.04	1.07	1.15	1.21	1.20	1.16
95% confidence interval, +/-	0.0%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Reference use, total primary	1.00	1.00	1.06	1.01	0.97	0.94	1.00	1.02	1.10	1.15	1.14	1.07
95% confidence interval, +/-	0.0%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%
Food, beverages and tobacco industry^{1,2}												
Reference use, electricity	1.00	1.02	1.04	1.07	1.09	1.10	1.07	1.03	1.00	1.01	1.00	1.04
95% confidence interval, +/-	0.0%	2.5%	2.5%	4.0%	4.0%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%
Reference use, fuels/heat	1.00	1.03	1.08	1.10	1.12	1.14	1.17	1.13	1.13	1.08	1.10	1.17
95% confidence interval, +/-	0.0%	2.5%	3.0%	3.5%	4.0%	4.0%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%
Reference use, non-energy use	1.17	1.16	1.00	1.00	1.33	1.22	1.08	1.13	1.18	1.14	1.07	0.99
95% confidence interval, +/-	5.0%	5%	0%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Reference use, total primary, excl. non-energy use	1.00	1.03	1.07	1.09	1.11	1.12	1.13	1.09	1.07	1.05	1.06	1.12
95% confidence interval, +/-	0.0%	2.0%	2.5%	3.0%	3.5%	3.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%
Reference use, total primary	1.00	1.03	1.07	1.09	1.11	1.12	1.13	1.09	1.07	1.05	1.06	1.12
95% confidence interval, +/-	0.0%	2.0%	2.5%	3.0%	3.5%	3.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%

¹⁾ Since non-energy use in the food, beverages and tobacco sector is less than 1% of the primary energy use, we did not separately calculate figures for the total primary energy use excluding non-energy use. The figures will be equal to the results given for the total primary energy use.

²⁾ Non-energy use figures are relative to 1997 (see chapter 7 of Neelis et al., 2004)

Table 3-1 Overview of development reference energy use (continued)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Paper, printing and publishing industry												
Reference use, electricity	1.00	1.00	1.07	1.05	1.08	1.12	1.07	1.10	1.13	1.17	1.17	1.15
95% confidence interval, +/-	0.0%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
Reference use, fuels/heat	1.00	1.01	1.07	1.07	1.10	1.13	1.07	1.12	1.13	1.16	1.16	1.13
95% confidence interval, +/-	0.0%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
Reference use, non-energy use	-	-	-	-	-	-	-	-	-	-	-	-
95% confidence interval, +/-	-	-	-	-	-	-	-	-	-	-	-	-
Reference use, total primary, excl. non-energy use	-	-	-	-	-	-	-	-	-	-	-	-
95% confidence interval, +/-	-	-	-	-	-	-	-	-	-	-	-	-
Reference use, total primary	1.00	1.01	1.07	1.06	1.09	1.12	1.07	1.11	1.13	1.16	1.17	1.14
95% confidence interval, +/-	0.0%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
Building materials industry												
Reference use, electricity	1.00	1.00	1.05	1.10	1.16	1.14	1.11	1.07	1.05	1.05	1.07	1.08
95% confidence interval, +/-	0.0%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Reference use, fuels/heat	1.00	0.98	1.02	1.06	1.08	1.08	1.07	1.01	0.99	1.02	1.05	1.05
95% confidence interval, +/-	0.0%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Reference use, non-energy use	1.00	0.74	0.88	1.01	1.21	1.10	1.12	1.14	1.01	1.04	1.03	0.99
95% confidence interval, +/-	0.0%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%
Reference use, total primary, excl. non-energy use	1.00	0.98	1.03	1.07	1.11	1.10	1.08	1.03	1.01	1.03	1.05	1.06
95% confidence interval, +/-	0.0%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Reference use, total primary	1.00	0.97	1.02	1.07	1.11	1.10	1.08	1.03	1.01	1.03	1.05	1.06
95% confidence interval, +/-	0.0%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Non-ferro basic metals industry												
Reference use, electricity	1.00	1.04	1.07	1.23	1.28	1.30	1.30	1.41	1.39	1.50	1.52	1.53
95% confidence interval, +/-	0.0%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%
Reference use, fuels/heat	1.00	0.93	0.98	1.09	1.14	1.19	1.17	1.18	1.20	1.26	1.29	1.14
95% confidence interval, +/-	0.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%
Reference use, non-energy use	1.00	0.84	0.86	0.99	1.08	1.09	1.09	1.12	1.04	1.21	1.32	1.19
95% confidence interval, +/-	0.0%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%
Reference use, total primary, excl. non-energy use	1.00	1.03	1.05	1.22	1.26	1.28	1.29	1.38	1.37	1.47	1.49	1.48
95% confidence interval, +/-	0.0%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%
Reference use, total primary	1.00	1.02	1.04	1.20	1.25	1.27	1.28	1.37	1.35	1.45	1.48	1.46
95% confidence interval, +/-	0.0%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%

Table 3-2 Overview of development energy efficiency indicator

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Chemical industry												
EEl, electricity	1.00	0.97	0.92	0.89	0.85	0.81	0.89	0.84	0.80	0.80	0.82	0.83
95% confidence interval, +/-	0.0%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%
EEl, fuels/heat	1.00	1.01	0.92	0.88	0.91	0.86	0.82	0.86	0.80	0.85	0.80	0.78
95% confidence interval, +/-	0.0%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%
EEl, non-energy use	1.00	0.90	0.91	0.90	0.97	1.06	1.11	1.10	1.01	1.08	1.24	1.16
95% confidence interval, +/-	0.0%	12.0%	12.0%	12.0%	12.0%	12.0%	12.0%	12.0%	12.0%	12.0%	12.0%	12.0%
EEl, total primary, excl. non-energy use	1.00	1.00	0.92	0.88	0.89	0.85	0.84	0.85	0.80	0.83	0.81	0.79
95% confidence interval, +/-	0.0%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%
EEl, total primary	1.00	0.95	0.91	0.89	0.93	0.94	0.96	0.96	0.90	0.95	1.01	0.96
95% confidence interval, +/-	0.0%	9.0%	9.0%	9.0%	9.0%	9.0%	9.0%	9.0%	9.0%	9.0%	9.0%	9.0%
Fertiliser industry												
EEl, electricity	1.00	1.12	0.93	1.01	0.96	0.85	0.77	0.87	0.85	0.91	0.90	0.55
95% confidence interval, +/-	0.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%
EEl, fuels/heat	1.00	0.99	0.91	0.94	0.90	0.82	0.74	0.82	0.86	0.88	0.88	0.73
95% confidence interval, +/-	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%
EEl, non-energy use	1.00	0.96	0.96	0.97	0.97	0.95	0.90	0.91	0.95	0.95	0.96	0.96
95% confidence interval, +/-	0.0%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%
EEl, total primary, excl. non-energy use	1.00	1.02	0.92	0.96	0.92	0.82	0.75	0.83	0.86	0.89	0.89	0.68
95% confidence interval, +/-	0.0%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%
EEl, total primary	1.00	0.98	0.94	0.97	0.95	0.91	0.85	0.89	0.92	0.93	0.93	0.84
95% confidence interval, +/-	0.0%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%
Iron and Steel, basic metal industry												
EEl, electricity	1.00	0.98	0.95	0.98	1.01	1.14	1.08	1.02	0.99	0.95	0.97	0.97
95% confidence interval, +/-	0.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
EEl, fuels/heat	1.00	1.00	0.95	0.90	0.86	0.88	0.84	0.82	0.76	0.77	0.76	0.80
95% confidence interval, +/-	0.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
EEl, non-energy use	1.00	0.99	1.01	1.02	1.02	0.99	1.01	1.01	1.00	0.98	0.97	0.95
95% confidence interval, +/-	0.0%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%
EEl, total primary, excl. non-energy use	1.00	0.99	0.95	0.93	0.92	0.98	0.92	0.89	0.85	0.84	0.83	0.86
95% confidence interval, +/-	0.0%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
EEl, total primary	1.00	0.99	0.98	0.98	0.97	0.99	0.96	0.95	0.92	0.90	0.90	0.90
95% confidence interval, +/-	0.0%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%
Food, beverages and tobacco industry^{1,2}												
EEl, electricity	1.00	1.10	1.06	1.05	1.02	1.02	1.12	1.14	1.16	1.14	1.15	1.16
95% confidence interval, +/-	0.0%	2.5%	3.0%	3.5%	4.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
EEl, fuels/heat	1.00	1.07	0.96	0.97	1.00	0.93	0.86	0.91	0.88	0.90	0.87	0.79
95% confidence interval, +/-	0.0%	2.5%	3.0%	3.0%	3.5%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
EEl, non-energy use	0.40	0.88	1.00	0.86	0.81	0.84	0.82	0.57	0.81	0.76	0.65	0.42
95% confidence interval, +/-	-	-	-	-	-	-	-	-	-	-	-	-
EEl, total primary, excl. non-energy use	1.00	1.08	1.00	1.00	1.01	0.96	0.96	1.00	0.99	0.99	0.98	0.94
95% confidence interval, +/-	0.0%	2.0%	2.5%	2.5%	3.0%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
EEl, total primary	1.00	1.08	1.00	1.00	1.01	0.97	0.97	1.00	0.99	1.00	0.98	0.94
95% confidence interval, +/-	0.0%	2.0%	2.5%	2.5%	3.0%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%

¹⁾ Since non-energy use in the food, beverages and tobacco sector is less than 1% of the primary energy use, we did not separately calculate figures for the total primary energy use excluding non-energy use. The figures will be equal to the results given for the total primary energy use.

²⁾ Non-energy use figures are relative to 1997 (see chapter 7 of Neelis et al., 2004)

Table 3-2 Overview of development energy efficiency indicator (continued)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Paper, printing and publishing industry												
EEl, electricity	1.00	1.02	1.03	1.05	1.06	1.06	1.05	1.06	1.01	0.98	0.96	0.99
95% confidence interval, +/-	0.0%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
EEl, fuels/heat	1.00	1.11	1.06	1.03	1.00	0.97	0.97	0.93	0.91	0.92	0.90	0.90
95% confidence interval, +/-	0.0%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
EEl, non-energy use	-	-	-	-	-	-	-	-	-	-	-	-
95% confidence interval, +/-	-	-	-	-	-	-	-	-	-	-	-	-
EEl, total primary, excl. non-energy use	-	-	-	-	-	-	-	-	-	-	-	-
95% confidence interval, +/-	-	-	-	-	-	-	-	-	-	-	-	-
EEl, total primary	1.00	1.06	1.04	1.04	1.03	1.02	1.01	1.00	0.96	0.95	0.93	0.95
95% confidence interval, +/-	0.0%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
Building materials industry												
EEl, electricity	1.00	1.07	1.09	1.00	0.98	1.08	1.06	1.05	1.02	0.99	0.98	0.98
95% confidence interval, +/-	0.0%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
EEl, fuels/heat	1.00	1.10	1.05	0.96	0.96	0.98	0.97	0.89	0.92	0.91	0.90	0.89
95% confidence interval, +/-	0.0%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
EEl, non-energy use	1.00	0.85	0.74	0.45	0.31	0.38	0.29	0.25	0.20	0.29	0.12	0.07
95% confidence interval, +/-	0.0%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%
EEl, total primary, excl. non-energy use	1.00	1.09	1.06	0.97	0.97	1.01	1.00	0.94	0.95	0.94	0.92	0.92
95% confidence interval, +/-	0.0%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
EEl, total primary	1.00	1.08	1.05	0.95	0.93	0.98	0.97	0.91	0.92	0.91	0.89	0.88
95% confidence interval, +/-	0.0%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Non-ferro basic metals industry												
EEl, electricity	1.00	1.00	1.00	0.96	0.97	1.00	0.97	0.88	0.91	0.92	0.91	0.81
95% confidence interval, +/-	0.0%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%
EEl, fuels/heat	1.00	1.00	1.03	0.91	0.80	0.84	0.73	0.74	0.73	0.80	0.80	0.82
95% confidence interval, +/-	0.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%
EEl, non-energy use	1.00	1.01	0.91	0.88	1.08	1.08	1.11	1.19	0.97	0.86	0.78	0.86
95% confidence interval, +/-	0.0%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%
EEl, total primary, excl. non-energy use	1.00	1.00	1.01	0.96	0.95	0.98	0.94	0.87	0.89	0.91	0.89	0.81
95% confidence interval, +/-	0.0%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%
EEl, total primary	1.00	1.00	1.00	0.95	0.96	0.98	0.95	0.88	0.89	0.90	0.89	0.82
95% confidence interval, +/-	0.0%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%

Table 3-3 Energy efficiency indicator in 2005 for the sum of sectors analysed

	Electricity			Fuels/Heat			Non-energy use			Total primary energy use (excl. non-energy use)			Total primary energy use		
	Reference energy use, 2005 (this study)	Realised energy use, 2005 (NEH)	EEI, 2005	Reference energy use, 2005 (this study)	Realised energy use, 2005 (NEH)	EEI, 2005	Reference energy use, 2005 (this study)	Realised energy use, 2005 (NEH)	EEI, 2005	Reference energy use, 2005 (this study)	Realised energy use, 2005 (NEH)	EEI, 2005	Reference energy use, 2005 (this study)	Realised energy use, 2005 (NEH)	EEI, 2005
	[PJ]	[PJ]		[PJ]	[PJ]		[PJ]	[PJ]		[PJ]	[PJ]		[PJ]	[PJ]	
Chemical industry	48.56	40.00	0.82	335.59	268.01	0.80	388.09	482.90	1.24	452.46	368.01	0.81	840.54	850.91	1.01
Fertiliser industry	3.27	2.93	0.90	27.04	23.89	0.88	68.79	65.90	0.96	35.21	31.21	0.89	104.01	97.12	0.93
Iron and steel basic metals industry	10.13	9.78	0.97	43.72	33.17	0.76	61.04	59.41	0.97	69.05	57.62	0.83	130.09	117.03	0.90
Food, beverages and tobacco industry ¹	20.57	23.63	1.15	77.01	67.09	0.87	0.46	0.30	0.65	128.45	126.17	0.98	128.62	126.47	0.98
Paper, printing and publishing industry	13.62	13.04	0.96	30.41	27.38	0.90	-	-	-	-	-	-	64.47	59.98	0.93
Building materials industry	5.30	5.17	0.98	30.02	26.97	0.90	2.02	0.25	0.12	43.27	39.90	0.92	45.30	40.15	0.89
Non-ferro basic metals industry	25.17	22.80	0.91	7.40	5.92	0.80	3.89	3.05	0.78	70.33	62.92	0.89	74.22	65.97	0.89
Total for all sectors	126.6	117.4	0.93	551.2	452.4	0.82	524.3	611.8	1.17	798.8	685.8	0.86	1387.2	1357.6	0.98
Total, excluding the chemical industry	78.1	77.4	0.99	215.6	184.4	0.86	136.2	128.9	0.95	346.3	317.8	0.92	546.7	506.7	0.93

¹ The EEI for non-energy use in the food, beverages and tobacco industry is relative to the year 1997, see Chapter 7 of Neelis et al., 2004 for details

Table 3-4 Energy efficiency indicator in 2006 for the sum of sectors analysed

	Electricity			Fuels/Heat			Non-energy use			Total primary energy use (excl. non-energy use)			Total primary energy use		
	Reference energy use, 2006 (this study)	Realised energy use, 2006 (NEH)	EEl, 2006	Reference energy use, 2006 (this study)	Realised energy use, 2006 (NEH)	EEl, 2006	Reference energy use, 2006 (this study)	Realised energy use, 2006 (NEH)	EEl, 2006	Reference energy use, 2006 (this study)	Realised energy use, 2006 (NEH)	EEl, 2006	Reference energy use, 2006 (this study)	Realised energy use, 2006 (NEH)	EEl, 2006
	[PJ]	[PJ]		[PJ]	[PJ]		[PJ]	[PJ]		[PJ]	[PJ]		[PJ]	[PJ]	
Chemical industry	49.86	41.22	0.83	329.18	255.62	0.78	372.77	432.31	1.16	454.87	358.67	0.79	827.63	790.98	0.96
Fertiliser industry	5.40	2.95	0.55	32.20	23.63	0.73	68.22	65.19	0.96	45.70	31.01	0.68	113.92	96.20	0.84
Iron and steel basic metals industry	9.99	9.65	0.97	41.96	33.38	0.80	54.83	52.27	0.95	66.93	57.51	0.86	121.76	109.78	0.90
Food, beverages and tobacco industry ¹	21.36	24.80	1.16	82.35	65.09	0.79	0.43	0.18	0.42	135.76	127.09	0.94	135.92	127.27	0.94
Paper, printing and publishing industry	13.36	13.25	0.99	29.54	26.61	0.90	-	-	-	-	-	-	62.93	59.74	0.95
Building materials industry	5.31	5.21	0.98	30.22	27.00	0.89	1.95	0.13	0.07	43.50	40.03	0.92	45.46	40.16	0.88
Non-ferro basic metals industry	25.30	20.60	0.81	6.53	5.36	0.82	3.51	3.03	0.86	69.79	56.86	0.81	73.30	59.89	0.82
Total for all sectors	130.6	117.7	0.90	552.0	436.7	0.79	501.7	553.1	1.10	816.6	671.2	0.82	1380.9	1284.0	0.93
Total, excluding the chemical industry	80.7	76.5	0.95	222.8	181.1	0.81	128.9	120.8	0.94	361.7	312.5	0.86	553.3	493.0	0.89

¹ The EEI for non-energy use in the food, beverages and tobacco industry is relative to the year 1997, see Chapter 7 of Neelis et al., 2004 for details

3.3 Chemical industry (excluding fertilisers)

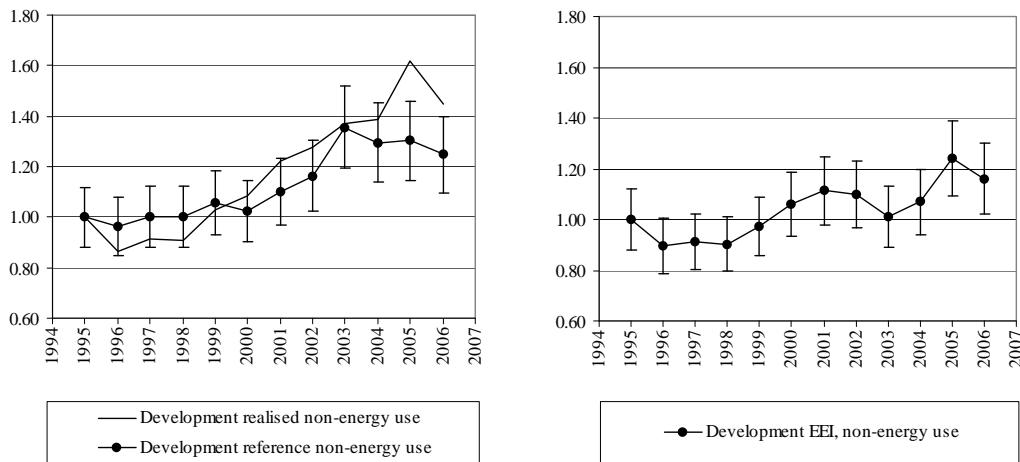


Figure 3-1 Development of reference energy use, realised energy use and energy efficiency indicator for non-energy use in the chemical industry (uncertainty bars in realised use not shown)

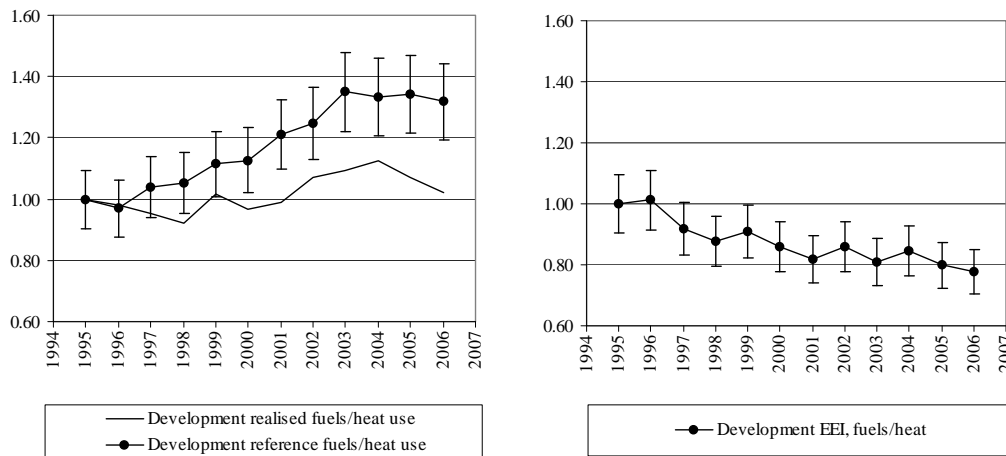


Figure 3-2 Development of reference energy use, realised energy use and energy efficiency indicator for fuels/heat use in the chemical industry (uncertainty bars in realised use not shown)

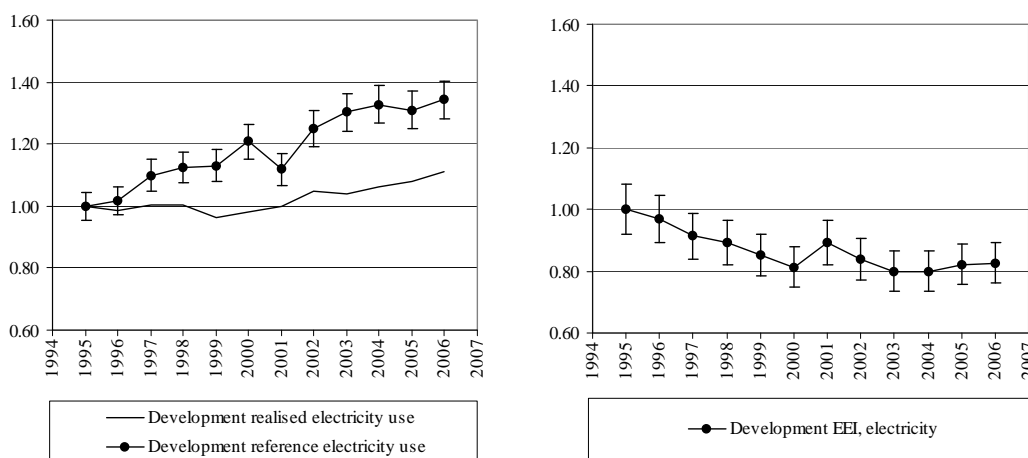


Figure 3-3 Development of reference energy use, realised energy use and energy efficiency indicator for electricity use in the chemical industry (uncertainty bars in realised use not shown)

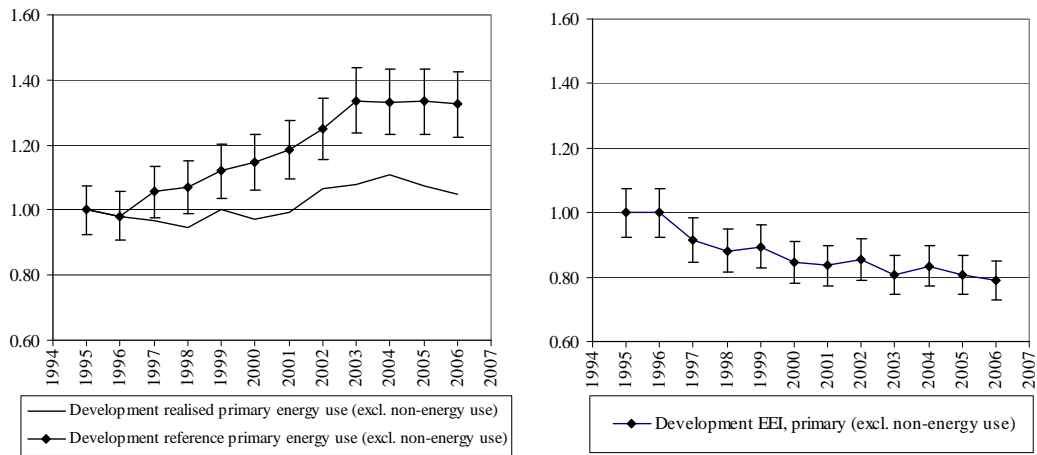


Figure 3-4 Development of reference energy use, realised energy use and energy efficiency indicator for primary energy use (static primary units), excluding non-energy use in the chemical industry (uncertainty bars in realised use not shown)

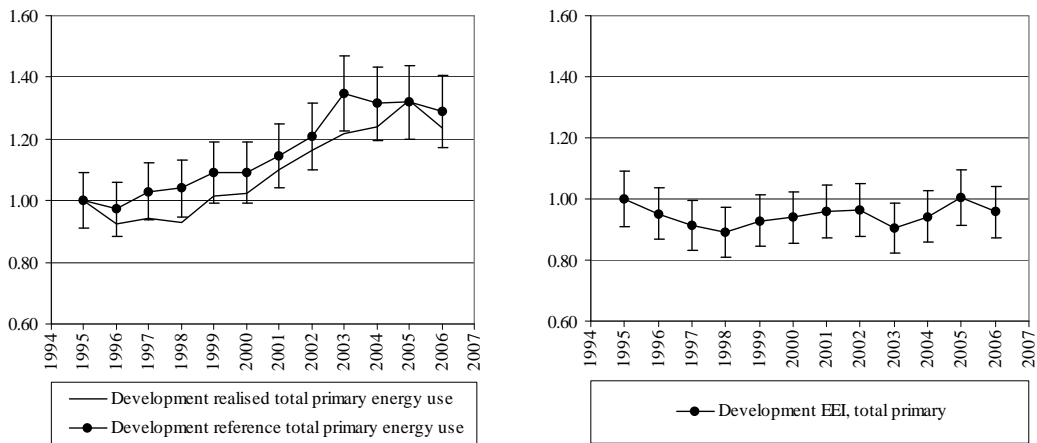


Figure 3-5 Development of reference energy use, realised energy use and energy efficiency indicator for total primary energy use (static primary units) in the chemical industry (uncertainty bars in realised use not shown)

3.4 Fertiliser industry

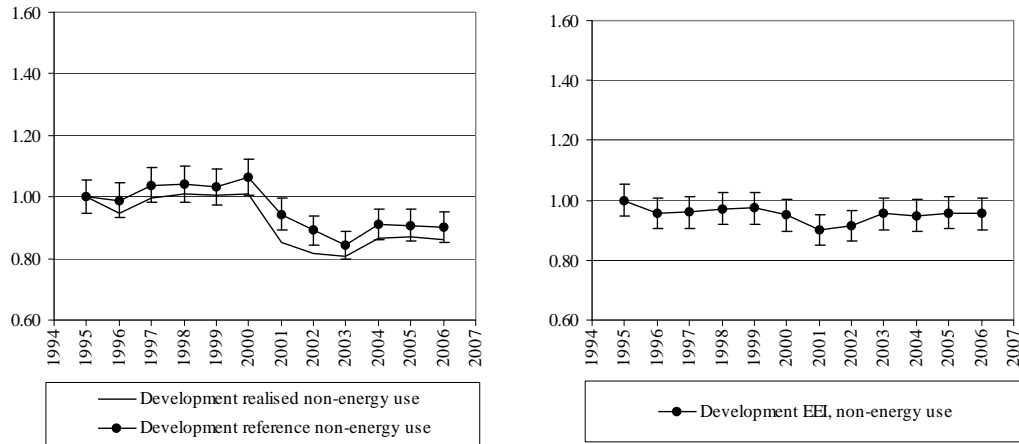


Figure 3-6 Development of reference energy use, realised energy use and energy efficiency indicator for non-energy use in the fertiliser industry (uncertainty bars in realised use not shown)

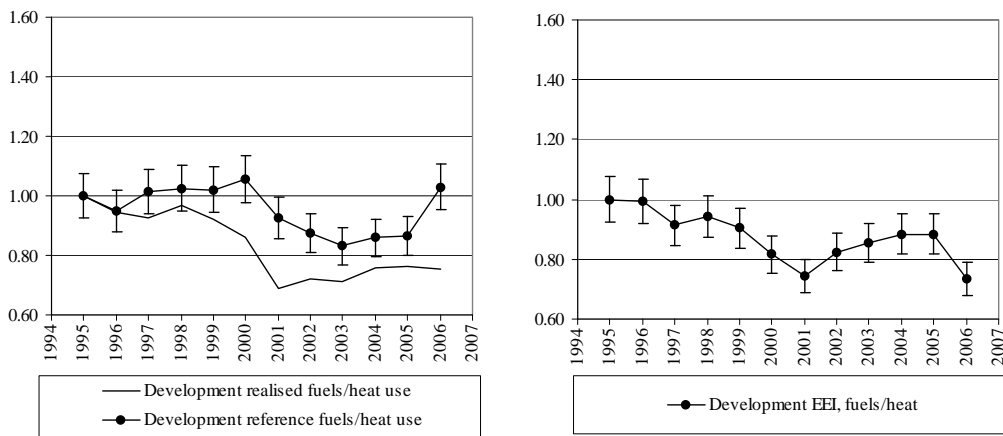


Figure 3-7 Development of reference energy use, realised energy use and energy efficiency indicator for fuels/heat use in the fertiliser industry (uncertainty bars in realised use not shown)

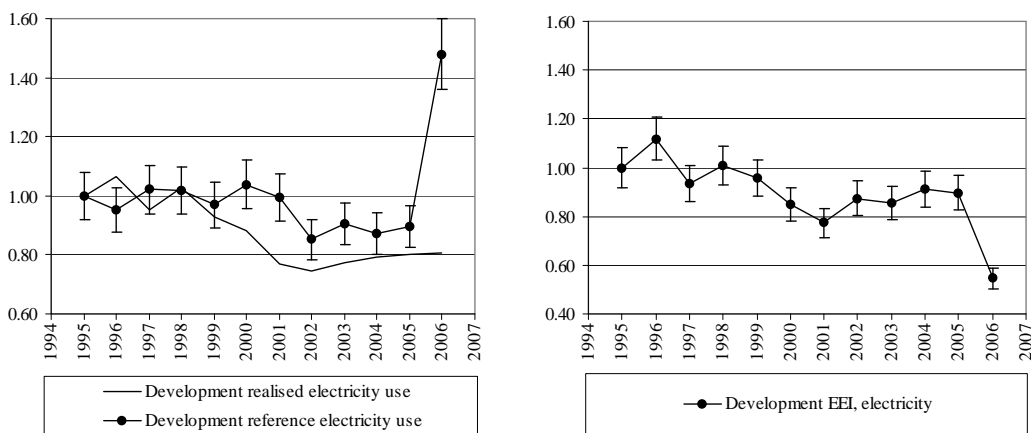


Figure 3-8 Development of reference energy use, realised energy use and energy efficiency indicator for electricity use in the fertiliser industry (uncertainty bars in realised use not shown)

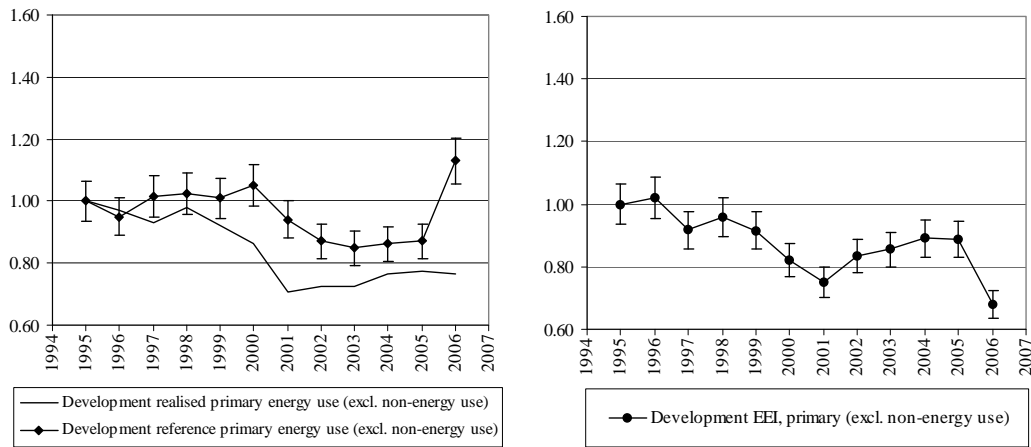


Figure 3-9 Development of reference energy use, realised energy use and energy efficiency indicator for primary energy use (static primary units), excluding non-energy use in the fertiliser industry (uncertainty bars in realised use not shown)

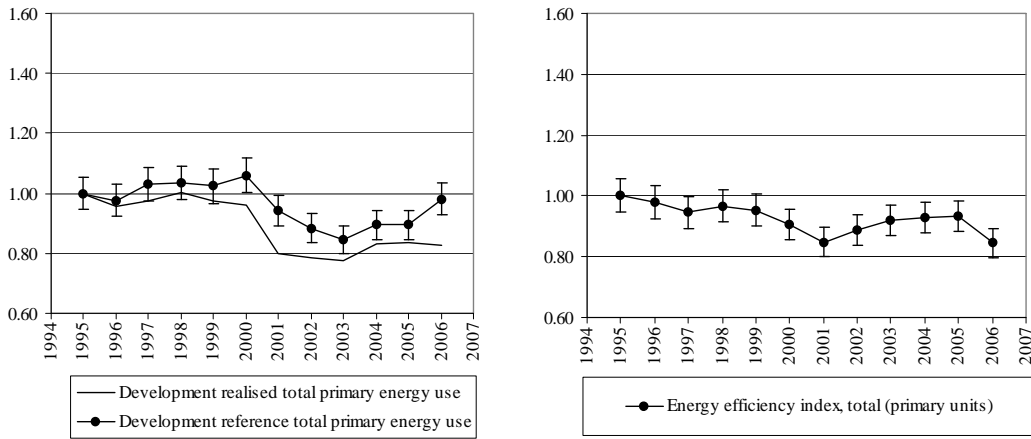


Figure 3-10 Development of reference energy use, realised energy use and energy efficiency indicator for total primary energy use (static primary units) in the fertiliser industry (uncertainty bars in realised use not shown)

3.5 Iron and steel basic metals industry

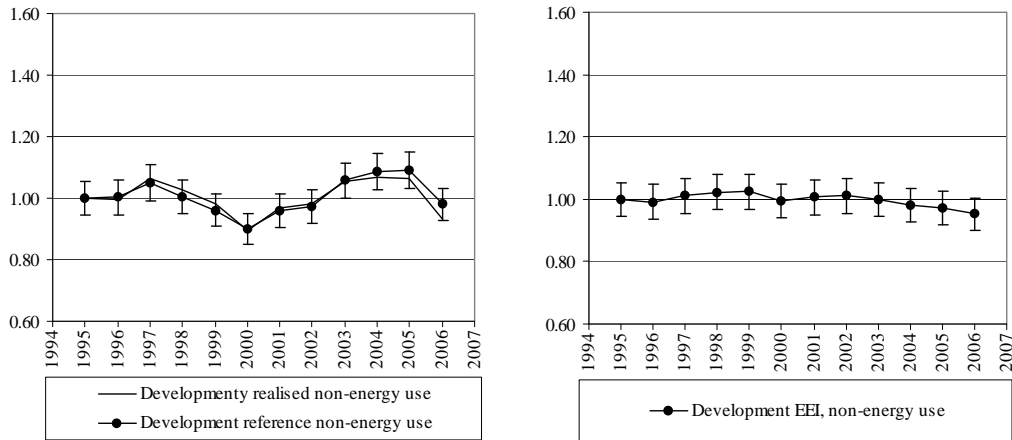


Figure 3-11 Development of reference energy use, realised energy use and energy efficiency indicator for non-energy use in the iron and steel basic metals industry (uncertainty bars in realised use not shown)

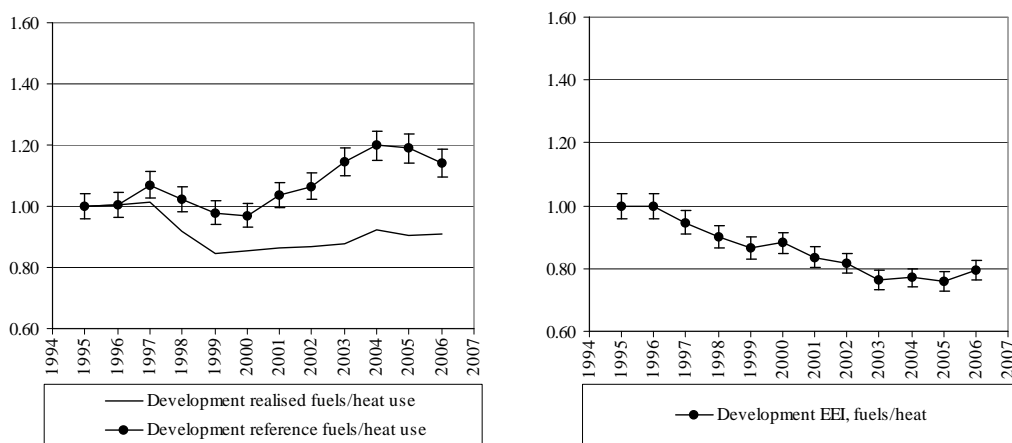


Figure 3-12 Development of reference energy use, realised energy use and energy efficiency indicator for fuels/heat use in the iron and steel basic metals industry (uncertainty bars in realised use not shown)

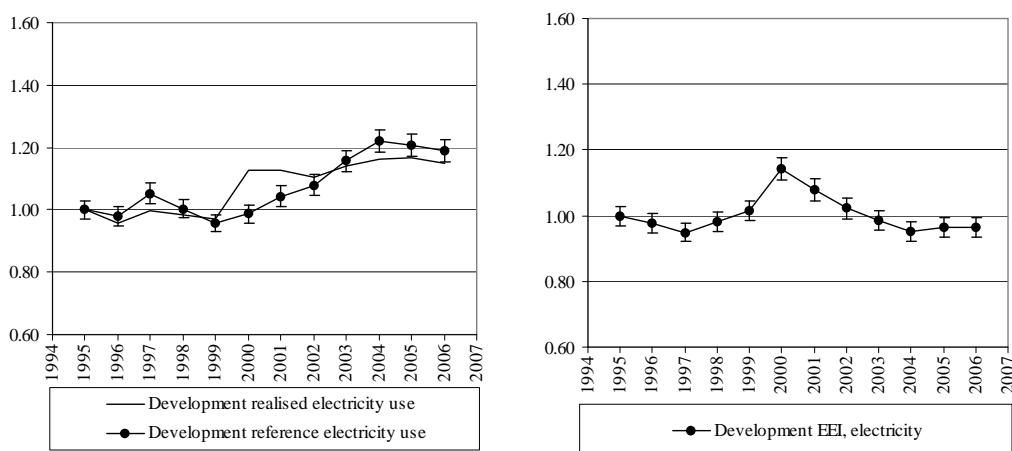


Figure 3-13 Development of reference energy use, realised energy use and energy efficiency indicator for electricity use in the iron and steel basic metals industry (uncertainty bars in realised use not shown)

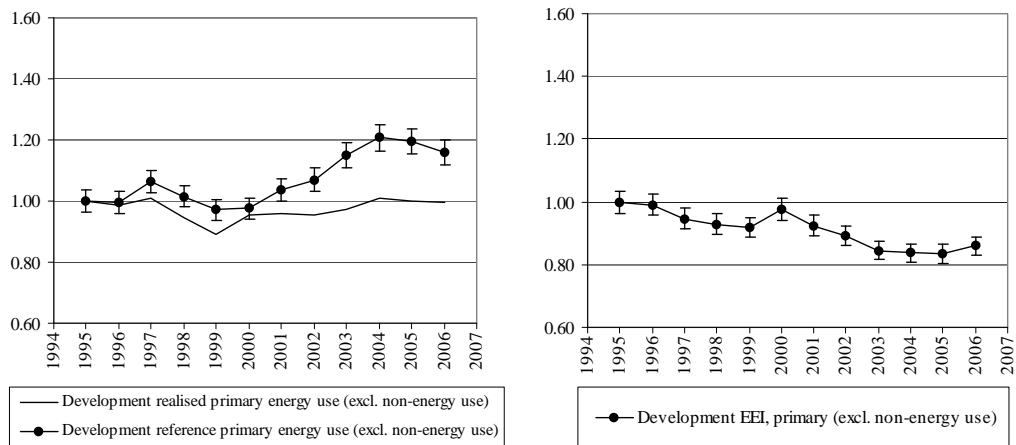


Figure 3-14 Development of reference energy use, realised energy use and energy efficiency indicator for primary energy use (static primary units), excluding non-energy use in the iron and steel basic metals industry (uncertainty bars in realised use not shown)

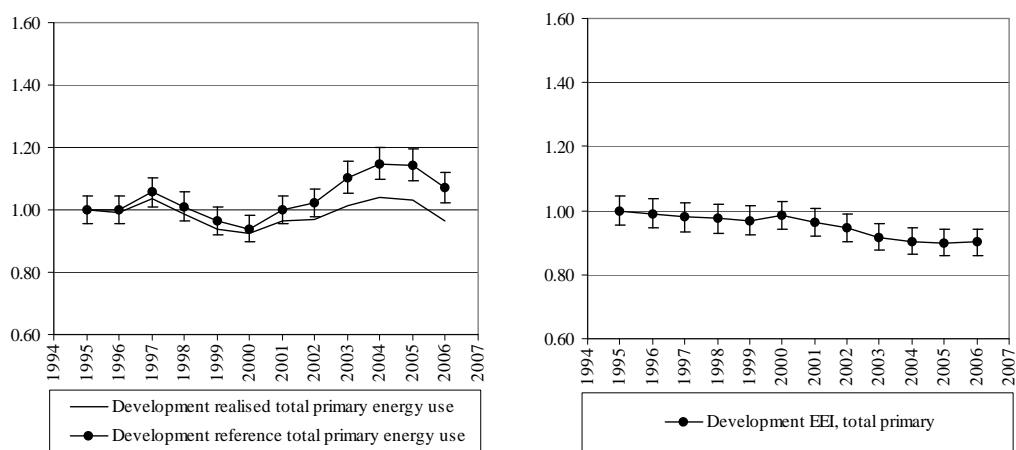


Figure 3-15 Development of reference energy use, realised energy use and energy efficiency indicator for total primary energy use (static primary units) in the iron and steel basic metals industry (uncertainty bars in realised use not shown)

3.6 Food, beverages and tobacco industry

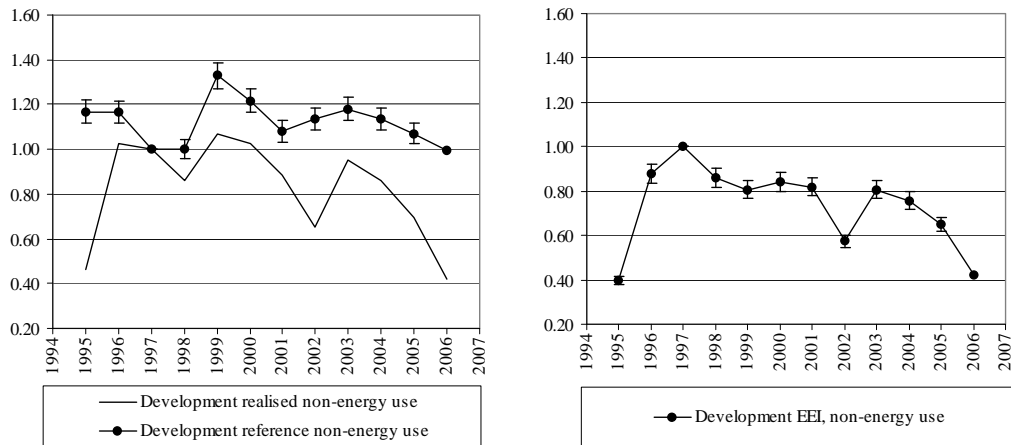


Figure 3-16 Development of reference energy use, realised energy use and energy efficiency indicator for non-energy use in the food, beverages and tobacco industry (uncertainty bars in realised use not shown)

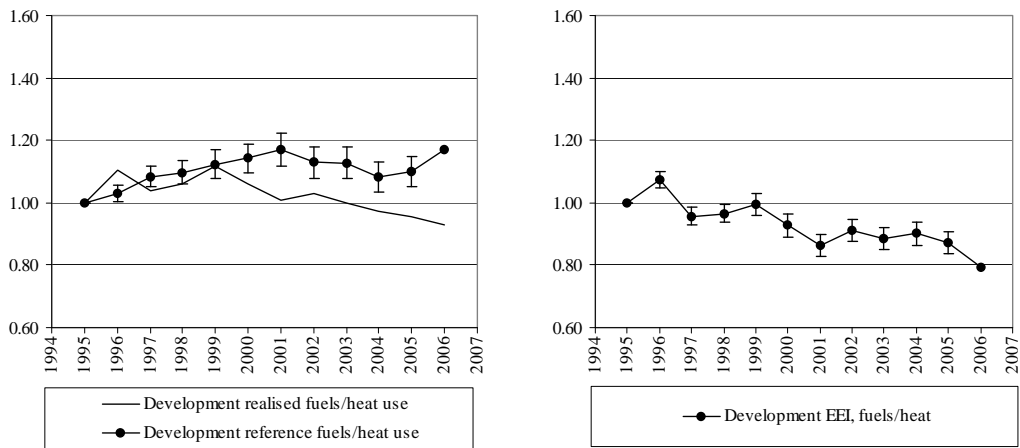


Figure 3-17 Development of reference energy use, realised energy use and energy efficiency indicator for fuels/heat use in the food, beverages and tobacco industry (uncertainty bars in realised use not shown)

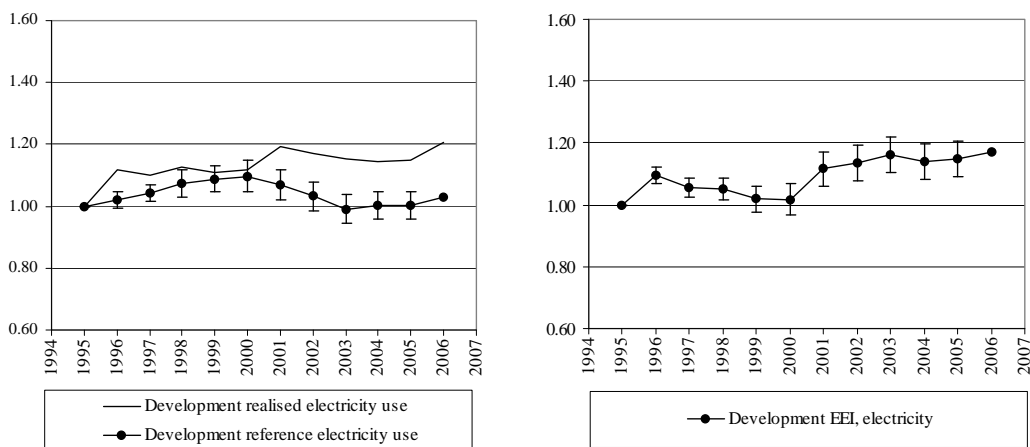


Figure 3-18 Development of reference energy use, realised energy use and energy efficiency indicator for electricity use in the food, beverages and tobacco industry (uncertainty bars in realised use not shown)

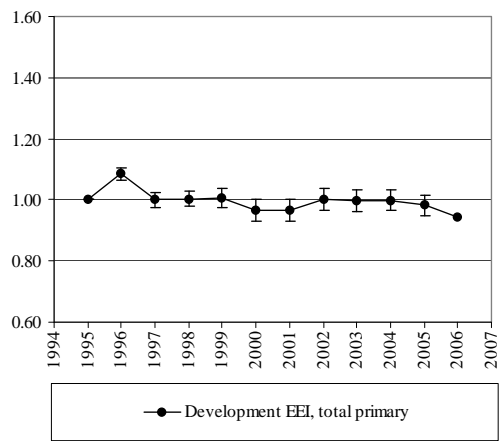
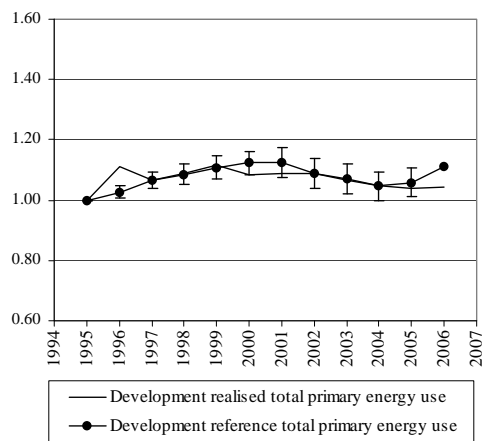


Figure 3-19 Development of reference energy use, realised energy use and energy efficiency indicator for total primary energy use (static primary units) in the food, beverages and tobacco industry (uncertainty bars in realised use not shown)

3.7 Paper, printing and publishing industry

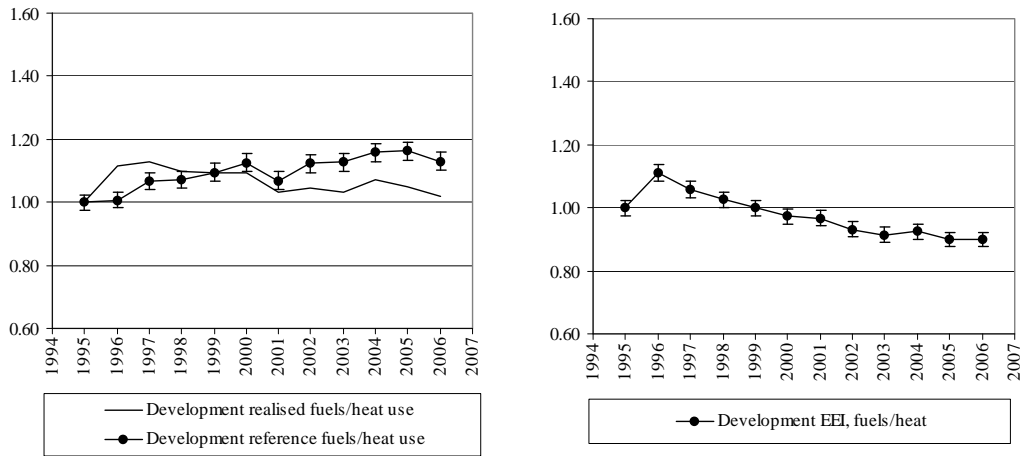


Figure 3-20 Development of reference energy use, realised energy use and energy efficiency indicator for fuels/heat use in the paper, printing and publishing industry (uncertainty bars in realised use not shown)

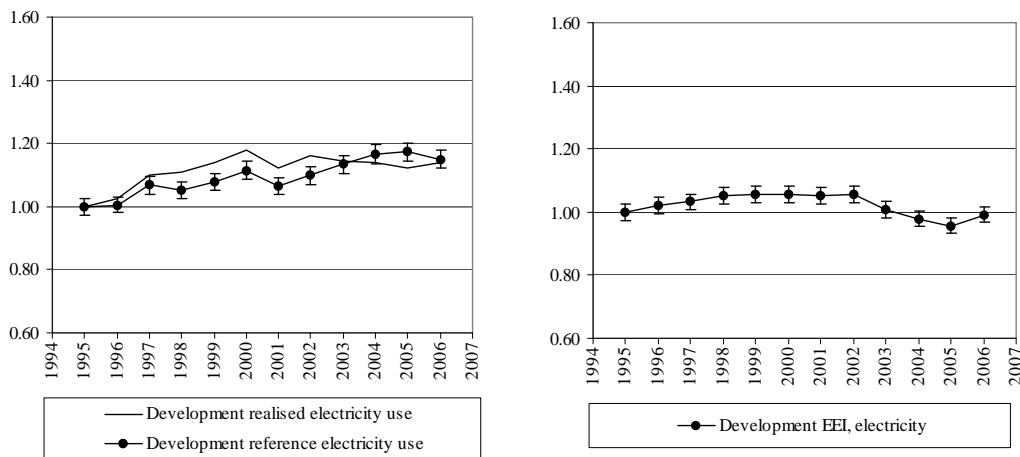


Figure 3-21 Development of reference energy use, realised energy use and energy efficiency indicator for electricity use in the paper, printing and publishing industry (uncertainty bars in realised use not shown)

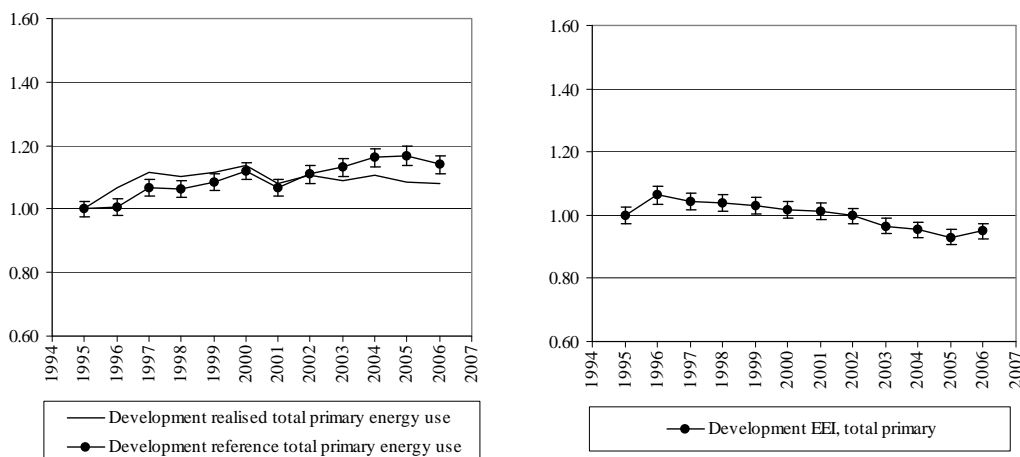


Figure 3-22 Development of reference energy use, realised energy use and energy efficiency indicator for total primary energy use (static primary units) in the paper, printing and publishing industry (uncertainty bars in realised use not shown)

3.8 Building materials industry

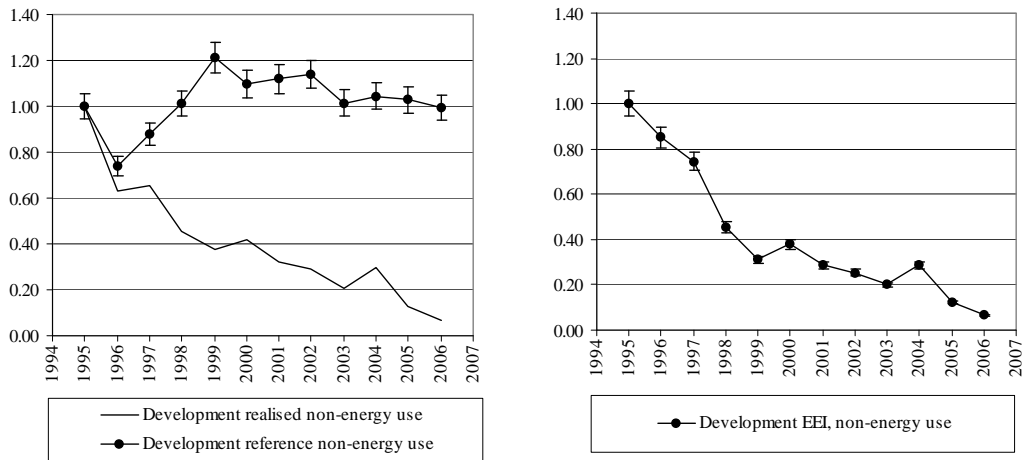


Figure 3-23 Development of reference energy use, realised energy use and energy efficiency indicator for non-energy use in the building materials industry (uncertainty bars in realised use not shown)

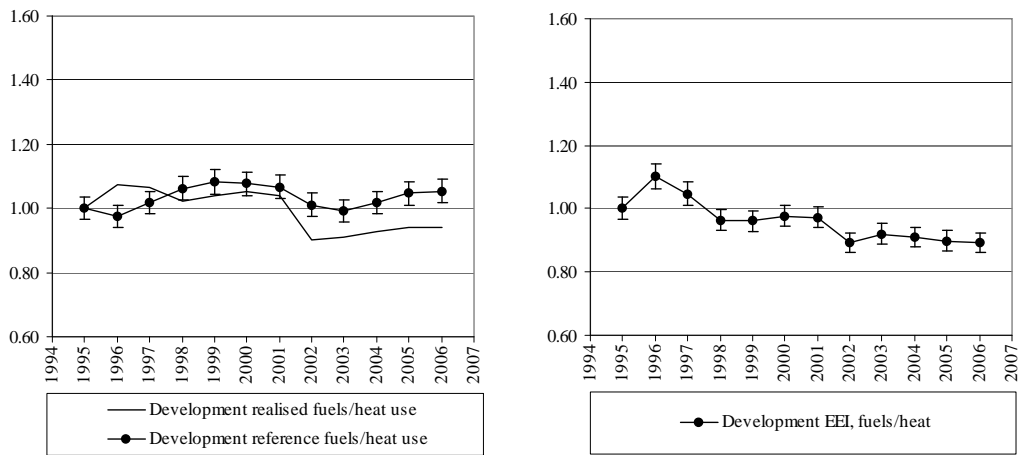


Figure 3-24 Development of reference energy use, realised energy use and energy efficiency indicator for fuels/heat use in the building materials industry (uncertainty bars in realised use not shown)

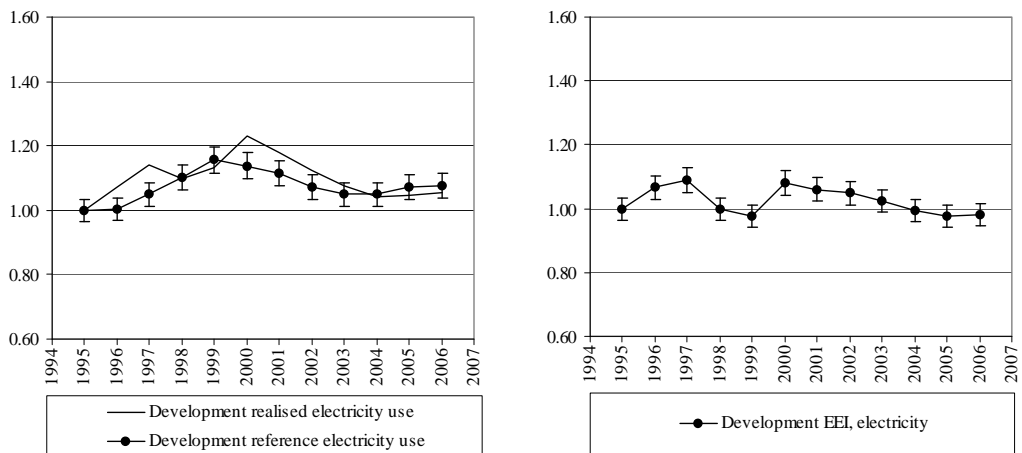


Figure 3-25 Development of reference energy use, realised energy use and energy efficiency indicator for electricity use in the building materials industry (uncertainty bars in realised use not shown)

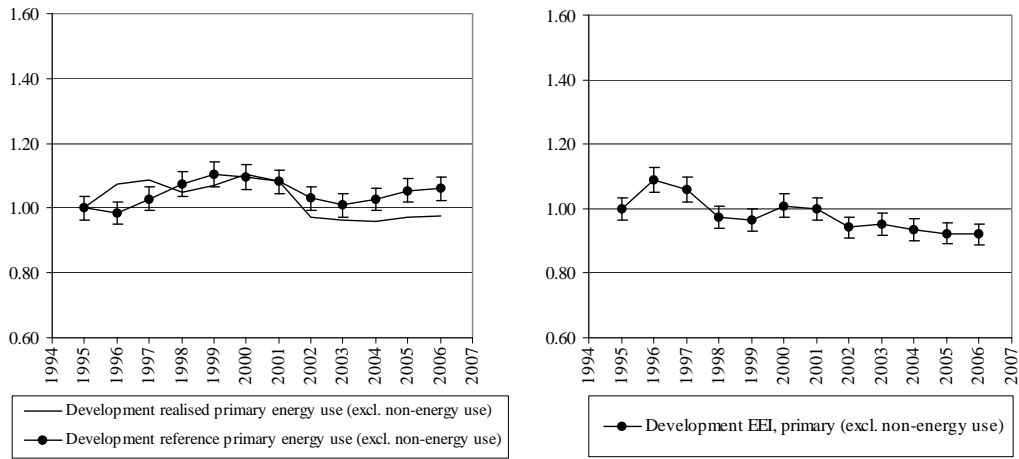


Figure 3-26 Development of reference energy use, realised energy use and energy efficiency indicator for primary energy use (static primary units), excluding non-energy use in the building materials industry (uncertainty bars in realised use not shown)

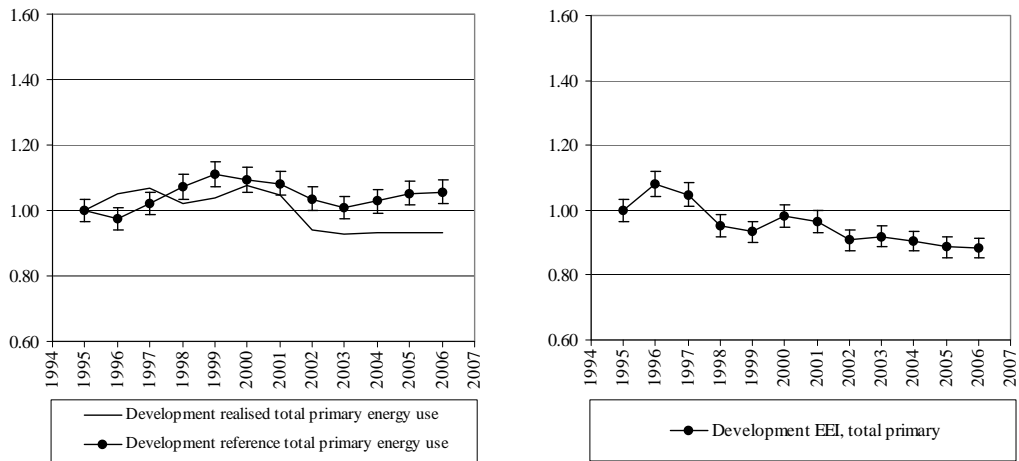


Figure 3-27 Development of reference energy use, realised energy use and energy efficiency indicator for total primary energy use (static primary units) in the building materials industry (uncertainty bars in realised use not shown)

3.9 Non-ferro, basic metals industry

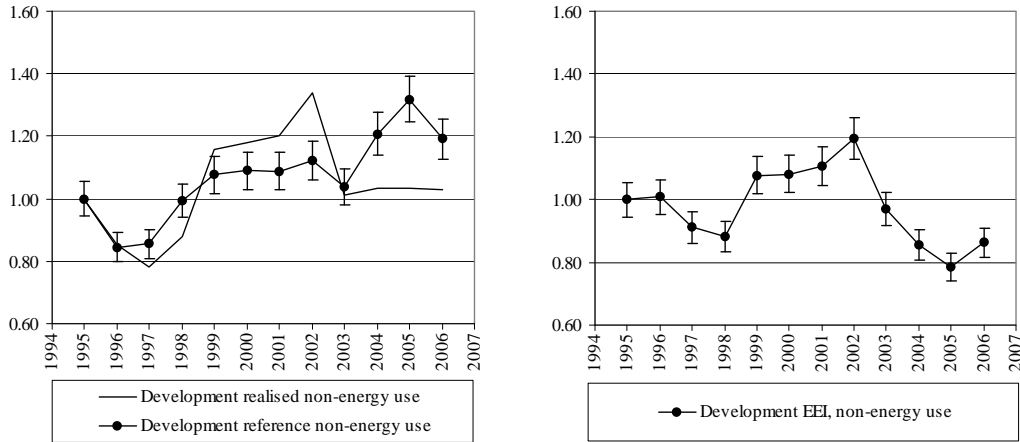


Figure 3-28 Development of reference energy use, realised energy use and energy efficiency indicator for non-energy use in the non-ferro basic metals industry (uncertainty bars in realised use not shown)

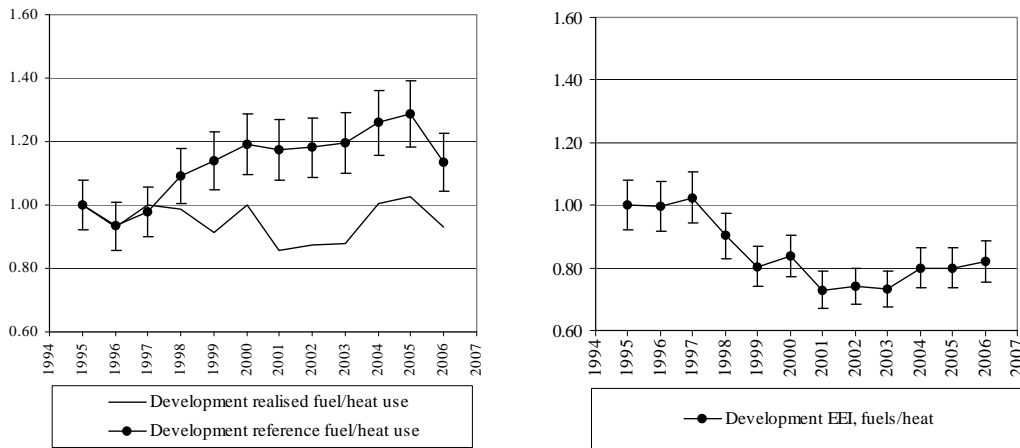


Figure 3-29 Development of reference energy use, realised energy use and energy efficiency indicator for fuels/heat use in the non-ferro basic metals industry (uncertainty bars in realised use not shown)

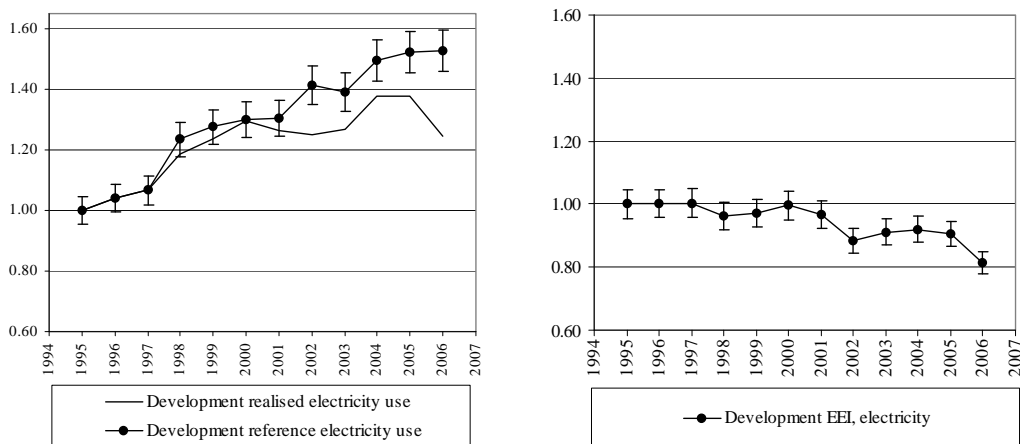


Figure 3-30 Development of reference energy use, realised energy use and energy efficiency indicator for electricity use in the non-ferro basic metals industry (uncertainty bars in realised use not shown)

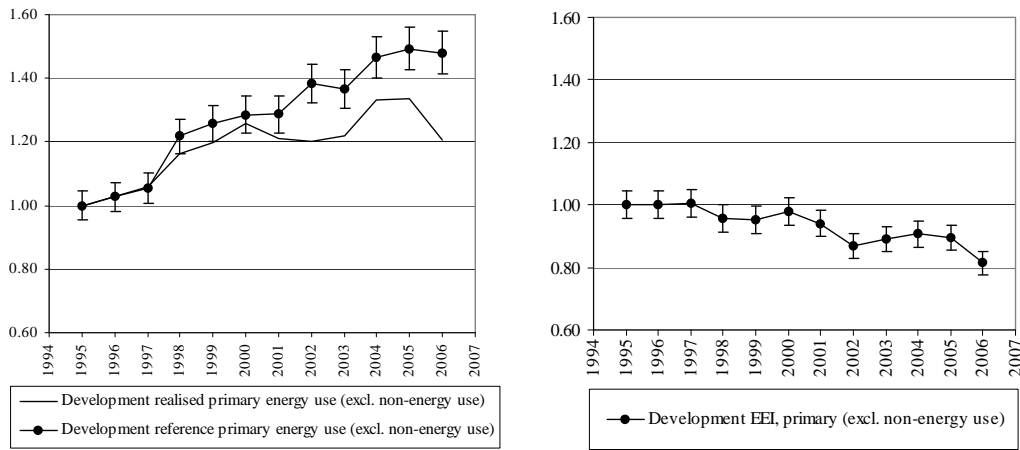


Figure 3-31 Development of reference energy use, realised energy use and energy efficiency indicator for primary energy use (static primary units), excluding non-energy use in the non-ferro basic metals industry (uncertainty bars in realised use not shown)

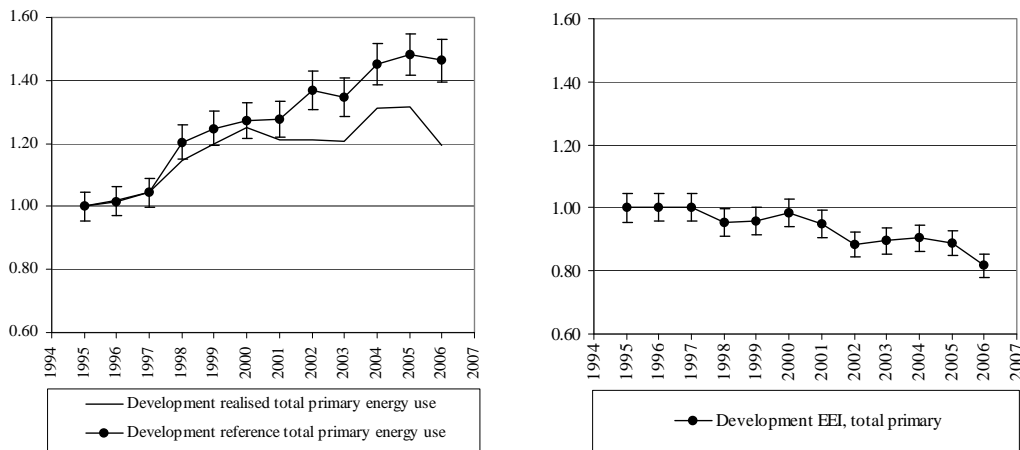


Figure 3-32 Development of reference energy use, realised energy use and energy efficiency indicator for total primary energy use (static primary units) in the non-ferro basic metals industry (uncertainty bars in realised use not shown)

4 References

- Beerkens, R. (2008), *Personal communication on glass production in physical units*, TNO/TPD, Eindhoven, 17 March 2008
- Boonekamp, P.G.M., Gijsen, A. and Vreuls, H.H.J., (2004) *Gerealiseerde energiebesparing 1995-2002, conform Protocol Monitoring Energiebesparing*, Energy Research Centre of the Netherlands, Petten
- Commission of the European Communities, *20 20 by 2020, Europe's climate change opportunity. Communication from the commission to the European parliament, the council, the European economic and social committee and the committee of regions*. Brussels, 23 Jan 2008.
- Eurostat (2007), *cocoa beans, whole or broken, raw or roasted, External trade statistics, 2007 edition* Eurostat, Luxemburg
- FAO (2008), *FAOSTAT data*.
Available online at: <http://faostat.fao.org/faostat>, accessed 29 May 2008.
- Frijlink, H. (2007), *Personal communication on anode production in physical units*, Alcan, Vlissingen, 27 February 2007
- IISI (2007), *Iron and steel, statistical yearbook 2007*, International Iron and Steel Institute (IISI), Brussels
- KNB (2006), *Jaarverslag 2006*, Koninklijk Verbond van Nederlandse Baksteenfabrikanten (KNB), de Steeg
- Maison-du-lait (2007), *caséines, production statistics NL*
Available online at: <http://www.maison-du-lait.com>, accessed 30 March 2007
- Mergelsberg, P. (2007), *Personal communication on clinker production*, ENCI Maastricht, 1 March 2007
- Neelis, M., Ramirez, A. and Patel, M. (2004), *Physical indicators as a basis for estimating energy efficiency developments in the Dutch industry*, Report NW&S-E-2004-20 Department of Science, Technology and Society, Copernicus Institute for Sustainable Development and Innovation, Utrecht University, Utrecht, August 2004
- Neelis, M., Ramirez, A. and Patel, M (2005), *Physical indicators as a basis for estimating energy efficiency developments in the Dutch industry – update 2005*, Report NW&S-E-2005-50 Department of Science, Technology and Society, Copernicus Institute for Sustainable Development and Innovation, Utrecht University, Utrecht, July 2005
- Neelis (2006), *De bruikbaarheid van Nederlandse Prodcom en energiestatistieken voor de berekening van CO₂ emissies en energiebesparing in de chemische industrie – openbare samenvatting*, Report NW&S-E-2006-7, Department of Science, Technology and Society, Copernicus Institute for Sustainable Development and Innovation, Utrecht University, Utrecht, June 2006
- Productschappen Vee, Vlees en Eieren (PVE), (2008), *Voorlopige jaarcijfers 2007*. Available online at: <https://bedrijfsnet.pve.agro.nl>, accesses 28 April 2008
- PZ (2008), *Statistisch Jaaroverzicht 2006*, Productschap Zuivel, Zoetermeer

Available online at: <http://www.prodzuivel.nl> , accessed 01 April 2008

Roes A.L., Neelis M.L. and Ramirez C.A.,(2007) *Physical indicators as a basis for estimating energy efficiency developments in the Dutch industry - update 2007*. Report NWS-E-2007-19
Department of Science, Technology and Society, Copernicus Institute for Sustainable Development and Innovation, Utrecht University, Utrecht, April 2007

CBS (2006), *De Nederlandse Energie Huishouding (NEH), jaarcijfers, 2006*

United Nations (UN, 2008), *United Nations Commodity Trade Statistics Database*, available online at <http://comtrade.un.org/db/>, accessed 28 April 2008

VNP (2006), *Annual report 2006*, Vereniging van Nederlandse Papier- en Kartonfabrieken (VNP), Hoofddorp