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Energy savings in the horticulture and road transport sector in the Netherlands over the period 1995-2010

***Background report** on "Bottom-up calculations" of energy savings under the EU Directive on energy end-use efficiency and energy services (ESD)*

FINAL

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Executive Summary

Monitoring and reporting under the ESD

Within the framework of the EU Directive on energy end-use efficiency and energy services (ESD) (EC, 2006) Member States are obliged to report on their achieved energy savings. Members States will need to report their saving using two different methods: top down and bottom-up. Calculations with bottom-up methods need to cover between 20% and 30% of the total savings calculated with the top-down method.

The Dutch National Energy Efficiency Action Plan (NEEAP) submitted in June 2007 holds indicative targets for 2010 and 2016. This background report includes the results of bottom-up energy savings calculations for the horticulture and transport sector for 2008, 2009 and an estimate 2010. The results are part of the 2nd Dutch Energy Efficiency Action Plan (EEAP) to show progress towards reaching the indicative targets.

Approach

The approach followed by the Netherlands for the second reporting under the ESD is that:

- "Early energy savings" are included assuming from energy efficiency measures that have been implement since 1995 and still have an impact in 2008, 2009 and 2010.
- Next to calculating the savings against 1995 efficiency levels energy savings were also calculated against 2007 to reveal the impact of early savings.
- "Autonomous" savings are included in the presented results.

***Horticulture*: Key policy measures**

The key policy instrument for the horticulture sector is a voluntary agreement with the government that was signed in 1997. Within the Glasshouse Horticulture and Environmental Covenant (GLAMI, broader than energy-use) the sector, among others, agreed that in 2010 specific energy use would be 35% below 1980 levels. This was further detailed in energy standards for various crops that were laid down in regulation. The GLAMI covenant expired in 2010 and the energy standards are now replaced by a more flexible CO_2 trading system. This system is currently in the pilot phase.

Part of the covenant between the horticulture sector and the government is an agreement on lower energy taxes for the sector. Because the horticulture sector is willing to take on voluntary energy efficiency targets the government applies a lower rate for the glasshouse horticulture, flower bulbs and the mushroom sector.

To support the financial attractiveness of energy efficiency measures fiscal incentives are in place for the sector. The most important measure it the Energy Investment Allowance Scheme (Dutch: EIA), which is a tax relief programme providing direct financial advantage to companies that invest in energy-saving equipment and sustainable energy.

Besides these instruments financial incentives are in place to stimulate the use of renewable energy sources in the sector (Green financing scheme, energy transition path "(Semi-) Closed Greenhouse". Renewable energy use contributes to the energy saving target for the Netherlands because it includes the use of renewables "behind the meter".

***Horticulture*: Overall results bottom-up calculations**

Table S1 shows the results for the horticulture sector.

*Table S1: Bottom-up final energy savings for the horticulture sector for 2008, 2009 and an estimate for 2010. Own calculation using information from LEI (2011), CBS (2011a) and NEA (2010). *) estimate for 2010.*

		2007	2008	2009	*2010*)*
Savings demand side					
Final energy consumption	PJ	125	125	137	
Final primary electricity consumption	PJ	49	54	72	
Final heat consumption	PJ	77	70	64	
Saving horticulture demand side (EEI 1995)	PJ	40	51	38	38
Saving horticulture demand side (EEI 2007)	PJ	0	8	-4	-4
Savings supply side					
Electricity production CHP	PJfinal	16	27	39	42
Heat prod. CHP	PJ	23	36	50	56
Saving horticulture supply side (EEI 1995)	PJ	13	28	33	36
Saving horticulture supply side (EEI 2007)	PJ	0	14	19	22
Total savings					
Total savings (EEI 1995)	PJ	53	79	71	74
Total savings (EEI 2007)	PJ	0	22	15	17
Total savings (EEI 1995)	GWh	14607	21905	19666	20469
Total savings (EEI 2007)	GWh	0	6194	4043	4849
Relative savings (EEI 1995)	%	32%	45%	41%	42%
Relative savings (EEI 2007)	%	0%	17%	11%	13%

For the horticulture sector a distinction is made between demand side and supply side efficiency improvements:

- Energy savings on the demand side reflect implementation of measures leading to a decrease in the amount of energy needed per m^2 or per unit of product;
- Energy savings on the supply side mainly include the introduction of combined heat and power (CHP) installations leading to a lower primary energy input for heat supplied to the greenhouse.

Table S1 shows that:

- Compared to 1995 efficiency levels energy efficiency for this sector improved by 41% to 45%, and by 11% to 17% compared to 2007 efficiency levels.
- Largest part of the saving for the reporting period result from measures implemented before 2007 (early savings).
- Savings on the demand side are decreasing whereas savings on the supply side are increasing.

<u>Horticulture</u>: Impact of separate policy instruments

<u>Horticulture:</u> Energy Investment Allowance Scheme

Table S2 provides an overview on the total investments by the horticulture sector that applied for EIA support and an estimate of the gross energy savings for these investments.

Table S2: Overview of investments that applied for EIA in the period 2006-2010 and an estimate of the gross savings that can be attributed to these measures. Sources: Agentschap NL (2010 b, c), SenterNovem (2007, 2008, 2009)

		2006	**2007**	**2008**	**2009**
Total investments EIA	mln euro	3710	2021	1439	870
Total investment horticulture	mln euro	329	434	234	112
Total investment horticulture in CHP	mln euro	260	306	*165*	60
Cumulative saving by CHP	PJ - low	1	3	3	3
Cumulative saving by CHP	PJ - high	8	19	27	30
Cumulative savings other measures	PJ	0	1	2	2
Total cumulative savings	PJ - low	2	4	4	5
Total cumulative savings	PJ - high	8	20	28	32
Total cumulative savings	GWh - low	532	1048	1223	1392
Total cumulative savings	GWh - high	2312	5564	7852	8798

"Gross" refers to the fact that the estimated energy savings are not corrected for autonomous energy savings and free riders. The table shows that investments that opted for EIA support dropped significantly in 2008 and 2009 compared to the years preceding and that major part of the investments includes CHP installations.

Horticulture: Renewable energy use

Use of renewable energy is stimulated by a variety of policy measures. Table S3 provides an overview of the production of heat and electricity by means of renewable energy sources for the period 2000-2009. The table shows that the use of renewable energy sources is slowly increasing.

Table S3: Use of renewable energy sources in the horticulture sector and associated saving on energy use. Sources: LEI (2011)

		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Saving renewable heat	PJ	0,1	0,1	0,1	0,1	0,1	0,3	0,4	0,6	1,1	1,2
Savings renewable electricity	PJ	0,0	0,0	0,1	0,2	0,3	0,2	0,3	0,4	0,4	0,3
Total savings renewables	PJ	0,1	0,1	0,2	0,3	0,4	0,5	0,7	1,0	1,5	1,6
Total savings renewables	GWh	28	28	58	89	114	130	198	286	414	434

Transport: Key policy measures

A large variety of policy measures are in place in to stimulate more efficient energy use in the transport sector. Measures are mainly aimed at passenger road transport and include fuel taxes, fiscal measures, labelling schemes and CO_2 standards.

Transport: Overall results top-down calculations

Table S4 provides the results of the bottom calculations for road transport for the years 2007, 2008, 2009 and an estimate for 2010. Compared to 1995 efficiency levels actual energy use decreased by 6%. Compared to 2007 efficiency levels no saving can be observed for this period[1]. This means that all savings calculated for the target period are the impact of autonomous savings and "early energy saving policies".

[11] The table actually shows "negative savings" for the transport sector, but because the savings are surrounded with uncertainties the "negative savings" are within the uncertainty range.

Table S4: Top-down final energy savings for the road transport sector for 2007, 2008, 2009 and an estimate for 2010. Own calculations using information from: KIM/CBS (2011), PBL (2011).

		2007	2008	2009	*2010*)*
Reference energy use (EEI-1995)	PJ	427	436	430	428
Actual energy use	PJ	400	409	404	403
Saving passenger + other road transport (EEI 1995)	GWh	3.277	3.174	3.479	*3.310*
Saving freight road transport (EEI 1995)	GWh	4.402	4.341	3.595	*3.595*
Saving passenger + other road transport (EEI 1995)	PJ	12	11	13	*12*
Saving freight road transport (EEI 1995)	PJ	16	16	13	*13*
Total savings (EEI 1995)	GWh	7.679	7.515	7.074	*6.905*
Total savings (EEI 1995)	PJ	28	27	25	*25*
Relative savings (compared to reference energy use)	%	6%	6%	6%	*6%*
		2007	**2008**	**2009**	***2010*)***
Reference energy use (EEI-2007)	PJ	400	408	402	401
Actual energy use	PJ	400	409	404	403
Saving passenger + other road transport (EEI 2007)	GWh	0	-169	142	*-9*
Saving freight road transport (EEI 2007)	GWh	0	-156	-655	*-655*
Saving passenger + other road transport (EEI 2007)	PJ	0	-1	1	*0*
Saving freight road transport (EEI 2007)	PJ	0	-1	-2	*-2*
Total savings (EEI 2007)	GWh	0	-325	-513	*-664*
Total savings (EEI 2007)	PJ	0	-1	-2	*-2*
Relative savings (compared to reference energy use)	%	0%	-1%	-2%	*-3%*
**) Estimate*					

***Transport*: Impact of separate policy instruments**

Passenger transport: Shift in passenger car labels (fiscal measures and labelling schemes)

Since 2001 all new passenger cars need to have an energy label. Since 2001 a shift can be observed towards cars with a lower energy label (A, B and C). This trend has accelerated over the last couple of years when fiscal measures (private motor vehicle tax, tax income increase for leased cars, scrapping scheme) were adapted to stimulate the purchase of passengers' cars with low CO_2 emissions per km.

Table S5 provides an overview of the calculated impact on the shift in energy labels since 2001 and shows that savings accumulate to approximately 6% in 2010 compared to the reference energy use (assuming that CO_2 emissions per km driven for new sold cars remain at 2001 levels), which is equal to 2440 GWh in 2010.

It must be noted that the results do not reflect the actual impact (effectiveness) of labelling and other policy instruments linked to the labelling system as the results were not corrected for autonomous improvements and free riders. It furthermore must be noted that the impacts were calculated using standard test data. Actual energy use can be substantially higher than the report standard test data, which would mean that our calculations overestimate the savings.

Table S5: Impact of shift in energy labels since 2001. Sources: KIM/CBS (2011), BOVAG (2010), PBL (2011a), RDC (2010)

Impact of shift in labels since 2001		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Annual new sales	number	528.745	507.091	486.885	480.901	460.021	481.610	498.172	493.465	386.000	483.186
Share A-label	*%*	*0%*	*3%*	*1%*	*1%*	*4%*	*6%*	*6%*	*12%*	*25%*	
Share B-label	*%*	*16%*	*16%*	*14%*	*15%*	*23%*	*16%*	*17%*	*31%*	*40%*	
Share C-label	*%*	*47%*	*40%*	*45%*	*44%*	*40%*	*40%*	*36%*	*28%*	*19%*	
Share D-label	*%*	*22%*	*27%*	*23%*	*24%*	*21%*	*25%*	*26%*	*20%*	*11%*	
Share E-label	*%*	*10%*	*9%*	*11%*	*10%*	*8%*	*8%*	*9%*	*6%*	*4%*	
Share F-label	*%*	*3%*	*4%*	*4%*	*4%*	*3%*	*3%*	*4%*	*2%*	*1%*	
Share G-label	*%*	*2%*	*2%*	*2%*	*2%*	*2%*	*2%*	*2%*	*1%*	*1%*	
Cumulative new sales since 2001	number	528.745	1.035.836	1.522.721	2.003.622	2.463.643	2.945.253	3.443.425	3.936.890	4.322.890	4.806.076
CO2 emissions per km new sold cars	gr/km	174	173	173	171	170	166	164	157	147	139
Total number of passenger cars in NL	number	6.539.000	6.710.000	6.855.000	7.151.000	7.299.000	7.256.000	7.413.000	7.597.000	7.756.800	7.776.000
Km driven by all passengercars in NL	mln km	92.189	93.944	94.924	97.379	96.930	97.903	99.601	101.695	101.608	100.968
Average annual km per passenger car	km	14.098	14.001	13.847	13.618	13.280	13.493	13.436	13.386	13.099	12.985
Energy use -reference case	PJ	18	35	50	65	78	95	110	126	135	149
Energy use - actual	PJ	18	34	50	65	77	93	108	122	129	140
Savings	PJ	0	0	0	1	1	2	2	4	6	9
Savings	GWh	0	41	59	143	246	445	690	1.118	1.616	2.440
Relative savings	%								3%	4%	6%

<u>*Passenger and freight transport:*</u> *Eco-Driving' programme*

Since 1999 an Eco-Driving programme is in place in the Netherlands. The Dutch Ecodriving programme 'Het Nieuwe Rijden' is focused on creating the necessary conditions and organisational structures that facilitate more energy-efficient purchase and driving behaviour, with the objective of reducing CO_2 emissions. Table S6 shows that the impact of the programme is estimated to be between 1,4 and 3,3 PJ in 2010.

Table S6: Estimated impact of the Ecodriving programme in the Netherlands. Own calculations based on: I&O Research (2010), Harmsen et al (2007).

		2007	2008	2009	2010
Impact Ecodriving: High estimate	PJ	4,9	4,9	3,3	3,3
Impact Ecodriving: High estimate	GWh	1370	1370	913	913
Impact Ecodriving: Low estimate	PJ	2,1	2,1	1,4	1,4
Impact Ecodriving: Low estimate	GWh	594	594	396	396

Railways: Long term Voluntary agreement with the Dutch Railways

Since 1999 a Long Term Voluntary Agreement (LTA) is in place between the Dutch government and the Dutch Railways. Targets for the period 1997-2010 are to improve the energy efficiency with 20% in 2010 compared to 1997, and to increase the share of renewable energy to 5%. Table S7 shows that main part of the savings was achieved in the period prior to 2007 and that they slowed down in the last couple of years.

Table S7: Reported energy savings by the Dutch railways reported under their LTA for the period 2001-2009. Source: AGL (2010b).

		2007	2008	2009
	PJ	1,475	1,479	1,482
Total savings (process efficiency + energy management)(2001-2009)	GWh	410	411	412

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1 Introduction

1.1 Background on the ESD

Within the framework of the EU Directive on energy end-use efficiency and energy services (ESD) (EC, 2006) Member States are obliged to report on their achieved energy savings. Deadline for the next report is June 2011 and for the first time Member States need to report on their actually achieved energy savings.

Members States will need to report their saving using two different methods: top down and bottom-up. Calculations with bottom-up methods need to cover between 20% and 30% of the total saving calculated with the top-down method. According to the directive this share will be raised in 2012. This report holds the results of the bottom-up calculations for the horticulture and road transport sector.

1.2 Indicative targets for the Netherlands

In June 2007 the Netherlands submitted their first National Energy Efficiency Action Plan (NEAP) (Min EZ, 2007). This plan holds an overview of the indicate energy saving target for the Netherlands and an estimate of the savings per sector for 2010 and 2016 (see Table 1).

The indicative target for 2016, presented in this table and adopted by the Netherlands, equals 9% of the average energy use of the sectors covered under the ESD over the period 2001-2005. The scope of the ESD is the total inland energy consumption excluding energy use with ETS sectors.

The indicative savings presented in Table 1 include savings of policies in place in 2007 and of new policies expected to be implemented in the target period. Savings were calculated against a background scenario without policies. Savings achieved before 2007 (Early Actions) were not included in these calculations.

Table 1: National indicative annual energy savings target for the Netherlands and expected saving per sector in 2010 and 2016. Source: Min EZ (2007).

National indicative annual energy savings target 2016 (GWh)				51.190
National intermediate indicative annual energy savings target 2010 (GWh)				11.376
Measures to improve energy efficiency planned for achieving the target	**Annual energy savings expected by end of 2010 (GWh)**		**Annual energy savings expected by end of 2016 (GWh)**	
	low	high	low	high
Package of measures in the residential sector	5.527	5.527	23.576	34.257
Package of measures in the tertiary sector	1.515	1.515	9.112	15.499
Package of measures in industry (non-ETS)	249	874	636	1.778
Package of measures in the transport sector	3.807	5.293	17.613	26.939
Package of measures in agriculture	845	1.158	2.917	5.528
Total ESD energy savings expected:	**11.943**	**14.366**	**53.854**	**84.001**

1.3 Harmonised bottom-up calculation methods

The ESD requires the development of harmonised calculation methods to be used by Member States to prove that they attain the overall target of 9 % energy savings by 2016. This includes development of bottom-up as well as top-down methods. An important start with the development of these methods was made within the European project "Evaluation and Monitoring for the EU Directive on Energy End-Use Efficiency and Energy Services" (EMEEES) (Wuppertal et al, 2009), which ran from 2006 to 2009. Within this project 20 bottom-up and 14 top-down evaluation methods and case studies were developed and applied.

In July 2010 the European Commission published recommendations on measurements and verification methods to be used within the framework of the ESD (EC, 2010). This document holds recommended formulas for top-down energy efficiency indicators, bottom-up calculation models and a list of recommended average lifetimes of energy efficiency improvement measures and programmes for bottom-up calculations of final energy savings. These methods build on the work performed within the EMEEES project.

For the transport sector bottom-up and top-down methods are available from the EC as well as from the EMEEES project. Because of lack of reliable data a top-down methods is applied in this project and not the available bottom-up method was used (further details are available in chapter 3). For the horticulture sector no method is available this means that we developed our own method within this project.

1.4 Approach

The approach followed by the Netherlands for the second reporting under the ESD is that 1) the gross impact of policies in place in 2007 and introduced since then as well as 2) the gross impact of early energy saving polices and 3) autonomous savings are included in the savings to count towards the indicative target. This is in contrast to the approach taken in the first NEAP in which autonomous and the impact of early policy measures were not included.

1.4.1 General starting points for the bottom-up calculations

- Achieved energy saving are calculated for 2008, 2009 and an extrapolation is made for 2010 (because statistical data are not yet available for 2010);
- The following general formula is applied to determine the savings:

Energy savings year $_X$ = Reference energy use year $_X$ - Actual energy use year $_X$

- Reference energy use is defined per (sub-)sector and is calculated starting from 1995 (base year 1995) and starting from 2007 (base year 2007).
    - For the calculation of the reference energy use starting from base year 1995 it is assumed that specific energy use (energy use per unit of performance) remains constant at 1995 levels for the target years 2008, 2009 and 2010. The calculated energy savings in this case include:
        1. Autonomous energy savings resulting from replacement of capital stock etc. since 1995;
        2. Gross energy savings resulting from “early energy saving policies” that still have an impact in the period 2008-2016 (this means that no corrections are made for free riders, rebound effect etc);
        3. Gross energy savings resulting from energy saving policies in place in 2007 and new policies implemented since that date.
    - For the calculation of the reference energy use starting from base year 2007 it is assumed that specific energy use remains constant at 2007 levels for the target years 2008, 2009 and 2010. The calculated savings in this case include:

1. Autonomous energy savings resulting from replacement of capital stock since 2007 etc;
2. Gross energy savings resulting from energy saving policies in place in 2007 and new policies implemented since that date.

- Comparing the calculated savings using base year 1995 and base year 2007 reveals the impact of early savings (see Figure 1).
- Energy savings include the savings on final energy use, i.e.:
    - All energy sold to the final customers (energy behind the meter);
    - For savings on electricity consumption a default factor of 2,5 is used reflecting the estimated 40 % average EU generation efficiency during the target period (EC, 2006).

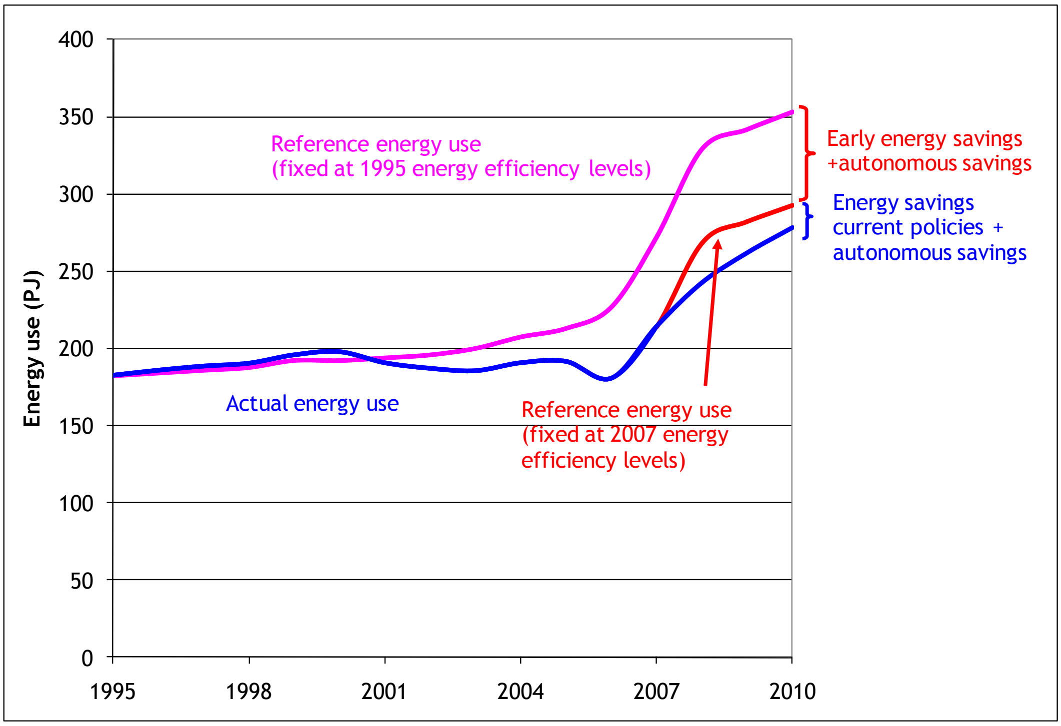

*Figure 1: Graphical presentation on the way the impact of early energy savings is calculated. The pink line represents the reference situation using 1995 efficiency levels, the **red line** represent the reference situation using 2007 efficiency levels. The difference between the pink and **red** line equals the early savings for the target period, whereas the difference between the **red** and **blue** line (actual energy use) equals the energy savings resulting from current and new policies implemented since 2007, and autonomous savings in the period 2007-2010.*

1.4.2 Impact of energy policies

In order to obtain an indication on the contribution of energy efficiency policies towards reaching the indicative target, information was collected on the effectiveness of individual policy instruments or packages of instruments for the horticulture and road transport sector. The focus in analysing the effectiveness of instruments is on instruments in place in 2007 or instruments that have been introduced since then.

2 Horticulture sector

2.1 Introduction to the horticulture sector

Figure 2 provides an overview on the development of some key indicators for the horticulture sector in the Netherlands over the period 1995-2009. The figure shows that installed capacity of combined heat and power installations (CHP) increased significantly since 2003/2004. Specific energy use dropped by almost 30% (this does not include savings by CHP). Production increased by almost 30% and final energy consumption more or less stabilised.

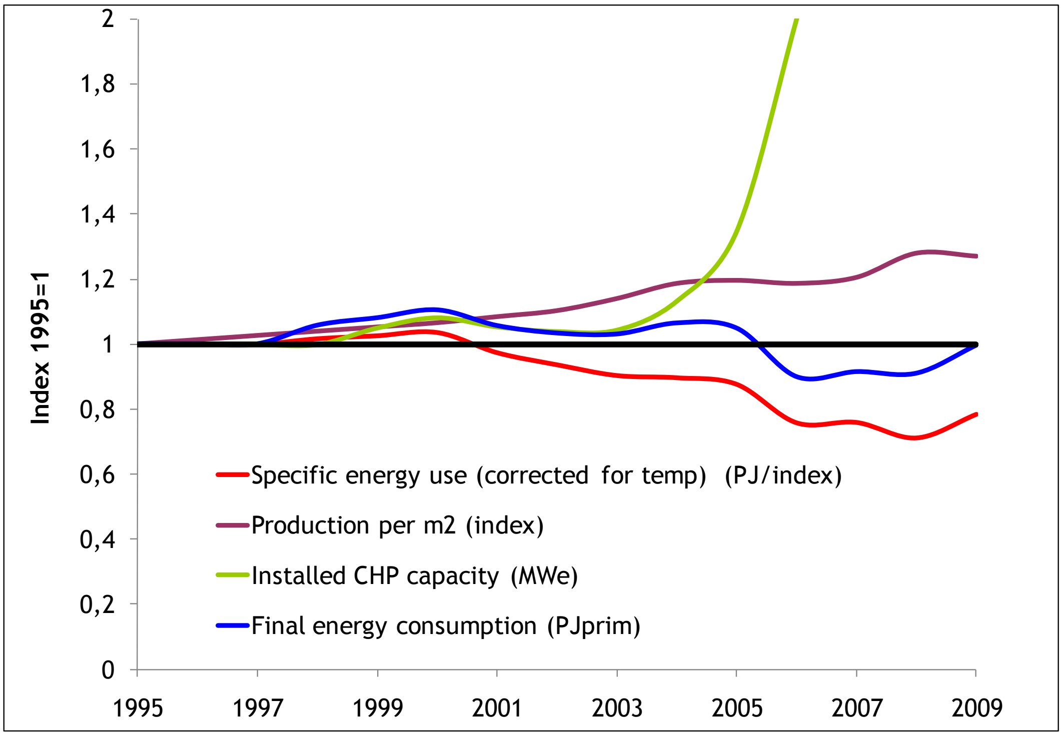

Figure 2: Some key figure on changes in production, energy use, specific energy use and installed CHP capacity in the horticulture sector in the Netherlands for the period 1995-2010. Sources: LEI (2011), CBS (2011a).

2.2 Applied method and assumption

"Early energy savings" are included assuming that all energy efficiency measures that have been implement since 1995 still have an impact in 2008, 2009 and 2010. This seems to be a reasonable assumption since the numbers show that savings are really catching up after 2000 and implemented measures still have an impact in the period 2008-2016.

Within the horticulture sector demand side and supply side efficiency improvements are calculated separately:

- Energy savings on the demand side reflect energy savings by measure leading to a decrease in the amount of energy needed per m^2 or per unit of product;
- Energy savings on the supply side mainly include the introduction of CHP in the horticulture sector leading to a lower primary energy input for heat supplied to the greenhouse.

The following formula is applied to calculate saving for 2008, 2009 and 2010:

***Energy savings** year X =*
***Energy savings demand side** year X **+ Energy savings supply side** year X*

***Energy savings demand side** year X=*
***EEI** 1995 or 2007 ** * Production** year X **- Actual energy use** year X*

Whereby (also see Figure 3):

- EEI (PJ/index) = Final energy consumption / production (index);
- For production volume the production index[2] published by LEI is used (LEI, 2011);
- For final energy consumption (PJ) = (Final elec. Consumption / Efficiency electricity production) + Heat output + Natural gas not applied for CHP + Other fossil fuels + External heat supply[3] + renewables).

In order to be able to calculate the finale energy consumption various statistics had to be combined (see Figure 3):

- Because no numbers were available on the installed amount of CHP prior to 1998 with CBS, it was assumed that CHP capacity and electricity production with CHP in 1995 is equal to 1998 levels. This seems to be a reasonable assumption because investments in CHP are really catching up after 2000;
- For the central electricity production an efficiency of 40% as indicated in the ESD was assumed;
- Primary final energy was corrected for temperature.

[2] Physical production in the horticulture sector is expressed in different unit (kg, pieces, bouquets). LEI therefore developed an index in which these units are summoned indirectly by using the turnover per sector and correct these for annual price differences.

[3] No primary energy use was allocated to heat supplied by external sources. This is in accordance with Annex I of the ESD Directive.

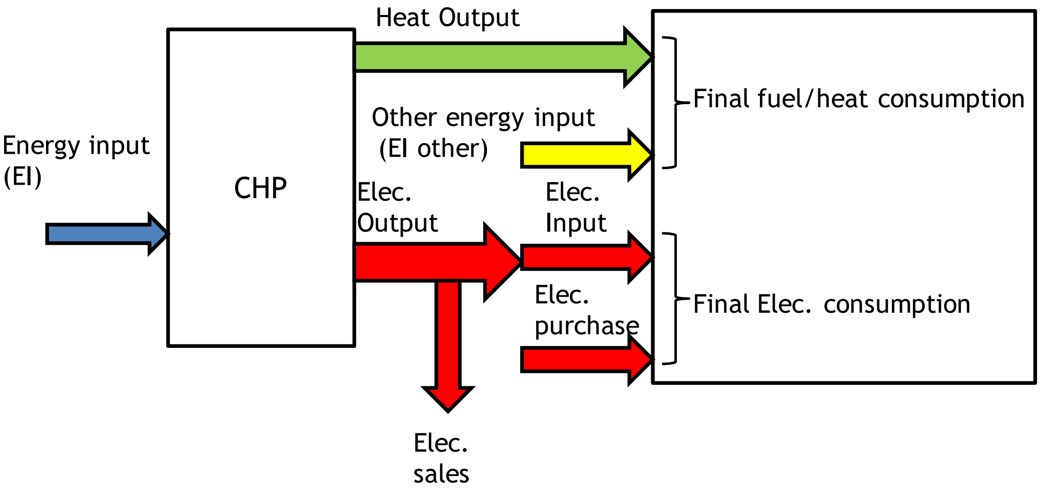

Figure 3: Overview of energy flows for the horticulture sector for which statistics are available.

Energy savings supply side $_{year\ X}$ =
Energy savings by CHP installed since 1995 or 2007

EU guidance states that "the use of combined heat and power and micro appliances in the residential and tertiary sector is an eligible energy efficiency measure, provided that both the heat and the electricity are used *mainly* on site. The same applies to the use of combined heat and power in the ESD industry sector". How "mainly" needs to be interpreted in quantitative term is not clear. The ratio between final electricity consumption and electricity production by CHP varies on an annual basis. Since 2006 the horticulture sector is a net exporter of electricity. However, still main part of the electricity is used by the sector itself, we there included all electricity produced by CHP in our calculations.

There are numerous ways to determine and allocate the energy savings with CHP (Harmelink, 2010). For this project we assumed that in the absence of a CHP installation the heat is produced with a boiler with an efficiency of 90% (Lower Heating Value) and that the electricity is purchased from the grid and produced with an average efficiency of 40%.

Part of the CHP installations is covered by the EU-ETS. Savings with these installations were subtracted from the total savings assuming that the savings run parallel to the fuel input. Corrections were executed using data on CO_2 emissions with CHP installations from the Dutch Emission Authorities (NEA, 2010).

Because no statistics on the actual energy use are available for 2010 estimates were made on the developments for this year. LEI published a report with first indications on the developments in the horticulture sector over 2010 (LEI, 2010b). This provides a scattered picture: in some areas the sector did better than in previous year and in other it did worse. Furthermore no overall production index could be retrieved from this report. It was therefore assumed that production levels stabilised on the level of 2008 and 2009. It is furthermore assumed that energy savings on the demand side do not further increase in 2010, and that additional savings come from a limited growth in installed CHP capacity that is equal to the growth in 2009. This limited growth is in line with the LEI report which states that net electricity will somewhat increase.

2.3 Results bottom-up calculations

Table 2 provides the results of the bottom calculations for the horticulture sector for the years 2007, 2008 and 2009 and an estimate for 2010.

Table 2: Bottom-up final energy savings for the horticulture sector for 2007, 2008, 2009 and an estimate for 2010. Own calculation using information from LEI (2011), CBS (2011a) and NEA (2010).

		2007	2008	2009	*2010*)*
Savings demand side					
Final energy consumption	PJ	125	125	137	
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Relative savings (EEI 1995)	%	32%	45%	41%	42%
Relative savings (EEI 2007)	%	0%	17%	11%	13%

Table 2 shows that compared to 1995 levels energy efficiency for this sector improved by 41-45%. Savings include: autonomous energy savings since 1995, gross energy savings resulting from "early energy saving policies" that still have an impact in the period 2008-2016, gross energy savings resulting from energy saving policies in place in 2007 and new policies implemented since that date. The table also shows that savings on the demand side are decreasing whereas savings on the supply side are increasing. Figure 4 provides a graphical presentation of the results for the period 1995-2010.

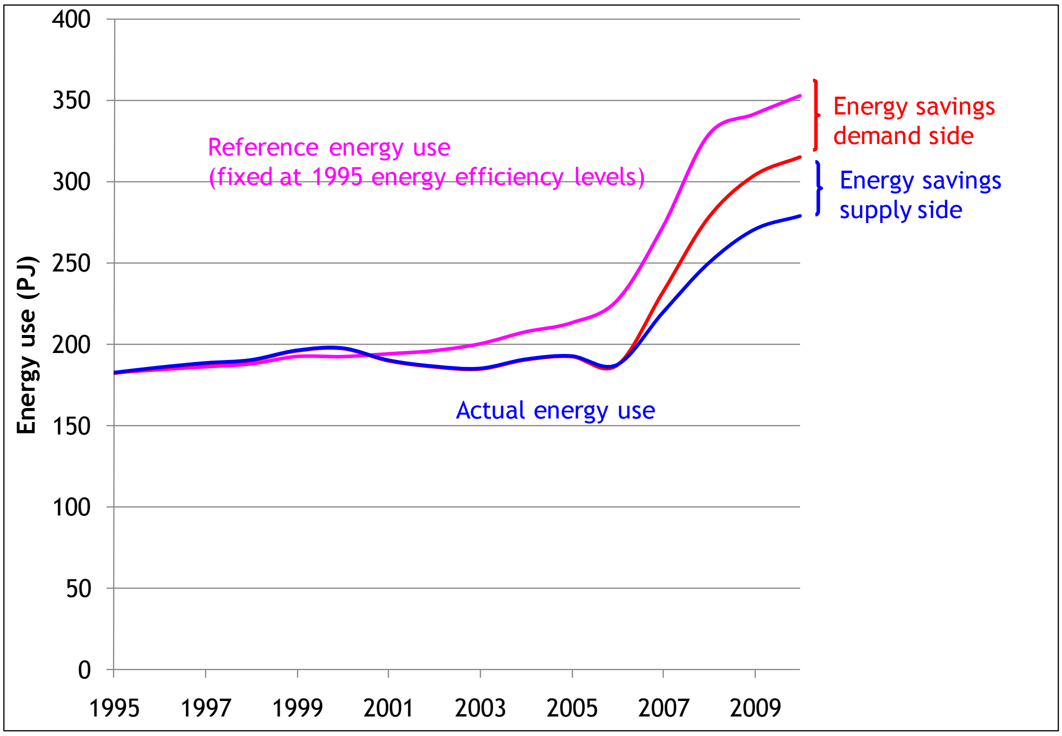

Figure 4: Energy savings due to demand and supply side measure for the horticulture sector for the period 1995-2010. Savings include the impact of autonomous energy savings, early policy and policies implemented since 2007.

Table 2 shows that compared to 2007 levels energy efficiency for this sector improved by 11%-17% (which includes the impact of policies in place in 2007, policies introduced since 2007 and autonomous savings since 2007). The table also shows that savings on the demand side are no longer visible[4] and that all savings are resulting from an increase in CHP.

Figure 5 shows the energy savings for the horticulture sector for the period 2007-2010

[4] The table actually shows "negative savings" for the demand side, but because the savings are surrounded with uncertainties the "negative savings" are probably within the uncertainty range.

with a distinction between early savings (early policies and autonomous savings) and the impact of policies in place in 2007, policies introduced since 2007 and autonomous savings since 2007. The figure shows that major part (72% and 76%) of the calculated savings for 2008-2010 results from early savings.

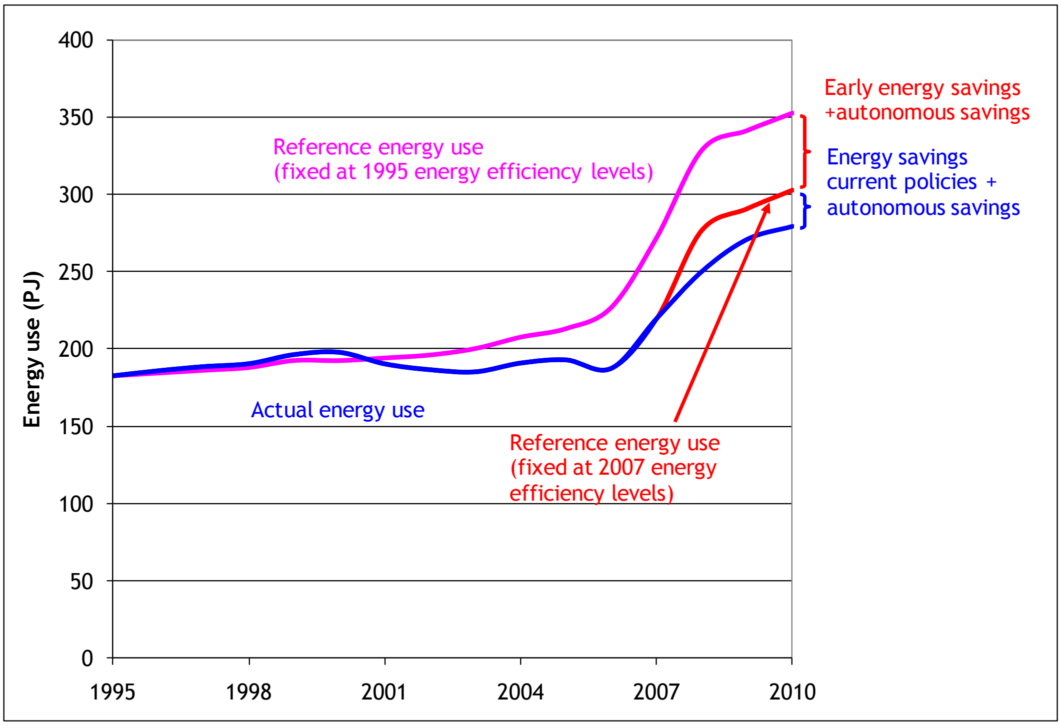

Figure 5: Energy savings for the horticulture sector for the period 2007-2010, with a distinction between early energy savings and impact of policies in place in 2007 and introduced since 2007.

2.3.1 Uncertainty in the presented results

It must be noted that the presented results are surrounded with uncertainties; this means that the results need to be interpreted with care. Main uncertainties derive from the fact that:

- No statistical information is available for 2010. Assumption had to be made regarding production levels, estimated growth of CHP and further increase in efficiency on the demand side. In the current calculations it is assumed that no further savings will be gained on the demand side in 2010 and that CHP will grow with the same pace as in 2009. If it is, however, assumed that installed CHP capacity will not further increase in 2010 the savings for 2010 drop with 1% to 2% points (savings amount to 11%-12% in 2010 instead of 13% compared to the reference energy use).

- Not all numbers are available to complete the electricity balance for the horticulture sector prior to 1998. E.g. numbers on installed amount of CHP and electricity production with CHP is not available with CBS prior to 1998. It is therefore assumed that CHP installed in 1998 was also already in place in 1995. If instead it is assumed that installed CHP capacity in 1995 would be 25% below 1998 levels savings in the target period would drop with 1% to 2% points.

2.4 Impact of policy measures

This section holds an overview of available information on the impact of policy measures. This section concentrates on the policies that were in place in 2007 and have been introduced since then in the horticulture sector. The aim of the analysis in the section is to obtain an indication on the contribution of energy efficiency policies towards reaching the indicative target.

2.4.1 GLAMI covenant

In 1997 the horticulture sector signed a voluntary agreement with the government. The Glasshouse Horticulture and Environmental Covenant (GLAMI, broader than energy) is applicable to glasshouse growers and holds targets for energy efficiency improvements. The sector agreed that in 2010 specific energy use would be 35% of specific energy use in 1980. This resulted in specific energy standards for various crops that are laid down in regulation. The GLAMI covenant expired in 2010, and the energy standards will be replaced with a more flexible CO_2 trading system. This system is currently in the pilot phase[5].

Within the framework of the government programme “Clean and Efficient” (“Schoon en Zuinig”) the sector agreed in 2020 that it would reduce CO_2 emission with 3.3 million tonne in 2020 compared to 1990 levels.

Part of the covenant between the horticulture sector and the government is an agreement about lower energy taxes for this sector. Because the horticulture sector is willing to take on voluntary energy efficiency targets the government applies a lower rate for glasshouse horticulture, flower bulbs and mushroom sectors. This measure allows these industries to enjoy the same benefits as the energy-intensive giant consumers.

[5] http://www.tuinbouw.nl/artikel/co2-sectorsysteem-eu-ets

No recent impact evaluation of the GLAMI covenant is available. Annual progress towards reaching the energy efficiency targets are published by LEI. These numbers were also used for our bottom-up calculations.

The only overall evaluation available is the study executed by the General Accounting Office (Algemene Rekenkamer, 2003) on the impact analysis of energy efficiency policies in the horticulture sector. They concluded that the impact of government policies were not visible in the horticulture sector. Their research method and use of data were highly debated. CPB reviewed their work and concluded that based on the results of their analysis no conclusions could be drawn on policies in the horticulture sector being ineffective (CPB, 2003).

2.4.2 Energy Investment Allowance (EIA)

The Energy Investment Allowance Scheme (Dutch: EIA) is a tax relief programme which gives a direct financial advantage to companies that invest in energy-saving equipment and sustainable energy. Entrepreneurs may deduct 44% of the investment costs for such equipment (purchase and/or production costs) from their company's fiscal profits. Table 3 provides an overview on the total investments by the horticulture sector that applied for IEA support. The table shows that investments that opted for EIA support dropped significantly in 2008 and 2009 compared to the years preceding and that major part of the investments includes CHP installations.

Table 3: Overview of investments that applied for EIA in the period 2006-2010 and an estimate of the gross savings that can be attributed to these measures. Sources: Agentschap NL (2010 b, c), SenterNovem (2007, 2008, 2009)

		2006	2007	2008	2009
Total investments EIA	mln euro	3710	2021	1439	870
Total investment horticulture	mln euro	329	434	234	112
Total investment horticulture in CHP	mln euro	260	306	*165*	60
Cumulative saving by CHP	PJ - low	1	3	3	3
Cumulative saving by CHP	PJ - high	8	19	27	30
Cumulative savings other measures	PJ	0	1	2	2
Total cumulative savings	PJ - low	2	4	4	5
Total cumulative savings	PJ - high	8	20	28	32
Total cumulative savings	GWh - low	532	1048	1223	1392
Total cumulative savings	GWh - high	2312	5564	7852	8798

Table 3 also holds an estimate of the gross energy savings for these investments. “Gross” refers to the fact that the estimated energy savings were not corrected for autonomous energy savings and free riders.

Largest part of the savings comes from investments in CHP. Table 4 provides an overview on the numbers used to calculate the gross savings by CHP. It was assumed that:

- Investments reported for the various power-ranges are equal to the maximum investments for these installations indicated in the Energy list of 2011 (AgNL, 2010b);
- Energy savings per MWe were taken from the results of the bottom-up calculations reported in Table 2. The high range also includes the savings of exported electricity and the lower range does not.
- As we do not know what the distribution is of the investments among the various power ranges we calculated a higher and lower range for the calculations: 1) high range: all investments in CHP are in the power range < 60 kWe, 2) low range: all investments are in the power range > 1 MWe.

Table 4: Overview of numbers used to calculate the gross savings that can be attributed to CHP investments that opted for EIA support. Sources: Agentschap NL (2010 b, c), SenterNovem (2007, 2008, 2009)

		2006	2007	2008	2009
Reported investments CHP	mln euro	€ 260	€ 306	€ 165	€ 60
Maximum investments for installations < 60 kWe	euro/kWe	€ 1.500	€ 1.500	€ 1.500	€ 1.500
Maximum investments for installations 60 kWe-1MWe	euro/kWe	€ 600	€ 600	€ 600	€ 600
Maximum investments for installations > 1MWe	euro/kWe	€ 350	€ 350	€ 350	€ 350
Energy savings - high	TJ/MWe	11	12	17	18
Energy savings - low	TJ/MWe	9	5	2	7
Annual savings -high	PJ	1	1	0	0
Annual savings - low	PJ	8	11	8	3
Cumulative savings -high	PJ	1	3	3	3
Cumulative savings -high	PJ	8	19	27	30
Installed capacity with EIA support < 60 Kwe	Mwe	173	204	110	40
Installed capacity with EIA support 60 kWe-1MWe	Mwe	433	510	275	100
Installed capacity with EIA support > 1MWe	Mwe	743	875	472	171
Saving per euro	Nm^2 / €	0,2	0,1	0,0	0,1
Saving per euro	Nm^2 / €	1,0	1,1	1,5	1,6

Other investments in the horticulture sector include a variety of measure such as energy screens and energy efficient lighting. To get a rough estimate on these savings by these measure we applied the generic criteria on savings by the EIA equalling 0,2 Nm3 per invested euro (which is equal to 6,3 MJ per invested euro).

2.4.3 Renewable energy

Use of renewable energy is stimulated by a variety of policy measures. Table 5 provides an overview of the production of heat and electricity by means of renewable energy sources for the period 2000-2009. The table shows that the use of renewable energy sources is slowly increasing.

Table 5: Use of renewable energy sources in the horticulture sector and associated saving on energy use. Sources: LEI (2011)

		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Saving renewable heat	PJ	0,1	0,1	0,1	0,1	0,1	0,3	0,4	0,6	1,1	1,2
Savings renewable electricity	PJ	0,0	0,0	0,1	0,2	0,3	0,2	0,3	0,4	0,4	0,3
Total savings renewables	PJ	0,1	0,1	0,2	0,3	0,4	0,5	0,7	1,0	1,5	1,6
Total savings renewables	GWh	28	28	58	89	114	130	198	286	414	434

3 Road transport sector

3.1 Introduction to the transport sector

Table 6 provides an overview of the energy use for road and other transport modes in the Netherlands for the period 1995-2009. The table shows that energy use for transport increased with 15% in this period and that energy use for road transport consumes 75% of all energy use for this sector. The analysis in this chapter is therefore limited to road transport.

Table 6: Energy use for road transport and other transport modes. Source: PBL (2011a).

		1995	2000	2005	2008	2009
Energy use road transport (passenger and freight transport)	PJ	351	386	409	428	426
Energy other transport modes (rail, shipping, avaition, mobile tools)	PJ	130	145	154	157	136
Total energy use	PJ	481	531	563	585	562

Figure 6 provides an overview on the development of some key indicators for the road transport sector in the Netherlands over the period 1995-2009. The most important indicator for the traffic performance of passenger cars, vans and auto busses closely link to energy use is the amount of km driven. For freight transport the traffic indicators most closely linked to energy use is the amount of ton.km.

Figure 6 shows that the volume of road freight transport (in terms of ton.km) and passenger cars + other road transport (vans and auto buses) increased significantly over the period 1995-2009.

Specific energy use dropped only slightly for passenger cars + other road transport. This is mainly due to the fact that people started driving bigger and heavier cars , which offset efficiency improvements achieved by car manufacturers. In the last couple of year average CO_2 emissions per km of new sold cars in decreasing significantly (RDC, 2011) but this is not yet visible in the overall energy efficiency numbers.

Specific energy use for freight transport increased by almost 15%. This 15% is in line with the conclusion from KIM in a special report on freight transport were they concluded that specific CO_2 emissions decreased with about 1% per year, which is mainly due to the use of larger vehicles (KIM, 2009).The figure also reveals that efficiency for freight transport seems to have worsened in the last couple of years.

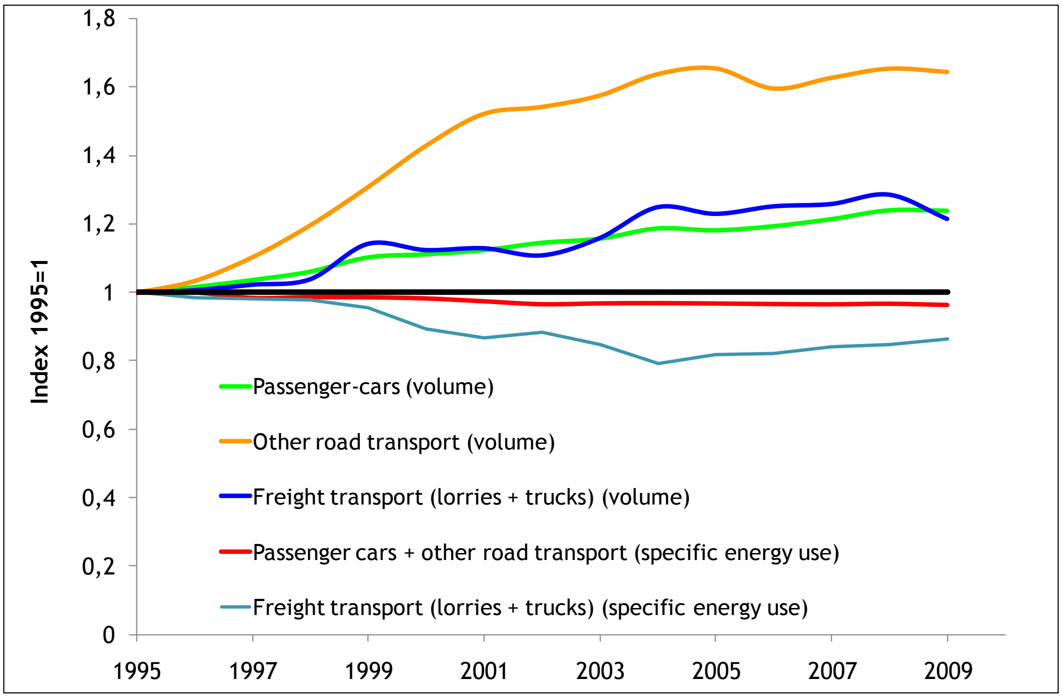

Figure 6: Some key figure on changes in volume and specific energy use for road transport in the Netherlands for the period 1995-2010. Sources: PBL (2011b), KIM/CBS (2011).

For this sector two methods were applied

1) A top-down method for the total transport sector taking data from CBS.
2) A bottom up approach for the passenger cars mainly based on sales data from RDW.

3.2 Assumptions ***top-down*** method

For the top-down method data on the final sales of transport fuels are combined with data on traffic performance. The results are presented on a rather aggregated level because a further detailing of the results towards subcategories would not provide useful results. The following approach is applied:

- "Early energy savings" are included assuming that all energy efficiency measures that have been implement since 1995 still have an impact in the year 2008, 2009 and 2010. This is a reasonable assumption because the average age for passenger cars when scrapped in 2008 and 2009 was over 16 year (Bovag, 2011). For freight transport also an average lifetime of 15 for vehicles was assumed.
- The following formula is applied to calculate saving for 2008, 2009 and 2010:

Energy savings road transport $_{year\ X}$ =
Energy savings passenger transport $_{year\ X}$ + ***Energy savings freight transport*** $_{year\ X}$

Energy savings passenger road transport $_{year\ X}$ **=**
EEI $_{1995}$ **** Traffic performance*** $_{year\ X}$ ***- Actual energy use*** $_{year\ X}$

Whereby:

- EEI (PJ/index) = Final energy sales / km driven
    - For passenger road transport a distinction is made between passenger cars and other transport, which includes auto buses and vans (mopeds and motorcycles were neglected because they only have a very limited share in total energy use).
    - Traffic performance is the amount of km driven by these categories.

Energy savings freight road transport $_{year\ X}$ **=**
EEI $_{1995}$ **** Traffic performance*** $_{year\ X}$ ***- Actual energy use*** $_{year\ X}$

Whereby:

- EEI (PJ/index) = Final energy sales / ton.km.
- Only data are available on the final energy sales. As mentioned in the introduction to this section no data are available on the actual energy consumption for all kilometres driven within the Netherlands. Final energy sales does not correct for border effects: energy sold in the Netherlands but consumed abroad and vice versa. This can have a substantial impact on the calculated savings (PBL, 2011c).
- No data are available for 2010 an estimate was made assuming:
    - For the categories "passenger cars and other road transport" the growth in traffic performance (number of km driven) is levelling off in the last couple of years. The 3 year average for 2007, 2008 and 2009 is taken as an estimate for 2010, and it is assumed that the specific energy use in 2010 is equals to the specific energy use in 2009.
    - For the freight transport sector the same approach is followed. However, it must be noted that the assumption regarding the development in ton.km is surrounded by large uncertainties because this sector suffered seriously from the economic downturn.

3.3 Results *top-down* method

Table 7 provides the results of the bottom calculations for road transport for the years 2007, 2008, 2009 and an estimate for 2010.

Table 7: Top-down final energy savings for the road transport sector for 2007, 2008, 2009 and an estimate for 2010. Own calculations using information from: KIM/CBS (2011), PBL (2011).

		2007	2008	2009	*2010*)*
Reference energy use (EEI-1995)	PJ	427	436	430	428
Actual energy use	PJ	400	409	404	403
Saving passenger + other road transport (EEI 1995)	GWh	3.277	3.174	3.479	*3.310*
Saving freight road transport (EEI 1995)	GWh	4.402	4.341	3.595	*3.595*
Saving passenger + other road transport (EEI 1995)	PJ	12	11	13	*12*
Saving freight road transport (EEI 1995)	PJ	16	16	13	*13*
Total savings (EEI 1995)	GWh	7.679	7.515	7.074	*6.905*
Total savings (EEI 1995)	PJ	28	27	25	*25*
Relative savings (compared to reference energy use)	%	6%	6%	6%	*6%*
		2007	**2008**	**2009**	***2010*)***
Reference energy use (EEI-2007)	PJ	400	408	402	401
Actual energy use	PJ	400	409	404	403
Saving passenger + other road transport (EEI 2007)	GWh	0	-169	142	*-9*
Saving freight road transport (EEI 2007)	GWh	0	-156	-655	*-655*
Saving passenger + other road transport (EEI 2007)	PJ	0	-1	1	*0*
Saving freight road transport (EEI 2007)	PJ	0	-1	-2	*-2*
Total savings (EEI 2007)	GWh	0	-325	-513	*-664*
Total savings (EEI 2007)	PJ	0	-1	-2	*-2*
Relative savings (compared to reference energy use)	%	0%	-1%	-2%	*-3%*
**) Estimate*					

The upper part of Table 7 provides the results of the bottom calculations for the road transport sector and shows the savings compared to the reference energy use fixed at 1995 levels, which means that early savings (autonomous savings + impact of early energy savings policies) are included in the results. Compared to the reference energy use the actual energy use decreased by 6%. Absolute savings for passenger cars + other road transport and freight transport are almost identical, in relative term there is a significant difference as energy consumption for passenger cars + other road transport is much larger than for freight transport. Relative savings for passenger + other transport are between 3% and 4% in the target period, whereas the savings for freight transport range from 14% to 16%. Figure 7 provides a graphical presentation of the results for this period.

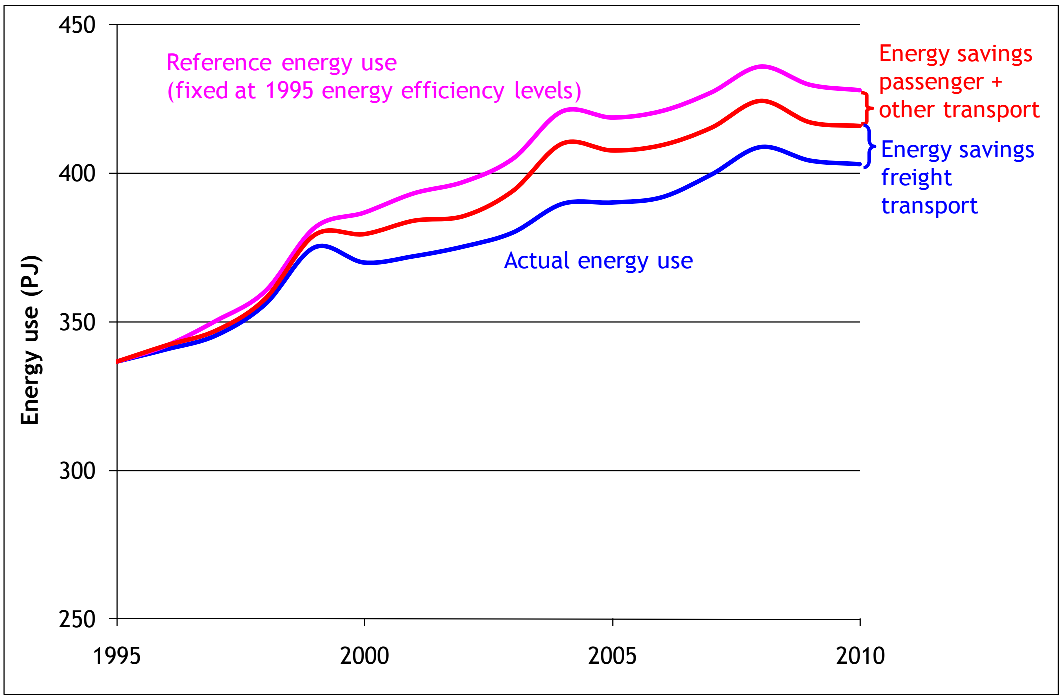

Figure 7: Energy savings for road transport with a distinction between savings for passenger cars + other transport and freight transport for the period 1995-2010. Savings include the impact of autonomous energy savings, early policy measures and policies implemented since 2007.

The lower part of Table 7 shows the savings compared to the reference energy use fixed at 2007 levels, which means that the impact of policies in place in 2007, policies introduced since 2007 and autonomous savings since 2007 are included in the results. The table shows that no saving can be observed for this period[6]. This means that all savings calculated for the target period are the impact of autonomous savings and “early energy saving policies”.

3.3.1 Uncertainty in the presented results

It must be noted that the presented results are surrounded with (substantial) uncertainties; this means that the results need to be interpreted with care. Main uncertainties derive from the fact that:

- In general road statistics are surrounded by substantial uncertainties (such as the earlier mentioned boarder effects for fuel sales but also the calculations regarding ton.km for freight transport). It, however, goes beyond the scope of this project to

[6] The table actually shows “negative savings” for the transport sector, but because the savings are surrounded with uncertainties the “negative savings” are within the uncertainty range.

make an estimate of the order of magnitude of the uncertainties on the outcome of our calculations.

- No statistical information is available for 2010. Assumptions are made regarding traffic performance and efficiency improvements. In the current calculations it is e.g. assumed that efficiency will not improve for passenger cars + other road transport. If it is assumed that due to policy measures introduced in the Netherland the energy-efficiency of passenger cars improved in 2010 with 1%, the savings in 2010 compared to 1995 efficiency levels for the whole road transport sector would increase with 1%-point (savings would be 7% instead of 6% compared to the reference energy use in 2010).

3.4 Assumptions ***Bottom-up*** method.

The bottom-up approach is limited to passenger cars. In the bottom-up approach the following data are combined:

1) the annual sales of passenger cars;
2) data on the average distance travelled by passenger cars;
3) The average specific energy use (CO_2 emissions) per car measured in the standard test cycle (i.e. the EU-norm data published by the manufacturers).

Data on the average CO_2 emission per km of cars is available since 2001, because from this year all new passenger cars need to have an energy label. This impact was calculated assuming that:

- In the reference situation the reported standard test data on CO_2 emissions per km driven for new sold cars remains constant at 2001 levels.
- The average amount of km driven by these new cars equals the average amount of km driven by all passenger cars in the Netherlands.

3.5 Results ***Bottom-up*** method.

Table 8 provides an overview of the calculated impact on the shift in energy labels since 2001. Since 2001 a shift can be observed towards cars with a lower energy label (A, B and C). This trend has accelerated over the last couple of years when fiscal measures (private motor vehicle tax, tax income increase for leased cars, scrapping scheme) were adapted to stimulate the purchase of passenger cars with low CO2 emissions per km. The calculated savings accumulate to approximately 6% in 2010 compared to the reference energy use, which is equal to 2440 GWh in 2010.

Table 8: Impact of shift in energy labels since 2001. Sources: KIM/CBS (2011), BOVAG (2010), PBL (2011a), RDC (2010)

Impact of shift in labels since 2001		**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Annual new sales	number	528.745	507.091	486.885	480.901	460.021	481.610	498.172	493.465	386.000	483.186
Share A-label	%	0%	3%	1%	1%	4%	6%	6%	12%	25%	
Share B-label	%	16%	16%	14%	15%	23%	16%	17%	31%	40%	
Share C-label	%	47%	40%	45%	44%	40%	40%	36%	28%	19%	
Share D-label	%	22%	27%	23%	24%	21%	25%	26%	20%	11%	
Share E-label	%	10%	9%	11%	10%	8%	8%	9%	6%	4%	
Share F-label	%	3%	4%	4%	4%	3%	3%	4%	2%	1%	
Share G-label	%	2%	2%	2%	2%	2%	2%	2%	1%	1%	
Cumulative new sales since 2001	number	528.745	1.035.836	1.522.721	2.003.622	2.463.643	2.945.253	3.443.425	3.936.890	4.322.890	4.806.076
CO2 emissions per km new sold cars	gr/km	174	173	173	171	170	166	164	157	147	139
Total number of passenger cars in NL	number	6.539.000	6.710.000	6.855.000	7.151.000	7.299.000	7.256.000	7.413.000	7.597.000	7.756.800	7.776.000
Km driven by all passengercars in NL	mln km	92.189	93.944	94.924	97.379	96.930	97.903	99.601	101.695	101.608	100.968
Average annual km per passenger car	km	14.098	14.001	13.847	13.618	13.280	13.493	13.436	13.386	13.099	12.985
Energy use -reference case	PJ	18	35	50	65	78	95	110	126	135	149
Energy use - actual	PJ	18	34	50	65	77	93	108	122	129	140
Savings	PJ	0	0	0	1	1	2	2	4	6	9
Savings	GWh	0	41	59	143	246	445	690	1.118	1.616	2.440
Relative savings	%								3%	4%	6%

It must be noted that the results do not reflect the actual impact (effectiveness) of labelling and other policy instruments linked to the labelling system as the results do not included autonomous improvements.

3.5.1 Uncertainty in the presented results

The results are surrounded by uncertainties that on the one hand lead to an overestimation of the savings and on the other hand to an underestimation of the results:

- The impacts were calculated using standard test data (i.e. the EU-norm data published by the manufacturers). Actual energy use can be higher than the report standard test data. Recent research shows that differences can be substantial; actual use is between 13% and 42% higher than the norm data, with the biggest differences observed for the most energy efficient cars (norm 100 gr CO_2/km) (TNO, 2010). This would imply that our calculations overestimate the savings.
- Impacts were calculated assuming that the average mileage for new sold cars is equal to the average mileage for all cars in the Netherlands. It is well possible that the amount of km driven by new cars sold is higher (e.g. because of high share of lease cars). This is leading to an underestimation of the calculated savings.

3.6 Impact of policy measures

This section holds an overview of available information on the impact of policy measures. This section concentrates on the policies that were in place in 2007 and have been introduced since then in the road transport sector. The aim of the analysis in the section is to obtain an indication on the contribution of energy efficiency policies towards reaching the indicative target.

The NEAP for the Netherlands (MinEZ, 2007) holds a long list of policy measures, which were taken from the work programme "Schoon en Zuinig" (Clean and Efficient) (Min Vrom, 2007). Not all these policy measure have actually been implemented. Our analysis focuses on policy measure that are actually implemented and for which impact assessments were carried out.

3.6.1 Private motor vehicle and motorcycle tax (BPM) (passenger cars)

The Private motor vehicle and motorcycle tax (Dutch: BPM) is a tax levied on the purchase of new cars. On 1 July 2006 a new Private Motor Vehicle & Motorcycle Tax regulation (bonus-penalty scheme) came into place aimed at stimulating the uptake of more energy efficient cars. Each new passenger car could receive a reduction on the BPM depending on the car's energy label. The aim of the scheme was to reward the most energy efficiency cars in their class size with a bonus (A- and B-label cars) on the BPM and to penalise relatively inefficient cars with a surcharge on the BPM (D to G label cars). Various studies were performed on the impact of this bonus-penalty system:

- CE carried out an evaluation based on sales data for the period 2004-2007. They concluded that the bonus-penalty scheme led to an efficiency improvement in this period with *new* passengers cars between 0,3% to 0,5% (CE, 2008).
- PBL executed a stated preference survey in which consumer choice behaviour was investigated for the non-commercial market. They concluded that energy savings with passenger cars can only for a limited extent be attributed to the bonus-penalty scheme in place since 2006. Of the observed efficiency improvements with *new* passenger cars of approximately 1% per year since 2001, about 0,2% can be attributed to the bonus-penalty scheme (PBL, 2009).

In 2008 the scheme was adapted by increasing the bonuses and penalties and introducing an additional tax for very energy inefficient cars. In both evaluations the impact of changes made to the scheme in 2008 were not accounted for. No evaluations are available for the last couple of year. What however can be observed is that the share of relatively energy efficient cars grew rapidly in 2008 and 2009. The market share of relatively fuel-efficient passenger cars (with A or B energy) increased significantly (see Figure 8). It must however be noted that this shift towards energy efficient cars cannot be solely attributed to the impact of the bonus-penalty scheme. One of the reasons for a further increase in A and B labels cars was that energy labels were not tightened in 2008 and 2009, resulting in an increase in the number of new cars with an A and B label.

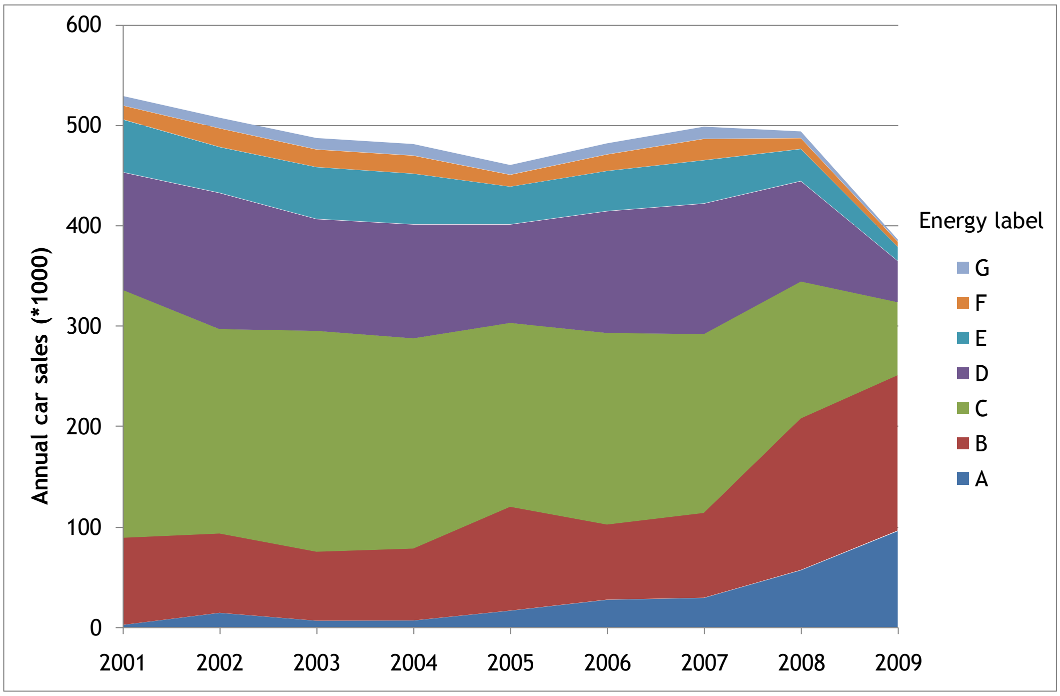

Figure 8: Annual sales of passenger cars for the period 2001-2009 broken down into energy labelling categories. Source: RDW (2010)

Starting in 2010 the scheme is changed into a system in which the level of BPM depends on the absolute CO_2 emissions per km of a car. From 2012 the BPM will only depend on the absolute CO_2 emission per km of a car. Because of the recent introduction of this scheme it is hard to tell what the impact is, and if this is leading to a further acceleration of the uptake of more energy-efficient cars. What can be observed is that the average CO_2 emission per km of new sold cars is continuously decreasing since 2007. In the third quarter of 2010 average emissions of new sold cars was 135 gr CO_2 per km (see Figure 9). It must be noted that these numbers refer to the emissions in the test cycle and not to the actual CO_2 emissions per km (RDC, 2010).

Figure 9: CO_2 emissions per km for new sold cars in the Netherlands in the period 2007-1010. Source: (RDC, 2010).

3.6.2 *Income tax increase for leased cars (passenger cars)*

In the Netherlands leased cars, which are also used for the private purposes of the employee, are seen as part of the income. The employee must pay income tax over cost price including tax. Since 2008 the systems is designed in such a way that car drivers with a lease car are fiscally encouraged to obtain an energy efficient car. This differentiation has influence to shift towards the lease of cars with lower CO_2 emissions per km (see Figure 10).

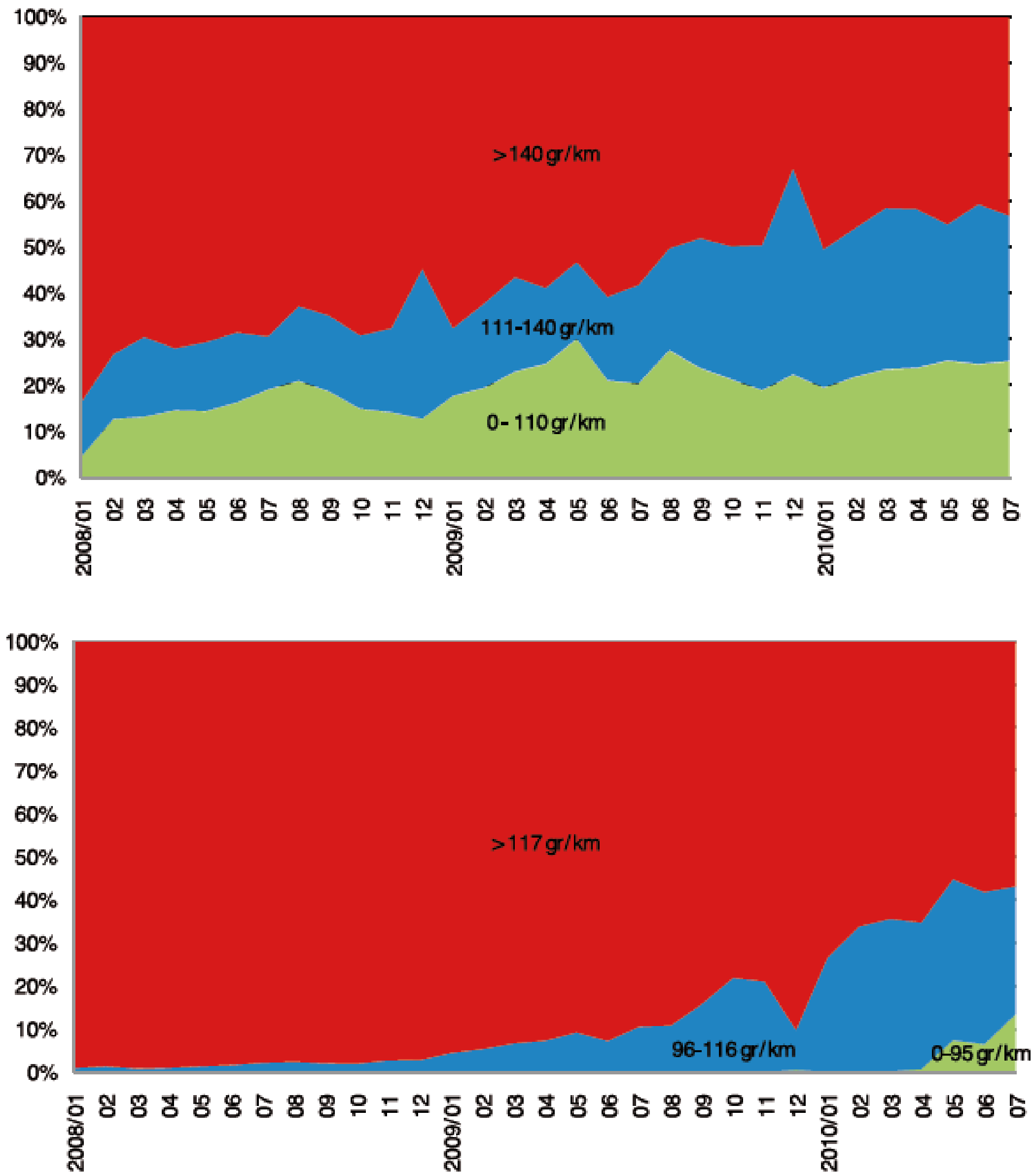

Figure 10: Share of various CO2 classes for the income tax in share of new sold lease cars. Top picture: petrol cars, lower picture: diesel cars (excluding diesel). Source: RDC (2010).

3.6.3 Fuel Taxes (passenger and freight transport)

Fuel tax is a tax included in the price of both petrol and diesel and is levied per litre. This is the most important policy instrument to influence variable car expenses in the Netherlands. What can be concluded that in the absence of these levies energy consumption for transport would have been higher. An international literature survey shows that (PBL, 2010):

- The long term fuel demand for passenger cars is relatively sensitive for changes in the fuel price, with elasticity's between -0,6 and -0,8 (i.e. when fuel prices increase with 10% energy use decreases on the long term with 6-8%). These changes are resulting from changes in car ownership, number of km driven and fuel efficiency of cars. The short term elasticity's are much lower, between -0.2 and -0.3. It must be noted that drivers with a lease cars are less sensitive to changes in fuel prices as their employer is usually paying the fuel bill.
- The long term fuel demand for freight transport is relatively sensitive for changes in the fuel price as well, with elasticity's between -0.6 and -0.9. The researches, however, notice that empirical evidence for freight transport is weaker than for passenger transport.

Figure 11 provides an overview on the level of the levies on petrol and diesel in the period 1995-2010 in nominal prices (i.e. the levies are not corrected for inflation).

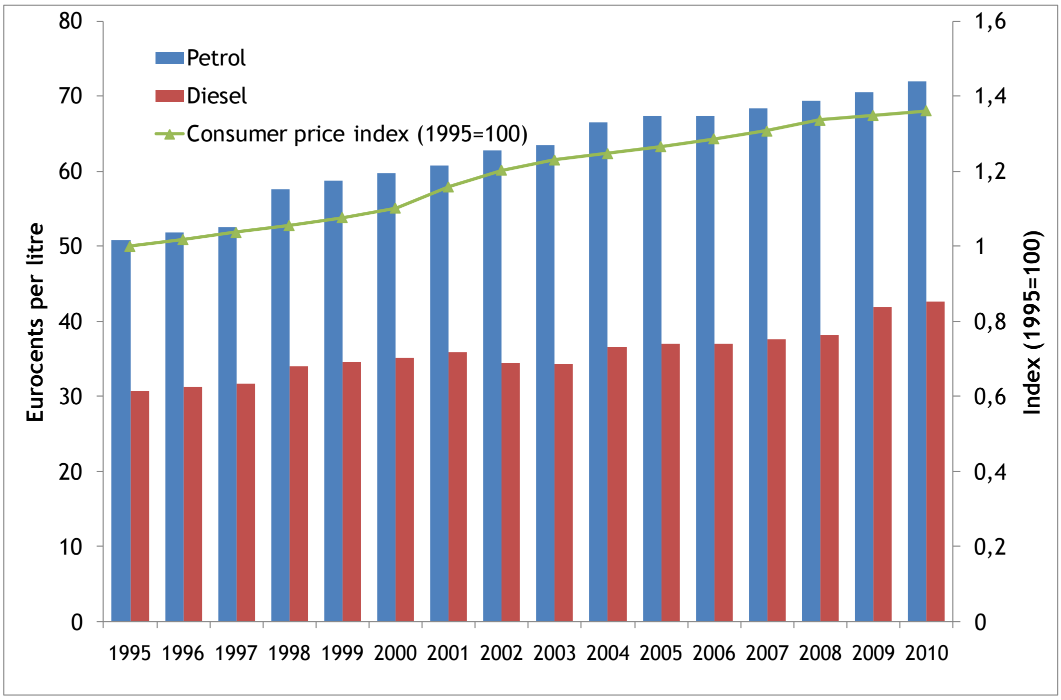

Figure 11: Levies on petrol and diesel in the Netherlands in the period 1995-2010 (nominal prices) and development in consumer prices. Source: BOVAG (2010), CBS (2011b).

The figure shows that the levies increased on average with 2% per year, which equals the increase in consumer prices which was also on average 2% per year in this period. This means that in real terms the fuel tax did not increase since 1995 and no impact can be observed from this policy measure. The current level of the taxes in 2010 amount to 280 euro per tonne of CO_2 and 170 euro per tonne of CO_2 for diesel.

3.6.4 Scrapping scheme (passenger transport)

In the period from May 2009 until April 2010 a temporary scrapping scheme was in place in the Netherlands. Within this scheme owners of relatively old cars and vans received a premium ranging from 750 and 1750 euro if they scrapped their vehicle and bought a newer one. A newer petrol vehicle was defined as a vehicle which was put on the market in 2001 or later. A newer diesel vehicle was defined as a vehicle equipped with a particle filter.

As a result of the scrapping scheme 75.000 passenger cars were taken off the road that would not have been taken off in the absence of the scheme. On average the cars were taken off one year in advance, this means that impacts on emission reductions and energy savings are visible one year earlier. As a result of the scheme CO_2 emissions decreased between 0,006 and 0,010 million tons of CO_2 per year as of 2010, which corresponds to ~0.1 PJ (Mu Consult, 2010). It must be noted that the primary aim of the scheme was to reduce emissions affecting local air quality; it was not specifically aimed at reducing CO_2 emission or improving energy efficiency.

3.6.5 Energy labelling of new cars (passenger transport)

Since 2001 all new passenger cars need to have an energy label. The label provides information about the energy consumption and CO_2 emissions of the car. Passenger cars with an A label are the most fuel-efficient cars. Cars with a G label are the least fuel-efficient. Cars with a C or D label have average fuel consumption for their size.

An evaluation by PBL shows that the impact of the label as such is limited when people need to make a choice for a new car, and that the impact cannot be quantified. The price of a car, reliability and comfort are the most important aspects when buying a new car. A distinction can be made between person buying an A-label and persons buying a G-label car. For the first category 75% stated that the label was important, whereas for the G-label 75% stated that the label was *not* important (PBL, 2009).

3.6.6 European CO_2 standards for cars (passenger transport)

In 1998, a voluntary agreement was concluded between the European Commission and the ACEA, JAMA and KAMA that the average CO_2 emissions from passenger cars sold on the European market would be 140 gram CO_2/km in 2008/2009. In 2009 a European

Directive was adopted which regulates CO_2 emission of light-duty vehicles and aims for an average emission of 130 gram CO_2/km for new sold cars (EC, 2009).

The separate impact of this voluntary agreement is hard to give. According to CE (2008) results from available evaluation studies show either no impact (because efficiency improvement do not go beyond the efficiency improvements observed before the introduction of the covenant) or the results are surrounded by large uncertainties. Their own estimate results in an impact over the period 1999-2006 between 0 and 0.3 million tons of CO_2.

3.6.7 'Eco-Driving' programme (passenger and freight transport)

Since 1999 an Eco-Driving programme is in place in the Netherlands. The Dutch Ecodriving programme 'Het Nieuwe Rijden' is focused on creating the necessary conditions and organisational structures that facilitate more energy-efficient purchase and driving behaviour, with the objective of reducing CO_2 emissions. The programme includes a whole range of communication and training activities, next to financial incentives. Financial incentives included amongst others between May 2000 and January 2005 a national tax exemption scheme for the purchase of fuel-saving in-car devices. The Eco-Driving programme interacts with other policies to increase the energy efficiency of cars on a consumer level such as the labelling of cars and fiscal measures (purchase behaviour) and taxes on car fuels (driving behaviour).

The Eco-Driving programme is thoroughly monitored on an annual basis. The annual monitoring report holds estimates on the impact of the programme on energy use and CO_2 emissions. Figure 12 provides the latest results on the impact on CO_2 emissions of 3 different elements that are part of the Eco-Driving programme (I&O Research,2010). The results in Figure 12 are corrected for overlaps between the different elements of the programme (e.g. the impact of fuel saving in-car devices overlaps with applying energy efficient driving techniques).

Most recent monitoring results show that the impact of Eco-Driving on the reduction of CO_2 emissions in the Netherlands decreased in 2009. Particularly the impact of checking tyre pressure decreased, whereas a slight increase in the effect of in-car devices was observed. Total impact on energy use in 2008 and 2009 was estimate to be respectively 8.2 PJ and 5.5 PJ. In 2009 about 25% of the saving were realised with freight transport and the main part with passenger transport. It must be noted that the report explicitly states that the estimated impacts cannot be directly linked to the outputs of the Eco-Driving programme itself, but are estimated impacts of the various elements that are part of the Eco-Driving programme.

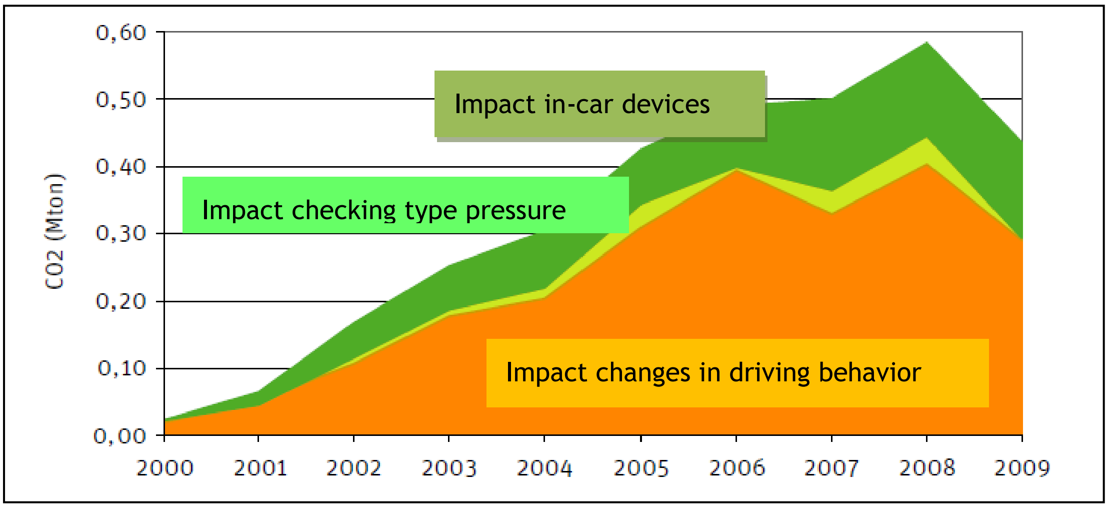

Figure 12: Estimated CO_2 reduction impact for the period 2000-2009 for 3 different elements that are part of the Dutch Eco-Driving programme. Source: I&O Research (2010).

It must be noted that calculations of the impact of Eco-Driving are surround with significant uncertainties. This is due to the fact that a large number of assumptions need to be made e.g. on the actual changes in behaviour, the persistence of new behaviour and free riders. In an article by Harmsen et al (2007) an attempt was made to estimate lower and upper boundaries on the impact of the Eco-Driving programme for the period 1999-2004. They estimated energy savings for the programme ranging from 1.3 – 3.0 PJ in 2004, whereas the annual report estimated the saving at around 5 PJ. We therefore estimate the impact of the programme to be between 1,4 and 3,3 PJ in 2010 (see Table 9).

Table 9: Estimated impact of the Ecodriving programme in the Netherlands. Own calculations based on: I&O Research (2010), Harmsen et al (2007).

		2007	2008	2009	2010
Impact Ecodriving: High estimate	PJ	4,9	4,9	3,3	3,3
Impact Ecodriving: High estimate	GWh	1370	1370	913	913
Impact Ecodriving: Low estimate	PJ	2,1	2,1	1,4	1,4
Impact Ecodriving: Low estimate	GWh	594	594	396	396

3.6.8 Energy Investment Allowance (freight transport)

Energy Investment Allowance (Dutch: EIA) is a tax relief programme which gives a direct financial advantage to companies that invest in energy-saving equipment and sustainable energy. Entrepreneurs may deduct 44% of the investment costs for such equipment (purchase and/or production costs) from their company's fiscal profits, over the calendar year in which the equipment was purchased.

In 2009 approximately 11,150 EIA applications were submitted, which account for € 870 million of investments in energy savings measures. The number of applications for investment in freight transport was about 500, involving approximately € 30 million of investment. For 2006, 2007 and 2008 investments amounted to 34, 57 and 50 million euro respectively. These include investments in: valance for trucks, headboard or windshield spoiler, intermodal chassis for trucks, pressure (control) system, and lightweight aramid reefer container (AgNL, 2010a).

According to the energy list that is published each year the energy savings criteria for granting EIA in transport should range from 0,2 Nm^3-0,8 Nm^3 per invested euro (AgNL, 2011b). Applying these generic numbers leads to gross saving (i.e. not corrected for free riders) between 0.2 PJ and 0.8 PJ. In the past various studies have been executed on the share of free riders for the EIA. In order to get the net impact these numbers need to be corrected for the share of free riders. The most recent impact evaluation of the EIA by SEO shows a range for the share of free riders between 25% and 70%, depending on the type of technique (SEO, 2007).

3.6.9 Subsidy scheme CO_2 reduction transport (passenger and freight transport)

Until 2007 the subsidy scheme CO_2 reduction transport sector provided subsidies to companies and organisations carrying out projects to reduce CO_2 reduction in transport. The scheme consisted of two programmes, one for freight traffic and one for transport of passengers. Projects for freight transport include: 1) improving efficiency of logistics, 2) stimulating modal shift and 3) cleaner technologies. Projects for passenger transport include: 1) clean technology and vehicles, 2) transport efficiency, and 3) alternatives for the private car (AgNL, 2011a).

3.6.10 Voluntary agreement with the Dutch railways (passenger transport)

Since 1999 a Long Term Voluntary Agreement (LTA) is in place between the Dutch government and the Dutch Railways. Targets for the period 1997-2010 are to improve the energy efficiency with 20% in 2010 compared to 1997, and to increase the share of renewable energy to 5%. Table 10 provides an overview of the reported savings resulting from process efficiency and energy management measures. The table shows that main part of the savings was achieved in the period prior to 2007 and that they slowed down in the last couple of years.

Table 10: Reported energy savings by the Dutch railways reported under their LTA for the period 2001-2009. Source: AGL (2010b).

		2007	2008	2009
Total savings (process efficiency + energy management)(2001-2009)	PJ	1,475	1,479	1,482
	GWh	410	411	412

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