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Progress of German climate change policies until 2020

"Report of the German Government for the assessment of projected progress in accordance with the implementation of the Kyoto Protocol - reporting in compliance to article 3(2) EU Directive 280/2004"

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pursuant to implementationof the Kyoto Protocol – report pursuant to Article 3 (2)

Final version

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1 Introduction

1.1 Policies and measures of the Federal Republic of Germany for limiting greenhouse-gas emissions

The Federal Government was early in developing a comprehensive climate-protection strategy. By resolution of 13 June 1990, the "CO_2-Reduction" Interministerial Working Group (IWG) was established, under the direction of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU). This working group's tasks include developing guidelines for policies and actions relative to climate protection, identifying needed action, highlighting potential for reducing greenhouse-gas emissions and proposing, to the Federal Cabinet, comprehensive packages of measures for reducing greenhouse-gas emissions in Germany.

The "CO2-Reduction" IWG has submitted a number of reports to the Federal Cabinet on Germany's national climate-protection strategy. It made such submissions in November 1990, December 1991, September 1994, November 1997, October 2000 and July 2005. And it has been continuing its work in this area.

The main pillars of Germany's national climate-protection strategy include saving energy, improving energy efficiency, achieving a balanced mix of energy sources and expanding use of renewable energies. These emphases are contributing to the achievement of a sustainable energy supply.

Germany's national climate-protection programme has a sectoral approach. This means that it considers climate-protection requirements, and the impacts of climate-protection measures, in terms of separate economic sectors: industry, the energy sector, commerce/trade/services, private households and transport.

In the framework of burden sharing within the EU, and on the basis of obligations arising from the Kyoto Protocol, Germany has committed to reducing its greenhouse-gas emissions by 21 percent by 2008-2012, with respect to the relevant emissions levels in 1990, the base year. The Federal Government plans to achieve this target by implementing, and increasing use of, climate-policy instruments and measures. There are no plans to use public funds to purchase emissions allowances as a means of achieving the Kyoto target.

1.2 Methodological approach

The present report is based on a combination of model calculations made, within the "Policy Scenarios IV" ("Politikszenarien IV") project, by a consortium of German research institutes working under commission to the Federal Environmental Agency (UBA) and the Federal Ministry for the Environment, Nature Conservation and Reactor Safety (BMU).[1] The Federal Government has compared these model calculations with other findings regarding the impacts of climate-protection measures and instruments, has adapted the calculations with regard to certain aspects and has expanded the calculations to include additional information. Where such adaptations or additions have been made, the texts cite the relevant sources. All information provided without any source citations originates from the aforementioned model calculations. At the same time, it is important to note that the Federal Government does not automatically endorse results of scenario and forecast studies that it has commissioned or that other parties have presented – although it does take account of such results within its own considerations.

The focuses of the model calculations carried out within the Policy Scenarios IV project include energy-related CO_2 emissions, since such emissions account for some 80 % of greenhouse-gas emissions in Germany. The results of the energy-sector reference forecast of EWI/Prognos (2006) (the so-called "oil-price variant") provided a useful initial database.

The following models for the various relevant areas of measures and instruments were used:

- Space heating and water heating: The Institute for Energy Research – Systems Analysis and Technology Evaluation (IEF-STE) carried out studies in this area using the STE space-heat model, which covers especially residential buildings (household sector) and non-residential buildings (commerce/trade/services sector).
- Household electrical appliances: FhG-ISI analysed these with its own data and models (this applies to the private households sector).
- Transport: FhG-ISI carried out the analysis in this area as well – primarily with the ASTRA model, with the addition of a number of ancillary calculations.

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[1] Titel des Title of the research project: "Policy scenarios for climate protection IV – Scenarios through 2030 for the 2007 projection report" ("Politikszenarien für den Klimaschutz IV – Szenarien bis 2030 für den Projektionsbericht 2007"; short title: "Policy Scenarios IV ("Politikszenarien IV")).

The consortium consisted of the following project partners: German Institute for Economic Research (DIW Berlin), Jülich Research Centre (Programme group for systems analysis and technology evaluation – STE), Fraunhofer Institute for Systems and Innovation Research (FhG-ISI) and the Öko-Institut.

- With regard to the energy sector, detailed, measures-oriented and instruments-oriented analysis was carried out only for power generation from renewable sources and from fossil fuels: DIW Berlin analysed development of power generation from renewable energies on the basis of the "Renewable Energies" lead study ("Leitstudie Erneuerbare Energien" – BMU 2007) and processed the relevant data as necessary. Fossil-fired condensing power stations and CHP plants in the power-generation sector were analysed using the ELIAS model of the Öko-Institut.

To ensure consistency throughout their energy-oriented model calculations, the commissioned parties compiled all results within the IKARUS LP energy-system model.[2] Partial results, and energy-scenario trends for energy-sector areas not separately analysed, were integrated with the IKARUS model. Data from EWI/Prognos (2006) provided the basis for describing final-consumption areas that were not analysed in detail (energy inputs for cooking in private households; energy consumption in the commerce/trade/services sector, apart from energy use for space heating, heat generation in the manufacturing and "other mining" sectors) . Development of energy consumption in energy-sector sub-areas that were not separately analysed, and total primary energy consumption, were determined via calculation runs with the IKARUS model. In the process, demand data on the final-energy side, and data for the power-generation sector, were fixed (i.e. "bounds" were defined), and then trends for the remaining energy-system parameters were calculated via the IKARUS model.

Along with energy-related CO_2 emissions, the present report also includes process-related CO_2 emissions, and other greenhouse gases, in the calculations, as follows:

- Energy-related emissions of N_2O and CH_4 were calculated via the IKARUS LP model.
- Process-related CO_2, N_2O, and CH_4 emissions were calculated by the Fraunhofer Institute for Systems and Innovation Research (FhG-ISI) and the Öko-Institut, on the basis of data, provided in EWI/Prognos, for development of production data.
- Inventory data for CH_4 and N_2O emissions from the waste-management sector were determined on the basis of a study of the Öko-Institut/Ifeu (2005).

[2] Although the IKARUS LP model is able to calculate its own scenarios for Germany's energy sector, in the present context it was used primarily for summarising the results calculated by other models.

- With regard to agricultural emissions, projections of the Federal Agricultural Research Institute (FAL 2006) were used, although such projections extend only until 2010. The trends seen in that sector were projected by the Federal Environmental Agency.

The following figure provides an overview of the manner in which emissions were calculated:

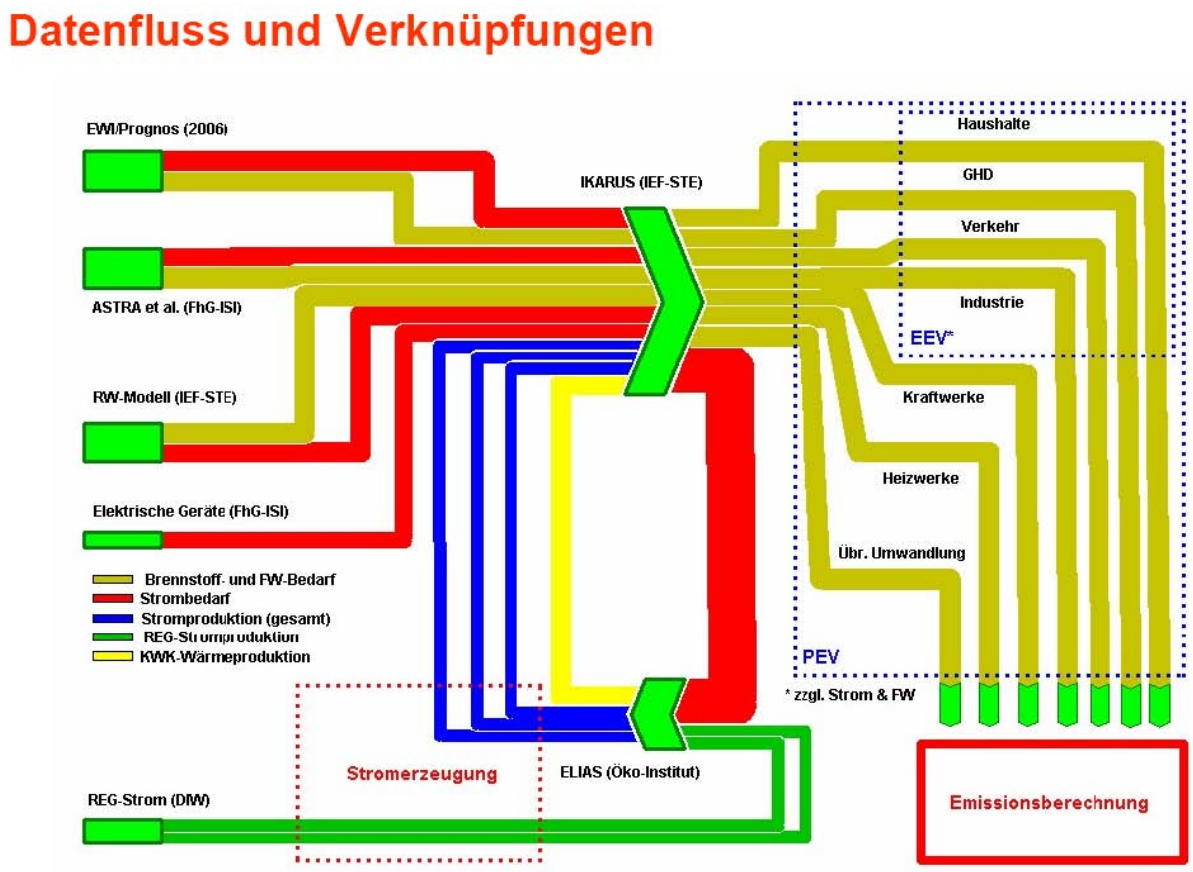

Fig. 1: Contributions of various model calculations, and the manner in which the calculations were combined to prepare the forecast [Data flow and links; EWI/Prognos (2006i), ASTRA et al. (FhG-ISI), Space-heat model (IEF-STE), Electrical appliances (FhG-ISI), Fuel and process heat requirements, Electricity requirements, Electricity production (total), Electricity production from renewable energy sources, CHP heat production, Electricity production from renewable energy sources (DIW), Electricity generation; IKARUS (IEF-STE), ELIAS (Öko-Institut); Households, Commerce/trade/services, Transport, Industry, Final energy consumption (EEV), Power stations, Heating stations, Other transformation, Process energy consumption (PEV), *does not include electricity and process heat; Emissions calculation]

Using the aforementioned model calculations as a basis, the present report presents the "with measures scenario" (reference scenario), which takes account of all measures approved to date

by the competent levels of government. In addition, the report presents a "without-measures scenario" ("Ohne-Maßnahmen-Szenario" – OMS), which describes a development in the absence of the new measures introduced since 2000. Finally, a "with additional measures scenario" ("Mit-Weiteren-Maßnahmen-Szenario" – MWMS) describes the development that could occur if additional climate-policy measures and instruments are adopted. These scenarios are national projections of greenhouse-gas emissions pursuant to EU Decision No. 280/2004/EC Art. 3 (2)[3] and they contain information about national policies and measures, for assessment of projected progress.

[3] Decision No. 280/2004/EC of the European Parliament and the Council of 11 February 2004 concerning a mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto Protocol.

2 Without-measures and with-measures scenarios: Description of measures and instruments implemented in Germany for climate protection, and quantification of the impacts of such measures and instruments

This chapter describes the relevant framework data and the measures and instruments that Germany has implemented in the period 2000 to 2006 (May).

2.1 Framework data and description of the "with-measures" and "without-measures" scenarios

2.1.1 Demographic, economic and other framework data for scenario development

Numerous frameworks play a key role in development of energy-requirements and emissions scenarios. Such frameworks include demographic and economic framework data and projected development of energy prices.[4]

Tab. 1: Selected demographic and economic framework data, 2000-2030

	2000	2005	2010	2015	2020	2025	2030
Demographische Entwicklung							
Wohnbevölkerung (1.000 Einwohner)	82.260	82.438	82.411	81.902	81.393	80.407	79.421
Private Haushalte (1.000 Haushalte)	38.151	39.178	39.665	39.843	40.021	39.869	39.716
Wirtschaftliche Entwicklung							
Bruttoinlandsprodukt	2.063	2.129	2.305	2.487	2.669	2.849	3.029
Bruttowertschöpfung des Verarbeitenden Gewerbes (Mrd. €2000)	426	457	471	505	540	575	610
Beschäftigte im Verarbeitenden Gewerbe (1.000 Beschäftigte)	7.950 (2002)		7.223	6.920	6.617	6.346	6.074
Beschäftigte im Dienstleistungssektor (1.000 Beschäftigte)	26.967 (2002)		27.728	28.055	28.381	28.090	27.798
Primärenergieträgerpreise							
Brent-Rohöl (US$2000 je bbl)	28	48	50	49	47	54	60
Steinkohle (€2000 je t SKE	42	62	53	53	52	54	56
CO_2-Zertifikatspreise (€2000 je EUA)	-	17	16	20	23	27	30

[Demographic development, Residential population (1,000s of inhabitants), Private households (1,000s of households); Economic development, Gross domestic product, Gross value added of the manufacturing sector (billions of € 2,000), Employees in the manufacturing sector (1,000s of employees), Employees in the services sector (1,000s of employees); Primary-fuel prices, Brent crude (US$ 2,000 per bbl), Hard coal (€2,000 per tonne HCU); CO_2 allowance prices (€2,000 per EUA)]

Quelle: Source: Federal Statistical Office, Federal Office of Economics and Export Control (BAFA), EIA, EWI/Prognos, calculations of DIW and Öko-Institut e.V. Institute for Applied Ecology.

The scenarios are based on a demographic development whereby Germany's residential population peaks in the period 2005 to 2010 and then decreases continually in the following years, eventually returning to a level of 81 million inhabitants by the year 2020. Nonetheless, the num-

[4] A complete overview of the relevant framework data is provided in the final report of the research project "Policy Scenarios for Climate Protection IV ("Politikszenarien für den Klimaschutz IV" – FKZ 205 46 434).

ber of private households is expected to continue increasing until 2020, as a result of the continuing trend toward smaller households, and to then decrease slowly in the subsequent decade.

As to economic trends, economic growth is expected to continue relatively constantly until 2020, with the result that Germany's gross domestic product in 2020 is expected to be about 29 % above GDP for 2000. During the same period, gross value addition in the manufacturing sector is expected to increase slightly less slowly, amounting to about 27 %. With regard to employment structures, the model calculations assume that the manufacturing sector's workforce in 2020 will be about 1.3 million persons, or about 17%, smaller than the corresponding workforce in 2002. Employment in the private and public services sectors is expected to increase slightly, by about 1.4 million persons, or about 5 %.

In projecting development of primary energy prices, the scenarios use a basis of about 47 US$ per barrel for the year 2020. In the area of hard coal, by contrast, the model calculations assume that prices will decrease slightly. The price of imported hard coal is expected to be about 16 % less in 2020 than it was in 2005. As of 2010, prices for EU (emissions) allowances (EUA) are expected to increase slightly, eventually reaching a level of about € 23 per EUA in 2020[5].

2.1.2 The "with-measures" scenario and the "without-measures" scenario

The scenario calculations are carried out for every fifth year, always with an orientation to the 2030 time horizon. As a rule, real consumption and emissions data are available for the period up to 2005. Trends in those data reflect some of the impacts of the reduction measures and instruments that took effect in that period. The base year for the scenario analyses is the year 2000.

The with-measures scenario (reference scenario) shows the long-term impacts of measures currently being implemented or already carried out. The model calculations project trends for ongoing, state-initiated reduction measures, and other autonomous reduction activities, until 2030[6]. As a result, any state financial support is assumed to continue, at its 2005/2006 level, until the end of the time horizon. The trends for technological developments have been extrapolated.

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[5] EU Allowance: corresponds to the right to emit one tonne of CO_2.

[6] This term refers to reductions that have not been initiated by state measures; i.e. that are carried out for other reasons. Such measures do not make use of programmes providing financial support.

The fictive without-measures scenario, by contrast, assumes the absence of the measures and instruments implemented or adopted since 2000. This scenario serves as a reference scenario for calculating the reductions achieved under the other scenarios.

The "with additional measures" scenario also takes account of the impacts of additional climate-policy and energy-policy measures and instruments (or targets). Chapter 3 studies this scenario in detail.

Tab.14 in Chapter 3.10 shows the development of greenhouse-gas emissions under the three scenarios, through 2030.

2.2 Cross-sectoral measures and instruments

The following chapter describes the cross-sectoral measures and instruments in place since 2000. Subsequent chapters then estimate the relevant sector-specific impacts.

2.2.1 Carbon dioxide (CO_2)

The most important cross-sectoral measures and instruments include the Ecological Tax Reform, expansion of use of CHP systems and promotion of use of renewable energies. Other pertinent measures described in the following chapters include the Energy Saving Ordinance (Energieeinsparverordnung), emissions trading and labelling of power sources.

2.2.1.1 Steps undertaken in the Ecological Tax Reform as of 2003, and amendment of energy taxation

Energy taxation in Germany is carried out primarily via the "energy tax" ("Energiesteuer"; until July 2006: "mineral oil tax" ("Mineralölsteuer") and the electricity tax, which was introduced in 1999. The Energy Taxation Act (until July 2006: Mineral Oil Tax Act ("Mineralölsteuergesetz") regulates taxation of motor and heating fuels. In April 1999, applicable tax rates were raised via the first stage of the Ecological Tax Reform. Additional increases of electricity and motor-fuel taxes were introduced in the years 2000 to 2003, and taxes on heating fuels were additionally increased in January 2003. In August 2006, a coal tax was introduced. For private households, that tax does not come into force until 31 December 2010 (cf. Tab. "Energy Taxation").

The results of the Ecological Tax Reform include prevention of 20 million tonnes of CO_2 emissions, creation of up to 250,000 jobs[7] and additional tax revenue of € 17.8 billion in 2005. The great majority of the additional tax revenue is being used to reduce the contribution rate for the public social security system; without Ecological Tax Reform, that rate would be 1.7 percentage points higher than it is. Step-wise increases in tax rates, defined throughout the medium term, have created a reliable planning basis for energy consumers and have provided economic incentives for thrifty use of energy.

For the manufacturing sector, as well as for the agricultural and forestry sectors, the Ecological Tax Reform grants 40 % discounts on standard tax rates for electricity and gas, along with a discount of about 27 % on heating oil. The manufacturing sector is also eligible for a so-called "net-burden compensation" ("Spitzenausgleich"). For companies with tax obligations that exceed the reductions provided on social security contributions, this compensation reduces marginal tax rates, with regard to their "eco-tax" fractions, to 3 % and less of regular eco-tax rates. These and other special regulations pertaining to energy-intensive processes help to ensure that such companies' competitiveness does not suffer as a result of the increases on energy taxes. In addition, in the transport and energy-generation sectors a number of special regulations apply that were introduced primarily for environmental-policy reasons.

The Ecological Tax Reform is thus having an effect in almost all of the sectors considered in this report. Its reduction impacts are summarised, in tabular form, at the end of each of the sections 2.3 – 2.7 below.

Tab. 2: Energy and electricity tax rates under the ecological tax reform

Fuel[1)]		**Without ETR** Until 31.03.1999	**1st stage** As of 01.04.1999	**2nd stage** As of 01.01.2000	**3rd stage** As of 01.01.2001	**4th stage** As of 01.01.2002	**5th stage** As of 01.01.2003	**EnergieStG** As of 01.08.2006
		in DM	**in DM**	**in DM**	**in DM**	**in Euros**	**in Euros**	**in Euros**
Petrol (unleaded)[2)]	per 1000 l	**980,00**	**1 040,00**	**1 100,00**	**1 160,00**	**623,80**	**654,50**	**654,50**
Diesel[2)]	per 1000 l	**620,00**	**680,00**	**740,00**	**800,00**	**439,70**	**470,40**	**470,40**

[7] *Source: DIW, Die gesamtwirtschaftlichen Auswirkungen der ökologischen Steuerreform [The overall economic effects of Ecological Tax Reform], 2001, p. 137 (Study carried out under commission to the Federal Ministry of Finance)*

Light heating oil	per 1000 l	**80,00**	**120,00**	**120,00**	**120,00**	**61,35**	**61,35**	**61,35**
Heavy heating oil	per1000 kg	**30,00/55,00**[3]	**30,00/55,00**[3]	**35,00**	**35,00**	**17,89**	**25,00**	**25,00**
Natural gas (as heating fuel)	per MWh	**3,60**	**6,80**	**6,80**	**6,80**	**3,48**	**5,50**	**5,50**
Coal (as heating fuel)[4]	per GJ coal							**0,33**
Electricity (StromStG)	per MWh		**20,00**	**25,00**	**30,00**	**17,90**	**20,50**	**20,50**

[1] Energy and electricity tax for key fuels (not including special regulations)

[2] As of 1 November 2001, with reduced sulphur content; as of 1 January 2003, sulphur-free

[3] For heat generation / electricity generation; in each case, until 31 December 1999

[4] Exemption for private households until 31 December 2010

Source: Bundesministerium Federal Ministry of Finance, "Ökologische Steuerreform" [Ecological Tax Reform], Berlin, August 2006, http://www.bundesfinanzministerium.de/lang_de/DE/Service/Downloads/Abt__IV/061,templateId=raw,property=publicationFile.pdf.

2.2.1.2 Introduction of coal tax

For a long period of time, coal – unlike other important fuels, such as heating oil and natural gas – was not taxed in Germany. The majority of the coal used for power generation and in the steel industry continues to be exempt from taxes. Only coal used for heat generation is taxed; such taxation, in place since 1 August 2006 and defined by the provisions of the Energy Taxation Act, has been introduced to fulfil requirements of the European Energy Tax Directive. Initially, such taxation applies only to commercial use. For social reasons, the coal tax has been suspended for private households until 31 December 2010. The relevant tax rate is € 0.33 / Gigajoule (GJ), with respect to the pertinent net calorific value. The applicable tax rate has been determined on the basis of the minimum tax rate, under the EU Energy Tax Directive, for non-commercial use (€ 0.30 / GJ), with regard to the gross calorific value; that minimum tax rate has then been converted with respect to the applicable net calorific value. The relevant regulations are set forth in the summary tables for the individual sectors.

2.2.1.3 New tax exemptions for certain energy-intensive industrial processes and procedures

Since 2006 the new Energy Taxation Act (Article 51) provides for energy-tax exemptions designed to protect German industry's international competitiveness. Also since 2006, the Electricity Tax Act (Stromsteuergesetz; Article 9a) defines similar exemptions with regard to electricity

taxes. The relevant provisions, enacted on the basis of Article 2 (4) letter b of the EU Energy Tax Directive, have the effect of exempting many energy-intensive processes and procedures from taxation.

Among other effects, Article 51 of the Energy Taxation Act transposes the legislative consequences of decision C-240/01 of the European Court of Justice of 29 April 2004, pursuant to which the previous German interpretation of the term "Verheizen" ("use as fuel") was no longer tenable. In a departure from existing Community law, however, the EU Energy Tax Directive now does allow tax exemptions for a majority of the processes affected by the relevant legal dispute. It does this via its Article 2 (4) letter b, which exempts certain applications from the Directive's scope of control. The provision is designed to prevent, where possible, any disadvantages arising for companies that had received preferential treatment, prior to the entry into force of the new Energy Taxation Act, via the German interpretation of the term "Verheizen" ("use as fuel"). In addition, Article 51 of the Energy Taxation Act and Article 9a of the Electricity Tax Act exempt a number of processes and procedures that had been subject to taxation prior to 2006.

The relevant reduction instrument is shown in Tab. 7: Politiken und Maßnahmen im Sektor Industrie.

2.2.1.4 Expansion of electricity-tax and energy-tax reductions (for electricity and heating fuels) in the manufacturing and agriculture sectors

In order to prevent any negative impacts on the international competitiveness of companies in the manufacturing and agriculture / forestry sectors, since April 1999 (introduction of the Ecological Tax Reform) such companies have been granted reductions on taxes on electricity and heating fuels (heating oil, natural gas and LP gas). From 1999 to 2002, the reductions amounted to 80 % of the tax increases in force since 1 April 1999; from 2003 to 2006, the reductions amounted to 40 % of those tax increases. Since 1 January 2007, the 40 % reductions for natural gas and LP gas have been oriented to the full tax rates for heating fuels, i.e. including the mineral-oil taxation in force prior to 1999. In one departure from this procedure, a tax reduction of only some 27 % of the full tax rate for heating oil is granted, in keeping with EU legal provisions for heating oil. The broader calculation basis results in reduced tax burdens for eligible companies and lower tax revenue for the state.

In addition, manufacturing sector companies (and only companies in that sector) are granted the so-called "net-burden compensation" ("Spitzenausgleich"), the amount of which is oriented to the applicable tax obligation and to the reduction resulting from the lowering of the employer's share of contributions to the social security system. Initially, the European Commission has approved the current net-burden-compensation provisions for a period until 2009. Thereafter, the pertinent decision allows the possibility of continuing the net-burden compensation until 2012, if German industry meets the targets it committed to in the climate-protection agreement of 9 November 2000. For review of target achievement, the European Commission has required that an effective monitoring system be in place as of 2009; such a system is currently being implemented by the Federal Government.

Since the relevant system of energy balances assigns agricultural-sector CO_2 emissions to the commerce/trade/services sector, the relevant reduction instrument has been listed again in the tabular summary for the commerce/trade/services chapter.

2.2.1.5 Renewable Energy Sources Act (EEG)

The cornerstones of a sustainable energy system include environmentally and naturally compatible expansion of renewable energies, along with systematic climate-protection policy. In recent years, Germany has significantly increased the degree to which renewable energies help meet energy consumption requirements. As of the end of 2006, biomass, water, wind, solar and geothermal energy sources were meeting a total of 5.8 % of primary energy requirements and 12.0 % of electricity requirements.

Tab. 3: Percentages of energy consumption met via renewable energies

in %	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Primary energy consumption	2,6	2,7	3,0	3,5	3,9	4,7	5,8
Gross electricity generation	6,3	6,7	7,8	7,9	9,3	10,4	12,0
Provision of heat energy	3,9	3,8	3,9	4,6	4,9	5,4	6,0
Fuel consumption	0,4	0,6	0,9	1,4	1,9	3,8	6,6

Source: BMU, working group on renewable energies (Arbeitsgruppe Erneuerbare Energien) – statistics.

In the long term, renewable energies could meet a majority of Germany's energy requirements, especially if most transformation and usage losses are eliminated (if energy efficiency is increased). To date, the costs of many relevant systems are higher than those of conventional

energy systems. The reasons for this include the fact that conventional systems are not yet required to bear the external costs they cause. Expansion of renewable energies is thus currently being intensified via a range of support instruments. The Act on granting priority to renewable energy sources (Renewable Energy Sources Act (EEG)) of 1 April 2000, which supplanted the Act on the Sale of Electricity to the Grid (Stromeinspeisungsgesetz) of 1991, has been making a key contribution in this regard. A description of the EEG's function has been included in the Federal Republic of Germany's fourth national report.[8]

Via progress reports, pursuant to Art. 20 EEG, the Act is to be regularly reviewed, with regard to its aims, and adjusted as necessary. On 1 July 2004, the amended version of the EEG entered into force, in connection with the first review of the Act. That amendment improved the framework for giving priority to connection of renewable-energy systems to the grid, as well as for giving priority to feeding of electricity from renewable sources into the grid and for distribution of such electricity, and it optimised the conditions for providing support for electricity from renewable sources. The key changes introduced by the amendment included reductions in compensation for electricity from wind power, and a significant increase in compensation for electricity generated from biomass, along with more appropriate differentiation of the various technologies used for biomass-based electricity generation. The changes with regard to biomass were designed to tap unused potential for biomass-based generation. One significant change had to do with photovoltaic systems, for which the amendment had to provide compensation for expiry of support, in 2003, from the "100,000 roofs" solar electricity programme. Since a seamless transition was required, legislators moved ahead with the amendment, with the result that the amendment was able to enter into force on 1 January 2004. Finally, the amendment provided for harmonisation of degression rates with real development of costs – with regard to wind energy, for example.

In addition to these significant changes, a number of smaller adjustments were also carried out – for example, via the Biomass Ordinance from 2001[9] – that affected the types of biomass eligible for support and other framework conditions. Other changes had to do with various framework conditions defined by the Act.

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[8] An overview of the current compensation rates for renewable-energy systems, broken down by the various relevant categories, is provided in: Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU (Ed.)): Erneuerbare Energie in Zahlen – Nationale und internationale Entwicklung, Berlin, June 2005, p. 22 f.
[9] Auf On the basis of Art. 2 (1) Sentence 2 of the Renewable Energy Sources Act (EEG) of 29 March 2000.

Following the Bundestag elections in fall 2005, the governing coalition agreed to retain the EEG, in its basic structure, in the interest of moving ahead with expansion of renewable energies.

Currently, the next regular progress report is being prepared, a report which the Federal Government plans to submit to the German Bundestag by fall 2007. Amendment of the EEG is planned for 2007/2008.

Introduction of the EEG has had a significant effect in Germany: The quantity of renewables-based electricity fed into the grid, for compensation, increased from about 10 TWh in 2000 to about 53 TWh in 2006. Wind-power electricity accounted for some 54 % of such power fed into the grid, for compensation[10], while photovoltaically generated electricity accounted for about 15 %.[11] A total of some 73.8 TWh of renewably-based electricity was generated in 2006, an amount corresponding to 12 % of total German electricity consumption.[12] Through 2020, the Renewable Energy Sources Act (EEG) is expected to reduce emissions by about 45 million tonnes of CO_2. As a result, the EEG is among the most important German climate-protection instruments.[13]

A quantification of this instrument's impacts is provided in the tabular summary for the "Energy industry" sector.

2.2.1.6 Market Incentives Programme (MAP) for promotion of renewable energies

In September 1999, the Federal Government, working in the context of the Ecological Tax Reform, launched the market incentives programme (Marktanreizprogramm – MAP) for promotion of measures for use of renewable energies. That programme focuses especially on promotion of solar collectors and biomass systems for heat generation. In 2003, the Federal Government increased the rates of support for solar collectors. As a result, the numbers of approved applications more than doubled from 2002 (56,000) to 2003 (over 145,000). From the programme's commencement until the end of 2005, a total of € 665.4 million were made available, and that funding triggered investments of about € 5 billion. Overall, the investments provided for installation of 421,500 solar systems, with a total area of 3.6 million square metres, and 60,000

[10] Source: EE in Zahlen, provisional figures

[11] Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU (Ed.)): Erneuerbare Energie in Zahlen – Nationale und internationale Entwicklung, Berlin, June 2006, p. 23.

[12] Ibid., p. 11

[13] Ibid., p. 15

small biomass boilers.[14] A total of € 180 million was made available for the MAP in 2006. For 2007, the Federal Government has increased relevant funding to € 213 million. A new MAP guideline, which came into force on 20 January 2007, has simplified the application process by enabling investors to apply for support after pertinent systems have been commissioned, if they include proof of proper operation. Previously, such applications had to be submitted before relevant projects were commenced. In addition, requirements for relevant systems have been defined more clearly. For example, the European "Solar Keymark" testing certification now serves as a criterion for granting support for solar-thermal systems. Support is provided for systems with areas of up to 40 m^2. At the same time, in future, larger systems receiving KfW-bank loans will be eligible for higher rates of support. Biomass combustion systems have to have boiler efficiency levels of at least 90 %. Especially innovative systems will be eligible for "innovation bonuses" in future.[15]

Along with subsidies for such systems, the Kreditanstalt für Wiederaufbau (KfW) has also provided funding loans – in some cases, involving even partial debt cancellation, for biogas systems, larger systems for combustion of solid biomass, systems for use of deep geothermal energy and smaller hydroelectric systems. All in all, the KfW has provided 1,951 loans in this area, and a total loan volume of € 508 million.

Since 2005, the KfW has also offered a separate, simply designed programme for financing of smaller photovoltaic (PV) investments. Relevant loans, which may be as large as € 50,000, are available for virtually all applicants, including private households (but not municipalities). In the area of commercially operated photovoltaic systems, the KfW offers its "environmental programme ("Umwelt-Programm"; cf. the Industrial sector, Chapter 2.4).

In any consideration of KfW's other support programmes in the area of renewable energies, it must be remembered that such programmes are closely linked with other support programmes for renovating and modernising existing buildings (residential modernisation programme, CO_2-oriented building-renovation programme). Chapter 2.6 (Private households) considers this topic in greater detail.

The Federal Government complements such funding with funding of its own, totalling some € 0.5 billion per year, for research and development in the area of renewable energies (cf. Chap-

[14] Ibid. p. 21

[15] Federal Office of Economics and Export Control (BAfA), Aufgaben (tasks), Energie (energy), erneuerbare Energien (renewable energies) (www.bafa.de/1/de/aufgaben/energie/erneuerbare_energien.php).

ter 2.2.1.7), and for market introduction of relevant systems. Still other funding is provided by the Länder, the EU, municipalities and private sources.

The tabular summaries for the sectors "commerce/trade/services" (Table 8) and "Private households" (Table 9) show these instruments' reduction impacts.

2.2.1.7 Promotion of research projects

Along with basic research into the climate system, into the natural and anthropogenic factors causing it to change and the impacts of such changes on nature and society, the Federal Government especially promotes research in the energy sector. The main emphases in this area are on "energy efficiency" and "renewable energies".

Within the Future Investment Programme (ZIP), which was introduced in 2001, the Federal Government has provided additional funding aimed at stabilising the effects of funding policies and at accelerating pertinent new developments. With its new energy research programme, which the Federal Cabinet approved in June 2005, the Federal Government is continuing its support for promotion of research and development into state-of-the-art energy technologies, and thus is contributing concretely to the fulfilment of current energy-policy and climate-policy requirements.

The key focuses in the area of energy efficiency include development of state-of-the-art, efficient power-station technologies, within the framework of the COORETEC concept of the Federal Ministry of Economics and Labour (BMWi). In addition, the BMWi has established emphases in the areas of fuel cells, hydrogen and energy-storage systems and technologies and processes for energy-optimised construction. The main emphases of support in the area of renewable energies include photovoltaic systems, wind energy and biomass.

In addition, the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) has been promoting research into high-temperature and low-temperature solar-thermal systems, geothermal systems and hydroelectric systems. Furthermore, the Federal Ministry of Education and Research (BMBF), via its institutional funding, supports research, by the Helmholtz Association of German Research Centres (HGF), in the areas of geothermal systems, thin-film solar cells, fuel cells and high-temperature solar-thermal systems. The BMBF also supports networks for basic research in the areas of renewable energies and energy efficiency.

The Federal Ministry of Consumer Protection, Food and Agriculture (BMELV) promotes improvement of opportunities for using biomass in heat and electricity generation and in fuel production. The Federal Government's comprehensive research activities in the areas of energy

efficiency and renewable energies are aimed at developing the excellent potential for expanding use of relevant systems and lowering the relevant costs, and at promoting pertinent innovation. Such activities are thus designed to contribute significantly to lowering of energy-related CO_2 emissions.

The Federal Government's total funding for research and development (R&D) in the areas of renewable energies, efficient energy use and efficient energy transformation amounted to € 207 million in 2003 (BMWi, 2005). Since then, the Federal Government has been considerably increasing funding for research into renewable energies technologies – with orientation especially to lower costs, environmental and natural compatibility, integration within the electricity grid and support for market introduction. In 2006, the BMU alone provided some € 98 million in funding for relevant projects. The largest shares of this funding went to projects in the areas of photovoltaic systems (44 %), geothermal systems (24 %) and wind-energy systems (16 %). A total of 12 % went to projects for solar-thermal energy systems (solar-thermal power and heat stations) (BMU, 2007b). In keeping with its ministerial responsibility, the BMELV promoted development of biomass technology.

In addition, the Länder have a range of programmes in place for promoting use of renewable energies. From 1991 to 2001, the Länder invested a total of € 1.8 billion in such programmes. Of that amount, a total of € 0.4 billion went to research and development, while € 1.4 billion went toward promotion of relevant market introduction. The main emphases of such support were on biomass, wind-energy and solar-collector systems.
The tabular summary for the "Energy industry" sector (Table 6) lists funding for relevant research projects. The effects of R&D activities on emissions levels have not been quantified in the present report, since such activities' effects are indirect.

2.2.1.8 Energy Saving Ordinance (Energieeinsparverordnung – EnEV)

(Wärmeschutzverordnung – WSchV95), the Energy Saving Ordinance (Energieeinsparverordnung – EnEV) has brought about the following improvements in energy saving:

- The EnEV links building and facility systems. Such links are expected to prompt stakeholders to make suitable adjustments, and the EnEV has indeed been triggering relatively new types of "holistic" planning – for example, planning aimed at improving the relationship between buildings' thermal properties and their heating systems and, thus, at saving

energy. The relevant effects cannot be quantified in the present report, however, since pertinent data on rates of saving and implementation are lacking.

- The EnEV tightens requirements with regard to annual consumption of new buildings by about 20 % (Ifeu, IWO 2005). A new building built in accordance with the EnEV thus requires only 80 % of the energy required by a comparable building built in accordance with the WSchV95. Such 20-percent savings do not appear in statistics listing total CO_2 emissions, however; such statistics only list the remaining additional consumption of relevant new buildings.
- The pertinent requirements for existing buildings now specify that building components must meet certain minimum thermal standards as soon as certain shares of components' areas are renovated/modernised. In principle, that requirement was already in place under the WSchV95. For existing buildings, in comparison to the WSchV95 the EnEV has simply tightened component-oriented requirements (in terms of U-values of components) for new and modified parts of buildings' skins by 10 to 15 %.
- The relevant model calculations include a general requirement that ceilings of top-level storeys be properly thermally insulated by 31 December 2006. In the model calculations, requirements designed to limit losses in heat distribution, in existing buildings, are taken into account in the form of lump-sum increases in heating systems' thermal efficiency.
- An orientation to annual primary energy requirements is increasingly displacing electrical systems, which have high CO_2 emissions per kilowatt-hour, from the heat market. The scenarios in the present report do not include this reduction effect, however, since their underlying balance sheets are based on the "source" principle. In another effect, the EnEV's orientation to primary energy tends to favour use of renewable energies.
- A 2007 amendment of the EnEV includes two substantially new elements that the European Energy Performance Building Directive[16] requires for all EU Member States as of 2006: the "energy passport" (cf. Chapter 2.5.1.3), and a new, integrated calculation method for non-residential buildings and for air-conditioned residential buildings. That calculation method takes account of all energy quantities required for proper heating, water-heating, air-conditioning and illumination in buildings. A pertinent method has been prepared in the framework of the DIN V 18599 series of standards.

[16] Energy Performance Building Directive EPBD; Directive 2002/91/EC of the European Parliament and of the Council of 16 December 2002 on the technology performance of buildings.

The savings brought about by the EnEV have been calculated, with the help of a space-heat model, with respect to emissions levels under the 1995 Ordinance on thermal efficiency (Wärmeschutzverordnung – WSchV95). For the 2006 to 2020 period, and in the "with-measures" scenario, the resulting cumulative savings amount to 1.9 million tonnes of CO_2 in new buildings and 1.8 million tonnes of CO_2 in existing buildings (cf.Tab. 4).

Tab. 4: CO_2 reductions, under the EnEV, in the "with-measures" scenario

	2005	2006	2010	2020	2030
	Mio. t				
Neubau: Einsparung gegen WSchV95 (20 %)	0,1	0,3	0,7	1,9	3,2
Altbau: Einsparung gegen WSchV95 (10 - 15 %)	0,1	0,2	0,7	1,8	2,8

[New structures: savings with respect to WSchV95 (20 %); Old structures: savings with respect to WSchV95 (10 - 15 %)]

Remark: not free of double-counting; 100% overlapping with other measures.

The EnEV is an overarching instrument that, while not itself initiating construction activities, has effects in connection with implementation of other measures and instruments. For this reason, the EnEV overlaps with other relevant measures and instruments. The calculated impacts under the EnEV cannot be added to savings achieved under monetary support instruments, therefore, because such a procedure would result in double-counting.
The instrument's reduction impacts are shown in the tabular summaries for the sectors "industry", "commerce" and "private households" (Tables 7-9).

2.2.1.9 Introduction of the EU Emissions Trading System

Since 1 January 2005, emissions trading, a new environmental policy instrument, has been in force in the EU. This instrument is of central importance with regard to climate protection. The emissions trading system gives system participants economic incentives to reduce CO_2 emissions – by saving energy, improving energy efficiency and switching to low-carbon fuels.

In Germany, the participants in the emissions trading system, since the system's commencement on 1 January 2005, have included operators of large energy installations (with thermal output from combustion > 20 megawatts) and of energy-intensive industrial systems in the refining, coking, steel, cement, glass, ceramics and pulp/paper sectors. At present, the system covers a total of some 54 % of German CO_2 emissions. As of 1 August 2008, it will also cover cracker systems in the chemical industry (inter alia), soot-production systems, previously non-included further-processing systems in the steel industry and certain installations for flaring of gaseous substances.

As of January 2005, CO_2 emissions for relevant installations are tied to limited emissions allowances. Emissions allowances for the first two trading periods, 2005-2007 and 2008-2012, were allocated to installation operators largely free of charge. Installation operators are able to trade these allowances freely throughout the entire EU. Where a installation's actual emissions exceed the relevant allocated quantity of emissions allowances, the installation operator must either reduce his installation's emissions or purchase additional emissions allowances. On the other hand, where actual emissions are lower than the relevant allocated quantity of emissions, the operator may sell emissions allowances.

To date, the German Bundestag has passed or planned a total of four laws for transposition of the 2003 EU Emissions Trading Directive:

- Greenhouse Gas Emissions Trading Act (Treibhausgas-Emissionshandelsgesetz – TEHG).
- Act on the National Allocation Plan for greenhouse-gas emissions allowances in the 2005 to 2007 allocation period (Zuteilungsgesetz 2007 – ZuG 2007).
- Act on the National Allocation Plan for greenhouse-gas emissions allowances in the 2008 to 2012 allocation period (Zuteilungsgesetz 2012 – ZuG 2012) ("Draft of an act for amending the legal foundations for emissions trading, with respect to the 2008 to 2012 allocation period").
- Act on project-based mechanisms pursuant to the Kyoto Protocol to the UN Framework Convention on Climate Change of 11 December 1997 (Projekt-Mechanismen-Gesetz – ProMechG).

While the TEHG regulates the basic aspects of emissions trading (such as pertinent authorisation and monitoring, trading procedures), the ZuG 2007 and ZuG 2012 allocation acts specify relevant numbers of emissions allowances and define the rules for allocation of allowances to relevant installations (allocation rules).

Germany's National Allocation Plan (NAP) for 2008-2012, like the 2005-2007 NAP, consists of two components:

A "macro" plan specifies how much CO_2 installations subject to emissions trading, in the energy and industry sectors, may emit overall (Cap). For the first allocation period (2005 to 2007), installations participating in emissions trading had a total budget of 499 million tonnes of CO_2 per year. That budget included a reserve for new installations, amounting to 3 million tonnes of CO_2

per year. The ZuG for 2012 provides for a budget of 453.1 million emissions allowances (EUA)[17], including a reserve of 23 million tonnes of CO_2 per year.

A "micro" plan regulates specific allocation of allowances to affected installations. The basic approach used in both periods involves free allocation. In the first period, such allocation has been carried out primarily on the basis of relevant installations' historical emissions ("Grandfathering"). In the second period, allocations for the energy sector are defined primarily on the basis of benchmarks (see below). In addition, some of the emissions allowances will be sold.

In contrast to the ZuG 2007, the ZuG 2012 provides for differential treatment of energy installations (activities I-V of Annex I to the TEHG) and industrial installations (activities VI-XVIII). This approach takes account of the fact that many industrial companies face international competition and thus are not in a position to apply additional costs to their product prices, while energy-sector companies have useful opportunities to pass on costs and, thus, can generate "windfall profits" via free allocation.

Under both the ZuG 2007 and the ZuG 2012, allocations for industrial installations are made on the basis of historical emissions. The ZuG 2012 uses the base period 2000-2005 for that purpose. In addition, the so-determined allocations are subject to a fulfilment factor that results in a 1.25% reduction for each industrial installation.

On the other hand, allocations for energy installations, which under the ZuG 2007 also received allocations on the basis of historical emissions, will in future be based on the average pertinent production quantity, for a base period, multiplied by a sector-standardised emissions factor per generated product unit (benchmark). Furthermore, the Act now provides for benchmarks to be used for both new installations and existing installations in the energy sector. The pertinent benchmarks vary by fuel. The benchmark for gas-fired power stations is 365 g CO_2/kWh, while the standard benchmark for coal-fired power stations is 750g CO_2/kWh. As a result of the expansion of the benchmarking system, as of 2008 allocations for existing energy-sector installations will be oriented to emissions of highly efficient new installations. In all likelihood, operators of old, inefficient installations will have to purchase considerable quantities of additional allowances. As a result, the ZuG will provide effective incentives for new investments and for necessary modernisation of the power-station pool as a whole.

If the budget is to be met, energy-sector installations will have to be proportionally reduced.

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[17] An EU Allowance (EUA) entitles its holder to emit 1 tonne of CO_2.

Under the ZuG 2007, the cap (upper emissions limit) amounted to 499 million EUA. By contrast, the cap under the ZuG 2012 is only 453.1 million EUA. That sum already includes allowances for newly added installations (about 11 million EUAs). In addition, when the aforementioned reserve under the ZuG 2012 is deducted, it produces an effective cap for existing installations subject to emissions trading under the ZuG 2007: about 419 million EUA. With respect to the cap under the ZuG 2007, that figure represents a reduction of about 76 million EUA.

The average emissions level in the years prior to emissions trading (2000 - 2005) was 479.9 million tonnes of CO_2. With regard to that value, the cap under the ZuG 2012 (again, taking newly added installations into account) translates into a reduction requirement of about 36 million tonnes of CO_2.

At the same time, the aforementioned values do not reflect the real reduction effects of emissions trading in Germany: On the one hand, as a result of EU-wide trading opportunities, that system's effects may be greater or smaller than those values, depending on whether the reduction opportunities available in Germany are more or less costly than those available in the other EU Member States.

On the other hand, as a result of integration of the "Kyoto mechanisms" JI and CDM, the effective reduction in Germany is likely to be lower than the value calculated above: existing plans, pursuant to Art. 6 (1b) TEHG, for example, call for including, in the allocation act for each allocation period, a limit on the numbers of allowances that may be obtained from JI or CDM projects. For the 2008-2012 period, legislators have set that limit at no more than 22 % of the relevant installation-based allocation quantity during the allocation period. As a result, installation operators could achieve annual reductions of up to 90 million tonnes of CO_2 equivalents – i.e. more than the annual reduction requirements of all installations subject to emissions trading, with respect to emissions in the years 2000-2006 – via projects carried out abroad rather than in Germany. Such a scenario is unlikely, however. The tabular summaries for the sectors "Energy industry" (Table 6) and "Industry" (Table 7) show the instrument's quantified reduction impacts.

2.2.1.10 Activities of dena

Deutsche Energie-Agentur GmbH (dena; German Energy Agency) was founded on 29 September 2000, at the initiative of the Federal Government. It is charged with working toward efficient – and, thus, environmentally compatible – energy production, transformation and use, as well as toward development of viable energy systems, giving special consideration to intensified use of renewable energies. dena carries out projects and information campaigns, thereby supporting

certain activities of the Federal Government. It is also expected to share information with municipal and regional energy agencies and with consumer agencies. Furthermore, it has the task of meeting information requirements on the part of private households, companies, associations and government authorities. Yet another, particularly important, task involves exchanging information with foreign partners, and jointly carrying out projects with such partners. It is thus also charged with adopting an international profile and suitably advising the Federal Government in the process.

This measure is difficult to quantify. It is included in the tabular summaries for the sectors "Industry", "Commerce/trade/services" and "Private households" (Tables 7-9).

2.2.2 Other greenhouse-gas emissions

Measures and instruments for reducing non-CO_2 greenhouse gases apply to the specific relevant sectors. They are described in chapters 2.3 to 2.10.

2.3 Energy industry (energy transformation)

2.3.1 Carbon dioxide (CO_2)

The following table shows the development of CO_2 emissions in Germany since 1990.

Tab. 5: Development of CO_2 emissions in Germany's energy sector

In millions of tonnes	**1990**	**1991**	**1992**	**1995**	**2000**	**2004**	**2005**
CO_2 emissions	415	402	380	357	348	370	362

Source: Federal Environmental Agency, CSE.

In the early 1990s, energy-sector CO_2 emissions decreased considerably in Germany. That trend did not continue, however, and beginning in the mid-1990s, those emissions stabilised at a level of about 360 million tonnes. German reunification was a key factor in the sharp decrease beginning in the early 1990s. Numerous fossil-fired power stations were modernised, and production in the new German Länder decreased considerably following reunification.

2.3.1.1 Renewable Energy Sources Act (EEG) and reduced electricity consumption

The cornerstones of a sustainable energy system and systematic climate-protection policy include environmentally and naturally compatible expansion of renewable energies, and efforts to reduce electricity consumption. For information about this aspect, cf. Sections 2.2.1.5, 2.2.1.10, 2.4.1.7, 2.4.1.8 and 2.5.1.5.

2.3.1.2 Promotion of combined heat and power generation (CHP systems)

Liberalisation of the electricity market suddenly worsened the conditions for this technology. As a result, the Federal Government took measures to prevent a likely decrease in the share of electricity generated via combined heat and power (CHP) systems and to expand use of this efficient technology:

- Act on the protection of electricity production via combined heat and power generation (Combined Heat & Power Act; KWKG) of 12 May 2000.
- Act on the Preservation, Modernisation and Development of Combined Heat and Power Generation (Combined Heat & Power Act; KWKG) of 19 March 2002.
- Mineral-oil tax exemption for CHP installations, upon introduction of the ecological tax reform in April 1999.
- In the EEG, promotion of CHP installations in connection with biomass-based electricity generation, via provision of a 2 cent/kWh bonus in addition to the relevant basic compensation.
- Agreement between the Federal Government and German industry, calling for reduction of CO_2 emissions and for promotion of combined heat and power (CHP) generation, and complementing the climate-protection agreement of 9 November 2000.

The sole function of the CHP Act (KWKG) of 2000 was to protect pertinent existing installations. The same can be said for the complete tax exemptions provided under the ecological tax reform. Both regulations had the primary effects of preventing a) the reductions of CHP-based electricity generation that could result from critical competition following electricity-market liberalisation and b) price increases in fuel markets.

The CHP Act (KWKG) that came into force on 1 April 2002 had a somewhat different effect; it has the following aims:

- Supporting the operation of (old and new) existing installations.
- Modernisation of existing installations, with modernised installations having to be commissioned by no later than 31 December 2005, and operators having to fulfil a number of additional auxiliary requirements.
- New construction of small CHP installations (<50 kW or 50 kW to 2 MW) and of fuel-cell systems. Subsidies for installations in the 50 kW to 2 MW size class are provided on a degressive basis and are available only until 31 December 2010. For small CHP installations with ratings up to 50 kW (very small installations), as well as for fuel-cell systems, subsi-

dies are provided for a total of 10 years, beginning with commencement of installations' long-term operation.

In the agreement between the Federal Government and various sector associations, the associations agree to reduce CO_2 emissions, via construction and modernisation of CHP installations, by a total of 20-23 million tonnes of CO_2 by the year 2010 (10 million tonnes by 2005), in comparison to the relevant level in the base year 1998. The CHP Act's impacts will amount to about 7 million tonnes by 2010, which falls somewhat short of the aims in connection with the Act. As a result of its term limitation, and of its compensation structure, which is oriented primarily to modernisation (and only slightly to new construction), the Act's reduction contribution will decrease to 3 million tonnes by 2020.[18]

2.3.1.3 Elimination of the energy tax on natural gas used for electricity generation

The Federal Government considers differentiated taxation of fuel inputs for electricity generation and for combined heat and power generation to be an effective instrument. For this reason, pertinent taxation was modified in connection with Act for revising taxation of energy products and for amending the Electricity Tax Act of 15 July 2006 (Federal Law Gazette I p. 1534). As a result, as of 1 August 2006, natural gas is generally exempt from taxes if is used for electricity generation in stationary installations with a rated electrical generating capacity of more than 2 megawatts or in stationary CHP installations with a monthly or annual usage efficiency of at least 70 %. Engine-based or gas-turbine-based CHP installations for which the monthly usage efficiency applies must have an annual usage efficiency of at least 60 %. Until July 2006, only natural gas inputs in CHIP installations with the above minimum usage efficiencies were tax-exempted.

Elimination of the natural gas tax for condensing power stations has increased the attractiveness of natural-gas-based electricity generation. Power-station operators now have greater incentives to build low-emissions gas-fired power stations instead of coal-fired power stations. This instrument is forecast to provide emissions savings of 6 million tonnes of CO_2 in 2020.

[18] The model calculation in the Policy Scenarios IV project yields only a contribution of 2 million tonnes of CO_2 by the year 2010 and 1 million tonnes by 2020. The Federal Government's KWKG monitoring report, which is considerably more detailed in this aspect, places the contribution of modernised CHP installations, and of the also-supported new, small CHP installations, at 7 million tonnes of CO_2 by the year 2010, however. In addition, an interim review shows a 4-million-tonne CO_2-emissions reduction for CHP installations already in place prior to 2000.

2.3.1.4 Promotion of research and development

Cf. Section 2.2.1.7.

2.3.1.5 Emissions trading

Cf. Section 2.2.1.9.

2.3.1.6 The Energy Industry Act's provisions relative to compensation for avoided network-utilisation fees

The Energy Industry Act (Energiewirtschaftsgesetz – EnWG), which was amended in summer 2005, and the pertinent Electricity-network utilisation-fee ordinance (StromNEV), created the first legal entitlements, for operators of non-central generation installations, to reimbursement of the network-utilisation fees avoided through non-central supply of electricity to the grid. In a network or transformation level with non-central feeding of electricity into the grid, the network operator's network fees payable to the next-higher network level are reduced as a result of reduced electric power removal. A non-central supplier to the grid receives a fee, the so-called "avoided network fee", that reflects the difference to the situation that would otherwise prevail without the non-central supply to the grid. In future, avoided network fees will be calculated for every network level – i.e. including the transformation level. As a result, for example, for an installation that feeds electricity into the medium-voltage network, the fee for removal from high-voltage / medium-voltage transformation, and not (as was previously the case) the fee for removal from the high-voltage network, serves as the basis for calculating the avoided network use.

2.3.1.7 Electricity "labelling"

The amended Energy industry act (Energiewirtschaftsgesetz – EnWG)[19] of 7 July 2005 requires electricity providers in Germany to inform their customers, as of 15 December 2005, in connection with so-called "electricity labelling" and in their invoices or in attachments thereto, what fuels the pertinent energy producers used to generate the electricity in question. In addition, information must be provided regarding environmental impacts relative to CO_2 emissions and regarding production of nuclear waste. Art. 42 EnWG transposes EU Directive 2003/54/EC into German law. On the basis it provides, consumers can choose their electricity providers in ac-

[19] Federal Law Gazette 2005; Part 1; No. 42 "Zweites Gesetz zur Neuregelung des Energiewirtschaftsrechtes" ("Second act for revision of laws pertaining to the energy industry"); p. 1991; Art. 42.

cordance with listed electricity-generation characteristics, as well as in accordance with price. Its main effect, however, is in the area of external communication; the information provided in accordance with its provisions helps raise public awareness.

Along with legally mandated electricity labelling, private certification systems for "green" electricity ("eco" electricity label) are growing in importance in Germany. The "green power" market is estimated to have reached a total volume of 3.6 TWh in 2005 (private households and commercial customers).[20] For comparison, the quantity of power subsidised via the EEG in 2006 amounted to about 53 TWh.[21]

2.3.2 Methane

2.3.2.1 Reductions of hard-coal mining

From 1990 until 2005, CH_4 emissions in the energy sector decreased by about 42 % (an amount corresponding to a greenhouse potential of over 11 million tonnes of CO_2 equivalents). That decrease has resulted primarily from emissions reductions in active coal mining, in keeping with decreases of hard-coal and lignite production. The decreases in hard-coal production have resulted from continuous rollbacks of hard-coal subsidies, as well as from lignite-production decreases in the new Länder in the first half of the 1990s. On the other hand, emissions from decommissioned coal mines have increased by about 65 kt CH_4 (about 1.4 million tonnes of CO_2 equivalents).

2.3.2.2 Natural gas extraction and transport

The natural gas sector has achieved reductions in volatile CH_4 emissions primarily in the areas of natural-gas production and distribution. The measures' expected reduction effects by 2020 amount to about 0.6 million tonnes of CO_2 equivalents with regard to the "without measures" scenario. The relevant reduction effects in oil extraction and provision (especially in storage of mineral-oil products) are marginal, to the extent that practically no emissions reductions worthy of mention result.

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[20] Source: E&M Ökostromumfrage 11/2006; that survey was the most comprehensive national survey in the segment of voluntary demand for green power (no relevant standardised national statistics are available).

[21] Source: Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU (Ed.)): Erneuerbare Energie in Zahlen – Nationale und internationale Entwicklung, Berlin, June 2007, p. 25.

2.3.3 Summary

The following Table summarises the measures and instruments in the energy sector.

Tab. 6: Policies and measures in the energy sector

Name of policy/measure	**Description / aims (scope of effects)**	**Greenhouse gas**	**Type**[22]	**Implementation status (effects)**	**Institution carrying out**	**Expected effect in 2010** (millions of t of CO_2 eq.)	**Expected effect in 2015** (millions of t of CO_2 eq.)	**Expected effect in 2020** (millions of t of CO_2 eq.)	**Expected effect in 2025** (millions of t of CO_2 eq.)	**Expected effect in 2030** (millions of t of CO_2 eq.)
Renewable Energy Sources Act (EEG)[23]	Minimum compensation levels for supply to the grid of electricity from renewable energies (aim: for such electricity to account for a share of at least 20% by 2020)	CO_2	E, R	in Kraft (EEG 2000, BioMVO 2001)	Federal Government	-35	-44	-55	-63	-70
Reduced power use	Reduction of energy requirements via reduction of power consumption	CO_2	O	uncertain	Federal Government	-5	-8	-7	-7	-6
CHP Act and CHP agreement between the Federal Government and industry (including effects in other sectors)	Promotion of CHP installations in electricity generation from biomass, within the context of the EEG; An agreed reduction target of 20-23 million tonnes of CO_2 by 2010	CO_2	E	2002	Federal Government	-7	-5	-3	-2	-1
Elimination of the natural gas tax	Increase in the attractiveness of use of natural gas in electricity generation	CO_2	F	2006	Federal Government	-3	-4	-6	-9	-9

[22] The following types of instruments are differentiated: Economic (E), Fiscal (F), Voluntary/Negotiated Agreement (V), Regulatory (R), Research (D), Information (I), Planning (P), Other (O).

[23] The Policy Scenarios IV study lists the combined CO_2-emissions reduction achieved through the Renewable Energy Sources Act (EEG) and through reductions in power use. The breakdown here has been made on the basis of relative contributions to replacement of conventional power generation, which the study lists in Annex A4-1.

Research and development	Promotion of R&D, including demonstration, energy-research programme	CO_2	D	uncertain	Federal Government	Not quantified				
Emissions trading (including effects in other sectors)	Cost-effective CO_2 reduction	CO_2	E	2005	Federal Government	-3	-3	-6	-8	-10
Compensation for avoided network utilsation	Improvement of the economic situation of non-central suppliers of electricity to the grid (especially CHP operators)	CO_2	O	2001	Federal Government	-2	-0,5	0	-0,3	-1
Reductions in hard-coal mining	Reductions in hard-coal production	CH_4	F	ongoing	Federal Government	Not quantified				
Natural gas production and distribution	Decreasing distribution losses, and increasing levels of connection of natural gas systems	CH_4	V	uncertain	Industry	-0,1	-0,3	-0,6	-0,8	-1,1

2.4 Industry

2.4.1 Carbon dioxide (CO_2)

The catalog of measures and instruments for industry, for reduction of CO_2 emissions in the buildings sector, overlaps extensively with the relevant catalog for the commerce/trade/services (CTS) sector. The Energy Saving Ordinance (Energieeinsparverordnung – EnEV), which entered into force on 1 February 2002, and "electricity labelling", also apply to the "private households" sector. For this reason, the chapters "Sector-overarching measures" and "Energy industry" present these measures in detail. The following sections simply list the potential emissions reductions seen in industrial CHP installations, along with the indirect CO_2 emissions resulting in the electricity and district-heat sectors. These factors (potential reductions and indirect emissions) enter into the quantifications for the energy sector.

2.4.1.1 Climate protection agreement

The climate-protection agreement between the Federal Government and industry will continue to play an important role in climate-protection policy. The last years have shown how efficient a joint, co-ordinated approach involving policy-makers and industry can be. The climate-protection agreements provide a basis for long-term investment decisions, thereby providing a reliable

planning basis for German companies. They have also provided indications for determining budgets within the framework of allocation of allowances for emissions trading. As a result, they have served as a sort of "bridge" between declarations of voluntary commitments and introduction of emissions trading.

On 9 November 2000, the Federal Government reached a climate-protection agreement with German industry. German industry has declared its willingness to reduce its specific greenhouse-gas emissions by 35% by 2012. For monitoring of this agreement, the Federal Government has reached agreement with German industry regarding a systematic, transparent monitoring system.

Monitoring reports to date highlight Germany industry's continuing efforts and successes in enhancing energy efficiency and reducing CO_2 emissions. In the industrial sector in particular, CO_2 emissions, both specific and absolute, have been markedly reduced.

2.4.1.2 Process-related CO_2 emissions

Development of process-related CO_2 emissions has linearly followed the development of the activity rates defined for the various relevant processes. A significant change in activity rate is expected only in the area of oxygen-steel production (in the present case: a reduction). The activity rates for other relevant processes (mineral and metals industry) are expected to remain largely constant. Because oxygen-steel production accounts for a large share of total process-related CO_2 emissions, such development in activity rates is expected to lead to considerable overall reductions in CO_2 emissions.

On the other hand, the forecast reduction in the activity rate for oxygen-steel production is subject to a high degree of uncertainty. In light of the current steel-market trends, it seems reasonable to suppose that the activity rate for oxygen-steel production could remain nearly constant throughout the period covered by the report. If that occurs, process-related CO_2 emissions would hardly change from their current level of 77.7 million tonnes.

2.4.1.3 Energy Saving Ordinance (Energieeinsparverordnung – EnEV)

Cf. Section 2.2.1.8.

2.4.1.4 Ecological Tax Reform, and new tax exemptions for certain energy-intensive processes

Cf. Section 2.2.1.1. Regarding the tax exemptions, cf. Section 2.2.1.3.

2.4.1.5 Introduction of the EU emissions trading system

Cf. Section 2.2.1.9.

2.4.1.6 Activities of DEnA

Cf. Section 2.2.1.10.

2.4.1.7 Electricity labelling

Cf. Section 2.3.1.7.

2.4.1.8 Energy Consumption Labelling Ordinance (Energieverbrauchskennzeichnungsverordnung – EnVKV) and Ordinance on Maximum Energy Consumption (Energieverbrauchshöchstwerteverordnung – EnVHV)

The electrical efficiency of large electrical appliances has increased in recent years. Beginning in 1992, the European Union adopted a number of regulations that have created requirements for listing of devices' electricity consumption and – as a result of decreases in the numbers of relevant devices – for limiting such consumption. The Federal Government has transposed these regulations via its Energy Consumption Labelling Ordinance (Energieverbrauchskennzeichnungsverordnung – EnVKV) of 1997 and its Ordinance on Maximum Energy Consumption (Energieverbrauchshöchstwerteverordnung – EnVHV) of 2002. The legal basis for both ordinances now consists of the Energy Consumption Labelling Act (Energieverbrauchskennzeichnungsgesetz – EnVKG) of 2002.

According to estimates of the Fraunhofer Institute for Systems and Innovation Research (ISI), power consumption decreased by about 2.2 TWh from 2000 to 2004 as a result of the aforementioned EU regulations, of other instruments of various stakeholders and of ongoing technical progress. This measure's reduction effect in 2020 is forecast at 9.4 TWh.

2.4.1.9 Voluntary commitments by manufacturers, aimed at reducing the electricity consumption of electrical devices

The requirements established by current voluntary commitments by manufacturers, aimed at reducing the electricity consumption of electrical devices, have to do primarily with consumer electronics. A range of pertinent agreements between relevant associations and the EU are in place:

- An agreement (negotiated agreement) between the EU Commission and the European Association of Consumer Electronics Manufacturers (EACEM) on standby losses of audio devices, dating from 2000.
- An Industry Self-Commitment to Improve the Energy Performance of Household Consumer Electronic Products Sold in the EU, dating from 2003.

In addition, the European Commission has issued various relevant guidelines, and these have been signed by individual companies (to establish self-commitments):

- Code of conduct on the electrical efficiency of external power supply units (throughout the range from 0.3 to 70 W), from 2000.
- Code of conduct on the electrical efficiency of digital TV systems (Version 2), from 2003.

The impacts of these instruments on the development of relevant devices' electrical efficiency can hardly be quantified; for this reason, no attempt at such quantification is made here (and also for the reason that these codes of conduct have very limited market coverage).

2.4.2 Nitrous oxide (N_2O)

In the industrial sector, process-related N_2O emissions (laughing gas) occur in production of adipic acid and of nitric acid. Technical measures to reduce emissions in adipic acid production have already brought about sharp reductions. It is presumed that industry has already exploited the available potential for reductions.

The "with-measures" scenario (reference scenario) includes a conservative projection of the laughing gas emissions occurring in the chemical industry, in production of nitric acid – the scenario assumes such emissions would remain constant until 2020.[24]

In recent years, the pertinent best available technology has further improved, however – also as a result of regulatory requirements (Technical Instructions on Air Quality Control (TA Luft)) – and industry is already using such technology, to some extent, in German installations. The 2003 TA Luft mandates that all installations must comply with a maximum permissible level of 800 mg/m^3 as of 2010. That value corresponds to an emission factor of 2.5 kg N_2O / tonne HNO_3, a level that German installations should be largely able to comply with. Nonetheless, it must also be assumed that some German installations will be able to achieve even lower emis-

[24] For emissions calculation until 2005, an emission factor of 5.5 kg N_2O / t HNO_3 was used, on the basis of the research project of Schön, Walz et al. (1993). Only the stoichiometric conversion of ammonia into N_2O was used as a basis; reduction measures, or other technical circumstances or operational conditions were not considered.

sions levels. The BREF "Large Volume Inorganic Chemicals Solids – Ammonia, Acids and Fertilisers (LVIC-AAF)"[25] lists an emission factor (EF) of 0.12-1.85 kg N_2O / t HNO_3 for existing installations using the best available technology.

Because large uncertainties prevail regarding the future development of nitric acid production in the chemical industry, the scenarios conservatively forecast – in spite of the described reduction potential – that emissions will remain about constant from 2005 to 2030. Until 2005, relevant figures were based on an emission factor of 5.5 kg N_2O / t HNO_3.

2.4.3 Halogenated hydrocarbons (HFCs, PFCs) and sulphur hexafluoride (SF_6)

Since 4 July 2006, this substance group, which previously had been largely unregulated, has been subject to Regulation (EC) No 842/2006 on certain fluorinated greenhouse gases and to Directive 2006/40/EC relating to emissions from air-conditioning systems in motor vehicles. These provisions contain measures and instruments aimed at preventing and minimising leaks in systems that contain the relevant substances. They also include regulations on leakproofness testing and on reclamation, as well as on the expertise of relevant persons, on record-keeping and reporting obligations, on limitations on the placing on the market and use of certain substances and on the phasing-out of use of the refrigerant R 134a in air-conditioning systems of new motor vehicles.

In addition to the aforementioned legal provisions, a number of (voluntary) agreements have been made with industry relative to this substance group.

2.4.3.1 XPS hard foams and PU foams

Until 2000, industry was still using some H-CFCs (CH_2FCF_3 and $C_2H_4F_2$) as substitutes for CFCs in blowing of XPS foam-insulation materials. Since these substances also deplete the earth's ozone layer, some manufacturers have been using HFCs since then, while others have stopped using halogenated blowing agents altogether. The most important relevant measure is to use substitutes for HFCs – for example, CO_2.

Industry long used CFCs and H-CFCs in producing PU hard foams. Today, those substances have been largely supplanted by halogen-free blowing agents. Although some HFCs are used, HFCs are not indispensable.

[25] EU Commission (2006)

Emissions from use of PU installation foam have decreased sharply in recent years. EU Regulation 842/2006 mandates a ban on such substances, apart from just a few exceptions, as of 4 July 2008.

The European Commission plans to review the entire area of insulation production again by 2010. By implementing voluntary measures, industry has already achieved reductions prior to the entry into force of the relevant measures and instruments.

2.4.3.2 Semiconductor manufacturing

In 2005, some 34.6 % of all PFC emissions originated in use of such gases as etching gases in semiconductor manufacturing. A number of suitable options are available for slowing emissions increases from the semiconductor industry. In addition to use of NF_3 as a substitute for PFCs in certain areas, such options include waste-gas combustion, process modifications and use of other fluorinated etching gases. PFC emissions tripled by 2005, with respect to their 1995 levels. In 1999, the World Semiconductor Council (WSC) committed itself to reducing emissions of fluorinated gases by 10 % by 2010, with respect to 1995 levels. In the meantime, the European industry association has submitted a self-obligation, with the same goal, to the EU Commission. The leading manufacturers in Germany have signed a national self-commitment declaration concerning this issue.

Since this industry sector tends to develop production technologies rapidly, and is forecast to continue growing strongly, relevant forecasts regarding this area are subject to large uncertainties.

2.4.3.3 Modernisation and optimisation processes in aluminium production

As a result of extensive modernisation measures in German aluminium smelters – for example, conversions to state-of-the-art technology (point-feeder technology) – as well as decommissioning of production capacities, PFC emissions from this sector decreased by 78 % (1.2 million tonnes of CO_2 equivalents) between 1995 and 2005.

2.4.3.4 Substitutes for sulphur hexafluoride as a protective gas in magnesium production

Industry uses SF_6 as a protective gas in magnesium production and processing. The available substitutes include SO_2, an HFC and a fluorinated ketone. While SO_2 has been used for years by some magnesium foundries, other substitutes have arrived on the market only recently. Because SO_2 has toxic properties, installations that wish to use it must first undertake safety conversions, and such conversions are not cost-effective for smaller magnesium foundries. On the

other hand, conversions to the newly developed alternatives can lower the overall costs of even smaller installations. To ensure that every foundry is able to find an optimal solution for process conversions, it will not be possible to require complete conversion to alternatives before 2009. The prohibition on use mandated by Regulation (EC) No 842/2006 is limited to large foundries for an initial period until 1 January 2008. Here as well, via modernisation measures, industry has achieved reductions in advance of legislation – the regulation. Sharp increases in use has tended to counter the reductions, however.

2.4.3.5 Electrical operating equipment – precautions in connection with scrapping

In spite of the increasing use of SF_6 in electrical transmission systems, pertinent emissions decreased by 0.5 million tonnes of CO_2 equivalents from 1995 to 2005. These reductions are the result of lower plant and assembly losses in medium-voltage and high-voltage switching systems.

EU laws have no influence on electrical operating equipment already in place. In June 2005, German manufacturers and operators of electrical operating equipment, acting in co-operation with the German SF_6 producer, adapted their voluntary declaration of self-commitment to the current situation and partly expanded it. The declaration calls for testing and use of alternatives in special applications and for further reductions of leakage rates.

2.4.4 Summary

The following overview summarises the pertinent emissions-reduction measures in the industry sector.

Tab. 7: Policies and measures in the industry sector

Name of policy/measure	**Description / aims (scope of effects)**	**Green house gas**	**Type**	**Implementation status (effects)**	**Institution carrying out**	**Expected effect in 2010** (millions of t of CO_2 eq.)	**Expected effect in 2015** (millions of t of CO_2 eq.)	**Expected effect in 2020** (millions of t of CO_2 eq.)	**Expected effect in 2025** (millions of t of CO_2 eq.)	**Expected effect in 2030** (millions of t of CO_2 eq.)
Process-related CO2 emissions	In keeping with activity rates. Reduction of the activity rate in oxygen-steel production		F	ongoing		-13	-16	-19	-19	-18
Energy Saving Ordinance (Ener-	Thermal insulation and energy-saving	CO_2	R	As of 2002;	Federal Government	The reduction effects enter into measures in the "Private households" sector.				

gieeinsparverord-nung – EnEV)	systems in buildings			amend-ment in 2007		
Act on Ecological Tax Reform	Phased introduction of, or increases in, rates of tax on indi-vidual fuels (electrici-ty, natural gas, motor fuels, heating oil), in conjunction with simultaneous reduc-tion of the costs of the "work" factor; reduced tax rates for the manufacturing sector	CO_2	E	As of 1999	Federal Gov-ernment	Not quantified
Tax exemptions for certain energy-intensive industrial processes and procedures	New tax exemptions in the 2006 Energy Taxation Act (Ener-giesteuergesetz)	CO_2	F	2006	Federal Gov-ernment	Not quantified
Emissions trading	Cost-effective CO_2 reduction via intro-duction of an EU-wide CO_2-emissions trad-ing system	CO_2	E	2005	Federal Gov-ernment	The reduction effects enter into measures in the "Energy industry" sector.
Electricity "labelling"	Voluntary purchase of electricity generated from renewable energies or via ener-gy-efficient processes	CO_2	V	uncertain	Industry, pri-vate house-holds	Not quantified
CHP Act and CHP agreement between the Federal Gov-ernment and indus-try	Promotion of CHP installations in elec-tricity generation from biomass, within the context of the EEG; An agreed reduction target of 20-23 million tonnes of CO_2 by 2010	CO_2	V,R	2002	Industry, Fed-eral Govern-ment	The reduction effects enter into measures in the "Energy industry" sector.
Energy Consump-tion Labelling Or-dinance (Energie-verbrauchskenn-zeichnungsverord-nung – EnVKV) / Ordinance on Max-imum Energy Con-	Mandatory labelling to show energy con-sumption, and con-sumption of other resources, of house-hold electrical ap-pliances; Mandatory upper	CO_2	I	Since 01.01.199 8 (actual effect already as of	Federal Gov-ernment	The reduction effects enter into measures in the "Households" sector.

sumption (Energieverbrauchshöchstwerteverordnung – EnVHV)	limits on energy consumption, pursuant to the EnVHV, are currently in place only for refrigerators and freezers and for some household lighting systems			1995/96 - already included in the OMS)					
Voluntary commitments by manufacturers, aimed at reducing the electricity consumption of electrical devices	Agreements, regulations and self-commitments relative to standby losses in audio devices, to energy efficiency of external power supply units and to digital TV systems from 2000/3 and to consumer electronic devices	CO_2	V	As of 2000	Industry, EU	Not quantified			
XPS hard foams and PU foams	Extensive use of substitutes for HFCs – for example, CO_2 – as of 2000, and discontinuation of introduction / use of HFCs for PU foam products / PU assembly foams; aim: Use of less climate-harmful gases in substitution of ozone-depleting gases, in keeping with EU Regulation 842/2006	HFC	V, R	As of 2008	Industry, EU	-2,4	-2,5	-2,7	Not quantified
Semiconductor manufacturing	Modernisation measures; partial substitution of PFC etching gases – for example, with NF_3; remark: This industry sector is growing strongly	PFC	V	since 1999	Industry	-0,5	-1,1	-1,6	Not quantified
Modernisation of aluminium production	Reduction of PFC emissions, via modernisation and optimisation processes in the aluminium industry	PFC	V	Effective since 1996; expanded in 2000	Industry	-0,5	-0,5	-0,5	Not quantified

Substitutions for sulphur hexafluoride as a protective gas in magnesium production	Phased prohibition of SF_6, and substitute use of SO_2 and other gases, as protective gases in magnesium production, pursuant to Regulation (EC) No 842/2006	SF_6	V, R	As of 2006	Industry, EU	-0,9	-1,2	-1,5	Not quantified
Electrical operating equipment	Precaution, reclamation, environmentally compatible disposal	SF_6	V	Since 1996; was expanded in 2005	Industry	-0,7	-0,7	-0,7	Not quantified
Climate-protection agreement	Industry self-commitment to reduce specific GG by 35%, on the basis of 1990 levels, by 2012	GG	V		Industry and Federal Government	20	Initially, this measure is effective only until 2012		

2.5 Commerce, trade, services (CTS - GHD)

2.5.1 Carbon dioxide (CO_2)

2.5.1.1 KfW CO_2 reduction programmes

Cf. Sections 2.2.1.6 and 2.6.1.1.

2.5.1.2 EnEV and the amendment of the EnEV

Cf. Section 2.2.1.8.

2.5.1.3 Introduction of the energy "passport"

Since 1995, the EnEV has required that energy and heating-requirements documents – "passports" be prepared for new buildings. An amendment of EnEV will extend this requirement to residential buildings that are for sale or rental.

The Federal Ministry of Transport, Building and Urban Affairs (BMVBS) estimates that some 900,000 energy passports will be issued each year (dpa 2006). With respect to all relevant existing buildings, that figure represents a rate of 4 % per year. It is assumed that, as a result of various hindrances, that figure will not be attained right away in the 2008, the year in which the system is introduced; instead, it will be attained only after an estimated three-year transition pe-

riod. Assuming that the passport-issue rate remains constant at an average of 900,000 passports per year, then nearly all buildings will have energy passports by 2030.

The energy-passport provision is likely to prompt building owners to make additional modernisations and renovations that they otherwise would not have undertaken or would have put off. It is difficult to make any quantitative estimates of this effect, since no pertinent empirical data are available.

In one study, Kleemann and Hansen (2005), using certain assumptions, calculated that the measure could yield reductions of 0.09 million tonnes of CO_2 per year. One of the key assumptions the authors made in reaching their conclusion was that only older buildings and buildings in need of renovation would actually be modernised/renovated, and that no significant additional reductions would be made in the new-buildings sector. The figure takes account of double-counting resulting from monetary support programmes and autonomous decisions.

The non-overlapping reductions of 0.09 million tonnes per year, as calculated in connection with energy passport, enter into the quantifications for the "with-measures" scenario. The cumulative reduction then reaches 1 million tonnes of CO_2 by 2020 and over 2 million tonnes of CO_2 by 2030. Consequently, exploitation of the potential in this area is expected to improve from its current level of 32 % to 42 % in 2030.

2.5.1.4 Energy Consumption Labelling Ordinance (Energieverbrauchskennzeichnungsverordnung - EnVKV) and Ordinance on Maximum Energy Consumption (Energieverbrauchshöchstwerteverordnung – EnVHV)

Cf. Section 2.4.1.7.

2.5.1.5 Voluntary labelling

For purchasers of office equipment and consumer electronics, energy labels can provide useful information about devices' energy consumption. They call attention to conformance with relevant standards, especially with regard to devices' stand-by and "off" states. Previously, energy labelling for IT and consumer electronic devices was not standardised in any way. One of the most widely used labels for office equipment is the "Energy Star". Office and consumer electronic devices that are especially efficient can receive the GEEA label, which also assesses power consumption during a device's "off" state. The "Blauer Engel" ("Blue Angel"), and various other

environmental and ergonomic labels – for example, the EU environmental label – also take power consumption into account.[26]

2.5.1.6 The Ecological Tax Reform, expansion of reductions of electricity and energy taxes; and the coal tax

Cf. Sections 2.2.1.1, 2.2.1.2 and 2.2.1.4.

2.5.1.7 Electricity "labelling"

Cf. Section 2.3.1.7.

2.5.1.8 Market incentives programme in favour of renewable energies

Cf. Section 2.2.1.6.

2.5.1.9 Promotion of combined heat and power generation (CHP systems)

Cf. Section 2.3.1.2.

2.5.2 Halogenated hydrocarbons (HFCs, PFCs) and sulphur hexafluoride (SF_6)

Cf. Section 2.4.3.

2.5.2.1 Stationary and mobile air-conditioning systems

From 1995 to 2005, use of HFCs as substitutes for CFCs and H-CFCs, and intensified use of HFCs – for example, in automobile air-conditioning systems – increased emissions of such substances 19-fold (to 7.6 million tonnes of CO_2 equivalents). This trend will continue – for example, because disposal emissions are increasing. In relevant forecasts, 1 January 2004 was seen as the date for the entry into force of maintenance obligations, for refrigeration and air-conditioning systems, that were expected to reduce pertinent emissions. Lawmakers were unable to comply with that date, however. This reduces the emissions-reduction effect assumed for 2010.

Mobile air-conditioning systems in motor vehicles now contribute significantly to total HFC emissions. This is due primarily to the sharp increase in the percentages of new vehicles equipped with air-conditioning systems, an increase that better leakproofness of systems has not been able to compensate for. While for some years it has been apparent that CO_2 is a suitable, halogen-free substitute, automakers have hesitated to use it in this application. The levels reached by longer-term emissions trends (2010/2020) will depend decisively on the time at which this

[26] Detailed information about the labels is provided at www.energy-labels.de.

substitute technology is introduced to the market. Emissions projections to date have assumed that CO_2 technology would be introduced to the market beginning in 2008. While the European Commission's aforementioned proposal would set 1 January 2011 as the date on which phasing-out of HFCs would begin, it would permit HFCs with a Global Warming Potential (GWP – greenhouse-gas potential) of up to 150 to be used as "substitutes".

2.5.2.2 Substitution of HFC-containing dose aerosols

This measure primarily involves substitution of HFC in use as a propellant in medical dose inhalers (for example, metered dose inhalers for asthma treatment). Although the market share of powder inhalers, which are suitable alternatives, has increased in recent years, additional action is needed in this area. Because of the special considerations applying to medical applications, the Federal Government continues to view voluntary measures as particularly appropriate in connection with dose inhalers. HFC substitution is technically possible also in the case of other aerosols. To date, only some of these ("novelty sprays") are covered by Regulation (EC) No 842/2006. In future, the Regulation could be extended to other applications (such as cosmetics). For 2020, the measure is projected to have a reduction effect of about 0.5 million tonnes of CO_2 equivalents.

2.5.2.3 Use of SF_6 in soundproof windows

At present, emissions from soundproof windows represent the second-largest single source of SF_6 emissions. While providing only slight improvements in sound insulation, SF_6 tends to worsen thermal insulation performance. Use of the substance has been decreasing since the mid-1990s, and alternatives have become established.

EC Regulation 842/2006 includes a prohibition of this use. On the other hand, SF_6 emissions resulting from disposal of soundproof windows that have reached the end of their lifetimes will increase strongly until 2020. Since the pertinent EC Regulation did not enter into force until 2006, the effect seen in 2020 will be smaller than that expected in 2000 for that year.

2.5.2.4 Filling of automobile tyres with SF_6

Automobile tyres, which are filled with SF_6 for image-related reasons (the improved pressure constancy is not relevant in practice), are another source of SF_6 emissions. Because of the climate relevance of SF_6, tyre manufacturers stopped advertising this application some years ago. This has led to a considerable reduction. As of 4 July 2007, this application is prohibited by Regulation (EC) No 842/2006. The bulk of today’s emissions originates from gas in older filled tyres.

2.5.3 Summary

The following overview summarises the instruments and measures in the commerce/trade/services sector.

Tab. 8: Policies and measures in the commerce/trade/services sector

Name of policy/measure	Description / aims (scope of effects)	Greenhouse gas	Type	Implementation status (effects)	Institution carrying out	Expected effect in 2010 (millions of t of CO_2 eq.)	Expected effect in 2015 (millions of t of CO_2 eq.)	Expected effect in 2020 (millions of t of CO_2 eq.)	Expected effect in 2025 (millions of t of CO_2 eq.)	Expected effect in 2030 (millions of t of CO_2 eq.)
KfW CO_2-reduction programme	Support instrument for reducing energy inputs and CO_2 emissions of operational processes and cross-cutting technologies	CO_2	F	As of 1996	Federal Government	The reduction effects enter into the measures in the "Private households" sector.				
Energy Saving Ordinance (Energieeinsparverordnung – EnEV)	Thermal insulation and energy-saving systems in buildings	CO_2	R	As of 2002; amended slated for 2007	Federal Government	The reduction effects enter into the measures in the "Private households" sector.				
Energy passport	Documentation of buildings' energy efficiency	CO_2	R	As of 2008	Federal Government	The reduction effects enter into the measures in the "Private households" sector.				
German Energy Agency (Deutsche Energie Agentur – DEnA)	Information, campaigns and projects for more efficient energy use, and promotion of renewable energies	CO_2	I	2000	Federal Government and industry	Not quantified				
Energy Consumption Labelling Ordinance (Energieverbrauchskennzeichnungsverordnung - EnVKV) and Ordinance on Maximum Energy Consumption (Energieverbrauchshöchstwerteverordnung –	Mandatory labelling to show household electrical appliances' consumption of energy and other resources; Mandatory upper limits on energy consumption, pursuant to the EnVHV, are currently in place only for refrigerators	CO_2	I	Since 01.01.1998 (actual effect already as of 1995/96 - already	Federal Government	The reduction effects enter into the measures in the "Households" sector.				

EnVHV)	and freezers and for some household lighting systems			included in the OMS)					
Voluntary labelling to show devices' energy consumption levels	Information about devices' energy consumption provided in labels	CO_2	I, R	uncertain	Industry, EU	Not quantified			
Act on the Ecological Tax Reform (including coal tax)	Phased introduction of, or increases in, rates of tax on individual fuels (electricity, natural gas, motor fuels, heating oil), in conjunction with simultaneous reduction of the costs of the "work" factor; reduced tax rates for the manufacturing sector	CO_2	E	In progress since 1999	Federal Government	Not quantified			
Electricity "labelling"	Voluntary purchase of electricity generated from renewable energies or via energy-efficient processes	CO_2	V	uncertain	Industry, private households	Not quantified			
A market-incentives programme for solar systems	Promotion of solar-collector systems	CO_2	F	As of 1999	Federal Government	The reduction effects enter into the measures in the "Private households" sector.			
A market-incentives programme for biomass use	Promotion of biomass-fired boilers	CO_2	F	As of 1999	Federal Government	The reduction effects enter into the measures in the "Private households" sector.			
CHP Act and CHP agreement between the Federal Government and industry	Promotion of CHP installations in electricity generation from biomass, within the context of the EEG; An agreed reduction target of 20-23 million tonnes of CO_2 by 2010	CO_2	V,R	In progress since 2002	Industry, Federal Government	The reduction effects enter into the measures in the "Energy industry" sector.			
Refrigeration and air-conditioning systems	a) Requirements for annual maintenance of refrigeration and air-conditioning systems using HFCs as	HFC	R	4.7.2007	EU, industry	-2,4	-3,8	-5,2	Not quantified

	refrigerants; b) Phase-out of HFC air-conditioning systems and phase-in of CO_2-based systems in motor vehicles as of 2011. Aim: Use of gases that are less climate-harmful								
Substitution of HFC-containing dose aerosols	Promotion of market share for powder inhalers – for example, in asthma therapy – with the aim of reducing use of HFC as a propellant, in keeping with EC Regulation No 842/2006	HFC	F	As of 2006	EU, industry	-0,4	-0,4	-0,5	Not quantified
Soundproof windows	Replacement of SF_6 techniques with modified glass structures, pursuant to EC Regulation 842/2006	SF_6	R	4.7.2007	EU, industry	-1	-1,1	-1,2	Not quantified
Discontinuation of use of SF_6 for filling of automobile tyres	Ban on use, in addition to tyre manufacturers' discontinuation of usage recommendations	SF_6	V+R	V, R effective as of 4 July 2007	EU, industry	-0,7	-0,7	-0,7	Not quantified

2.6 Private households

2.6.1 Carbon dioxide (CO_2)

2.6.1.1 KfW CO_2-reduction programmes

The KfW banking group's CO_2-reduction programmes provide low-interest, long-term financing for investments at reducing buildings' energy requirements and CO_2 emissions, and well as for investments for construction of energy-saving homes. KfW offers low-interest loans for such purposes. The KfW CO_2-reduction programme, which began in 1996, has primarily funded individual measures. In 2005, KfW integrated the reduction programme within its modernisation programme (cf. Chapter 2.6.1.2). KfW's CO_2-oriented housing modernisation programme, which was launched in 2001, has a complementary effect. It promotes packages of measures (combinations of measures). For 2006, that programme's resources were increased by € 640 million,

to € 1.0 billion, and the programme was expanded in scope. In the period 2007 to 2009, additional interest-subsidy and other subsidy funding, averaging € 1.0 billion (programme resources) per year, will be provided. Since 2006, support for relevant efforts has been provided via low-interest loans with redemption subsidies, with subsidies and interest rates oriented to the energy savings actually achieved. As of 2007, the group is also providing investment subsidies in this area.

If the CO_2-oriented building modernisation programme, via the KfW banking group, is continued after 2009, until 2030, and if its average annual volume of € 1 billion in interest subsidies and other subsidies (programme resources) is maintained, as is assumed for the "with-measures" scenario, then by 2020 it would result in total CO_2 savings of about 3.3 million tonnes.

2.6.1.2 The KfW's housing modernisation programme

In 2003, KfW extended this modernisation to all of Germany. The programme provided support for modernisation and renovation of residential buildings, including (under certain conditions) attic conversions, add-on structures, additional storeys, grounds improvements for multi-family homes and, in the new German Länder and east Berlin, removal of vacant rental-apartment buildings. The support programme terminated at the end of 2004. In early 2005, then, KfW combined its modernisation and CO_2-reduction programmes.

To calculate the relevant reductions by 2010, the models assumed a total loan volume of € 9 billion. That assumption leads to an annual amount of € 1.5 billion, which is close to the average support level in the years 2000 to 2004. For the period 2010 to 2030, an annual volume of € 1.5 billion was also assumed. The resulting CO_2 reductions amount to some 1 million tonnes by 2020.

2.6.1.3 EnEV and the amended version of the EnEV

Cf. Section 2.2.1.8.

2.6.1.4 Promotion of energy advising and on-site advising

In recent years, an average of about 5,000 advising sessions have been carried out annually. The expenditures for the programme amounted to € 1.6 million in 2002 and to € 1.76 million in 2003. The expenditure per advising session averaged about € 340.

No all proposals provided in advising sessions are actually implemented. A survey conducted by the Federal Office of Economics and Export Control (BAFA 2000), for example, found that

the results of advising sessions strongly influenced energy-saving-investments decisions of 64 % of those persons surveyed. Eza (2004), on the other hand, found that the average rate of implementation of proposals provided in on-site advising was only 50 %. The following estimate of CO_2 reductions is based on the BAFA study's more optimistic value of 64 %.

Continuing the programme until 2020 would yield a gross cumulative reduction of 0.35 million tonnes of CO_2 by 2020.

Many persons who receive advising make use of financial support for their resulting modernisations. As a result, there is some overlapping with the calculated savings resulting via monetary support instruments. Kleemann and Hansen (2005) place the relevant percentage share for support at about 60 %.

2.6.1.5 Measures affecting existing structures, within the context of subsidised public housing

Until 2006, the Federal Government provided the Länder with financial assistance for subsidisation of public housing. Such subsidies have been provided especially for those households who are unable to pay for suitable housing with their own resources. Under the results of Germany's Federalism Reform I (Föderalismusreform I), relative to reduction of requirements for mixed financing, as of 2007 public housing subsidisation was placed under the sole task and financial responsibility of the Länder, with compensation payments to be provided by the Federal Government for a limited period. The Länder are to continue applying the Federal payments toward investment purposes related to housing subsidisation. The direct focuses of support include housing modernisation. This term is understood to refer to structural measures that improve the functional value of living spaces in lasting ways, that improve general living conditions in lasting ways or that provide lasting reductions of heating-energy or water requirements.

If the Länder support level of € 300 million per year is continued (this was the level in 2003), the resulting reductions could amount to about 0.19 million tonnes of CO_2 by 2020. Energy savings would absorb 25% of relevant funding.

2.6.1.6 City-reconstruction programme "East" (Stadtumbauprogramm Ost)

The City-reconstruction programme "East" (Stadtumbau Ost), a programme of the Federal Ministry of Transport, Building and Urban Affairs (BMVBS) in progress since the beginning of 2002, has the aims of removing unneeded housing, in order to streamline and stabilise local housing markets, and of improving existing housing, immediate housing surroundings and city districts.

Plans call for some 350,000 flats to be taken off the market in the period 2002 to 2009. These figures translate into an average rate of about 45,000 flats per year. The great majority of the flats / residences being removed are vacant and no longer needed.

The improvement measures include adjustments of municipal infrastructure and improvements in existing buildings. The programme does not explicitly include "energy-saving" and "CO_2 reduction" among its aims. Nonetheless, the programme's section "improvements in existing buildings" will provide some energy savings.

From 2002 to 2009, the Federal Government is providing a total of € 1.1 billion in programme funding (as of 2007) for the city-reconstruction "East" programme. The average annual support level is thus about € 140 million. As a result, funding is apportioned equally to removal and improvement measures. If current support levels are continued, as is assumed in the "with-measures" scenario, savings of 0.1 million tonnes of CO_2 would result by 2020.

2.6.1.7 Introduction of the energy "passport"

Cf. Section 2.5.1.3.

2.6.1.8 Activities of DEnA

Cf. Section 2.2.1.10.

2.6.1.9 Ordinance on Maximum Energy Consumption (Energieverbrauchshöchstwerteverordnung – EnVHV) and Energy Consumption Labelling Ordinance (Energieverbrauchskennzeichnungsverordnung - EnVKV)

Cf. Section 2.5.1.4.

2.6.1.10 Market incentives programme for promotion of renewable energies

Cf. Section 2.2.1.6.

2.6.1.11 Manufacturers' voluntary commitments to reducing electricity consumption of electrical devices

Cf. Section 2.4.1.8.

2.6.1.12 Voluntary labelling

Cf. Section 2.5.1.5.

2.6.1.13 Ecological Tax Reform and coal tax

Cf. Sections 2.2.1.1 and 2.2.1.2.

2.6.2 Summary

The following Table summarises the policies and measures in the "Private households" sector.

Tab. 9: Policies and measures in the "Private households" sector

Name of policy/measure	Description / aims (scope of effects)	Greenhouse gas	Type	Implementation status (effects)	Institution carrying out	Expected effect in 2010 (millions of t of CO_2 eq.)	Expected effect in 2015 (millions of t of CO_2 eq.)	Expected effect in 2020 (millions of t of CO_2 eq.)	Expected effect in 2025 (millions of t of CO_2 eq.)	Expected effect in 2030 (millions of t of CO_2 eq.)
KfW CO_2-reduction programme (including effects in other sectors)	Support measure for reducing energy inputs and CO_2 emissions of operational processes and cross-cutting technologies	CO_2	F	As of 1996	Federal Government	-1,2	-2,3	-3,3	-4,3	-5,3
New modernisation programme	Support measure for maintaining the function and improving the value of housing	CO_2	F	As of 2003	Federal Government	-0,4	-0,7	-1,0	-1,3	-1,6
Energy Saving Ordinance (EnEV) (including effects in other sectors)	Thermal insulation and energy-saving systems in buildings	CO_2	R	As of 2002; amended slated for 2007	Federal Government	-1,4	-2,6	-3,7	-4,9	-6,0
On-site advising	Support for advising to promote thrifty, efficient energy use in residential buildings	CO_2	F	ongoing	Federal Government	-0,1	-0,2	-0,4	-0,5	-0,6
Promotion of energy advising (including the "EnSan" funding priority, which provides information, encouragement and other impetus for relevant modernisations)		CO_2	F	ongoing	Federal Government	-2,6	-6,0	-9,2	-12,0	-14,0
Support for public housing	Housing modernisation	CO_2	F	In 2002, supplanted the public housing construction programme (sozialer	Federal Government	-0,1	-0,1	-0,2	-0,3	-0,3

				Woh-nungsbau) getreten						
City-reconstruction "East" (Stadtumbau Ost)	Support measure for improving city districts and promoting re-moval of unneeded housing	CO_2	F	As of 2002	Federal Gov-ernment	0	-0,1	-0,1	-0,1	-0,2
Energy passport (including effects in other sectors)	Documentation of buildings' energy efficiency	CO_2	R	As of 2008	Federal Gov-ernment	-0,2	-0,7	-1,1	-1,6	-2,0
German Energy Agency (Deutsche Energie Agentur – DEnA)	Information, cam-paigns and projects for more efficient energy use, and promotion of renewa-ble energies	CO_2	I	2000	Federal Gov-ernment	Not quantified				
Energy Consump-tion Labelling Or-dinance (EnVKV) / Ordinance on Max-imum Energy Con-sumption (EnVHV) (including effects in other sectors)	Mandatory labelling to show household electrical appliances' consumption of ener-gy and other re-sources; Mandatory upper limits on energy consumption, pur-suant to the EnVHV, are currently in place only for refrigerators and freezers and for some household lighting systems	CO_2	I	Ongoing since 01.01.199 8 (actual effect already as of 1995/96 - already included in the "without-measures" scenario)	Federal Gov-ernment	-6	-9	-9	-9	-9
"Solar" market incentives pro-gramme (including effects in other sectors)	Promotion of solar-collector systems	CO_2	F	As of 1999	Federal Gov-ernment	-0,2	-0,4	-0,6	-0,8	-1,0
"Biomass" market incentives pro-gramme (including effects in other sectors)	Promotion of bio-mass-fired boilers	CO_2	F	As of 1999	Federal Gov-ernment	-0,8	-1,5	-2,2	-2,9	-3,6
Manufacturers' voluntary commit-	Agreements, regula-tions and self-	CO_2	V	As of 2000	Industry, EU	Not quantified				

ments to reducing electricity consumption of electrical devices	commitments relative to standby losses in audio devices, to energy efficiency of external power supply units and to digital TV systems from 2000/3 and to consumer electronic devices					
Voluntary labelling to show devices' energy consumption levels	Information about devices' energy consumption provided in labels	CO_2	I, R	uncertain	Industry, EU	Not quantified
Ecological Tax Reform (including coal tax)	Phased introduction of, or increases in, rates of tax on individual fuels (electricity, natural gas, motor fuels, heating oil), in conjunction with simultaneous reduction of the costs of the "work" factor; reduced tax rates for the manufacturing sector	CO_2	E	since 1999	Federal Government	Not quantified

2.7 Transport sector

2.7.1 Carbon dioxide

2.7.1.1 Ecological Tax Reform

Cf. also Section 2.2.1.1.

The "Act for introduction of the Ecological Tax Reform" ("Gesetz zum Einstieg in die ökologische Steuerreform"), which entered into force on 1 April 1999, introduced energy taxation designed to reduce energy consumption and the resulting emissions. The great majority of revenue generated via the Ecological Tax Reform is applied toward reductions of rates of contribution to the social security system, and some revenue is used to promote renewable energies. Under the Ecological Tax Reform, the mineral-oil tax was increased by 3.07 cents per litre annually, for both petrol and diesel, from 1999 to 2003. For petrol, this action increased the mineral-oil tax from 50 cents to 65 cents, while for diesel it increased the tax from 32 cents to 47 cents.

Fuel-price increases lead to reduced consumption and to reduced total mileage. In the transport sector, the Ecological Tax Reform thus resulted in CO_2-emissions reductions of 2.4 million tonnes in 2010 and of 2.5 million tonnes in 2020.

2.7.1.2 Introduction of road-use tolls for trucks in January 2005

Since 1 January 2005, trucks with permissible total weight of more than 12 t have been subject to a road-use toll of 12.4 ct / vehicle-km on Germany's autobahns. Under a "toll compromise", plans calls for the toll to increase to an average of 13.5 ct / vehicle-km as of September 2007. Revenue from the toll is used to finance the toll system and transport-infrastructure investments. With this policy, Germany, in financing its road system, has begun to move away from tax financing and toward user financing.

Calculations indicate that the truck toll will reduce CO_2 emissions from truck traffic by 2.4 million tonnes in 2010 and by 2.6 million tonnes in 2020.

2.7.1.3 Voluntary commitment by the automobile industry

In 1998, the European automobile industry (represented by the European Automobile Manufacturers' Association – ACEA) made a voluntary commitment, to the European Commission, to reduce the CO_2 emissions of new automobiles purchased in the EU to an average of 140 g/km by 2008. In addition, it was agreed that an intermediate goal, an average of 165-170 g/km in 2003, would serve as a progress indicator. In addition, the automobile industry agreed that by 2000 it would begin selling automobiles that emit 120 g CO_2 / km or less.

Under the assumption that the target level of 140 g/km is reached in 2008, the resulting CO_2-emissions reductions would amount to 6.3 million tonnes in 2010 and 8.1 million tonnes in 2020.

2.7.1.4 Requirement to add biofuels, and taxation of biofuels

As of 1 January 2007, the Biofuel Quota Act (BioKraftQuG) has required companies that sell fossil fuels to sell a certain percentage of biofuels (i.e. as a share of their total fuel sales). Prior to the entry into force of that requirement, biofuels were already being added to fossil diesel fuel, and used in pure form as transport fuels (biodiesel, vegetable oil). By 2005, some 600,000 t of biodiesel were added, and an additional 1.2 million tonnes of 100 % biodiesel used, for transport purposes (UFOP 2006). By contrast, mixing of biofuels with petrol, and use of bioethanol (E85), had had very little market impact in Germany. The Biofuel Quota Act will give these practices their first significant market shares.

Taking the entire life cycles of biofuels into account (especially the refining processes used to produce them), the mixing requirement will reduce CO_2 emissions by 7.1 million tonnes in 2010 and by 6.0 million tonnes in 2020.

2.7.1.5 Limitation of the distance-based tax benefit (Entfernungspauschale)

On 7 July 2006, the Bundesrat approved the 2007 Tax Amendment Act (Steueränderungsgesetz), thereby also approving a new income-tax provision applying to expenses incurred in employment (Werbungskosten) for commuting between one's home and workplace. As of 1 January 2007, only expenditures for commuting distances greater than 20 kilometers are deductable – at a rate of € 0.30 per kilometer – with the total deduction limited to € 4,500.

This measure is expected to reduce road-traffic CO_2 emissions by 0.6 million tonnes in 2010 and by 2.1 million tonnes in 2020.

2.7.2 Summary

The following Table provides an overview of relevant measures in the transport sector.

Tab. 10: Policies and measures in the transport sector

Name of policy/measure	**Description / aims (scope of effects)**	**Greenhouse gas**	**Type**	**Implementation status (effects)**	**Institution carrying out**	**Expected effect in 2010** (millions of t of CO_2 eq.)	**Expected effect in 2015** (millions of t of CO_2 eq.)	**Expected effect in 2020** (millions of t of CO_2 eq.)	**Expected effect in 2025** (millions of t of CO_2 eq.)	**Expected effect in 2030** (millions of t of CO_2 eq.)
Ecological Tax Reform	Increase in the mineral-oil tax, by 3.07 cents per litre of petrol or diesel, per year, from 1999 to 2003	CO_2	F	As of 1999	Federal Government	-2,4	-2,5	-2,5	-2,4	-2,3
Introduction of road-use tolls for trucks since January 2005	Introduction of a road-use toll of 12.4 ct / vehicle-km, for trucks with a permissible total weight of more than 12 t, on autobahns	CO_2	F	As of 2005	Federal Government	-2,4	-2,6	-2,6	-2,7	-2,8
Voluntary commitments by the automobile industry	Voluntary commitment by the automobile industry to reduce CO_2 emissions of new	CO_2	V	As of 1998	European Automobile Manufacturers' Association	-6,3	-8,0	-8,1	-7,7	-7,1

	automobiles purchased in the EU to an average of 140 g/km, by 2008				(ACEA)					
Biofuel Quota Act (BioKraftQuG)	Requirement to add biofuels, and taxation of biofuels	CO_2	R	As of 2007	Federal Government	-7,1	-6,7	-6,0	-5,7	-6,2
Limitation of the distance-based tax benefit (Entfernungspauschale)	Limitation on tax deduction for employment-related expenses incurred in communting between one's home and workplace	CO_2	F	As of 2007	Federal Government	-0,6	-1,8	-2,1	-2,2	-2,3

2.8 Agriculture

2.8.1 Carbon dioxide (CO_2)

Under the System of Energy Balances, agricultural operations are included in the commerce/trade/services (CTS) sector. As a result, the CTS sector includes CO_2 emissions from agriculture (cf. Chapter 2.5). Since no differentiated data are available, CO_2 emissions from agriculture cannot be separately listed.

2.8.2 Methane (CH_4)

The following Table shows how CH_4 emissions from agricultural animal husbandry would decrease from 1990 to 2020.

Tab. 11: CH_4 emissions from agricultural animal husbandry, 1990-2020

In millions of tonnes of CO_2-equivalents	**1990**	**1995**	**2000**	**2005**	**2010**	**2015**	**2020**
Fermentation	24,15	20,79	19,53	18,27	17,45	16,46	15,53
Manure management	5,88	5,46	5,25	5,04	5,06	4,94	4,81
Total	30,03	26,25	24,78	23,31	22,51	21,39	20,32
With respect to 1990					-25,0%	-28,8%	-32,3%
With respect to 2005					-3,4%	-8,2%	-12,8%

Source: Federal Environmental Agency

The following sections describe the instruments leading to such reductions.

2.8.2.1 Renewable Energy Sources Act (EEG) and Biomass Ordinance

The Renewable Energy Sources Act (EEG) promotes use of substitutes, including biomass, for fossil fuels (cf. 2.2.1.5 and 2.2.1.6). By promoting use (combustion) of biogas, landfill gas, gas from wastewater treatment and pit gas, it helps to prevent methane emissions. The Biomass Ordinance (Biomasseverordnung) of 21 June 2001 specifies what substances are considered biomass, what technical processes for electricity generation from biomass fall under the Act's scope of application and what binding environmental requirements apply to generation of electricity from biomass.

2.8.2.2 Package of measures in agriculture (CH_4 reduction)

A considerable share of agricultural emissions result from natural processes over which, as far as is currently known, farmers normally have little influence under actual operational conditions. CH_4-emissions reductions in agriculture have been achieved via the following measures and instruments (inter alia):

- Intensified use of farm manure in agricultural biogas systems (prevention of CH_4 emissions via gasification of liquid manure).
- Expansion of agricultural-investments support for environmentally compatible technologies.This applies both to stall construction and to storage and spreading of farm manure.
- Severing links to direct payments
  The 2003 agricultural reform severed links to direct payments, and the German "decoupling model" provides for complete "decoupling" of animal bonuses. As a result, maintenance of animal-husbandry operations is no longer a key basis for receipt of direct payments. Consequently, farmers can orient their production exclusively to the needs of the market. Experts forecast that, in the medium and long terms, "decoupling" of direct payments will result in decreasing trends in cattle and sheep production.
- Further reductions in dairy-cattle herds, as a result of increases in per-animal yields.

These measures and instruments are expected to bring about a clearly decreasing emissions trend, a trend resulting primarily from reductions in animal herds [27] and in expansion of biogas

[27] If the most recent world-market price trends prove lasting, then this assessment may have to be revised.

production. On the basis of these assumptions, the current decrease in CH_4 emissions is expected to continue. This trend is forecast to result in a CH_4-emissions reduction of 10 million tonnes of CO_2 equivalents by 2020, with respect to 1990, or a reduction of about 30 %. Since that reduction will not be the result of climate-protection measures and instruments, no separate calculation for a "without-measures" scenario has been carried out.

2.8.3 Nitrous oxide (N_2O)

Natural processes in the soil (nitrification, denitrification) generate unavoidable N_2O emissions. N_2O emissions, in the present context, depend centrally on nitrogen fertiliser inputs (about 1 % of nitrogen fertiliser inputs, regardless of whether they are of mineral or farm-manure origin, escape from the soil as N_2O). More extensive (as opposed to intensive) agricultural soil use, involving lower concentrations of available nitrogen in the soil – as is practiced in organic farming – thus normally leads to decreasing N_2O emissions. While nitrogen efficiency can be expected to increase continually (thereby lowering N_2O emissions), increasing biomass production, and the more and more intensive land management it involves, leads to increasing N_2O emissions from agricultural lands. Furthermore, it must also be remembered that pertinent financial resources of the Länder, along with the spectrum of agricultural environmental programmes offered by the Länder, have both decreased. Land set-asides are decreasing, to the benefit of raw-materials production (rape and corn for biofuels), and thus fertilisation is continuing. The overall result of this trend is that N_2O emissions from agricultural lands are remaining at about the same level. In contrast to the relationships seen in the area of methane emissions, decreases in direct emissions from (decreasing) animal husbandry are unable to counter the aforementioned increases in N_2O emissions.

The following Table summarises the trends and forecasts for N_2O-emissions reductions from soils and animal husbandry.[28]

Tab. 12: N_2O emissions from soils and animal husbandry, 1990-2020

In millions of tonnes of CO_2 equivalents	**1990**	**1995**	**2000**	**2005**	**2010**	**2015**	**2020**
Animal husbandry	4,03	2,79	2,79	3,10	2,48	2,48	2,48
Soils	44,33	38,13	39,99	37,82	34,72	34,72	34,72

[28] The Table is based on information as modelled by the Federal Agricultural Research Institute (FAL), for the period until 2010. The figures for 2015 and 2020 are based on the assumption that emissions remain constant.

Total	48,36	40,92	42,78	40,92	37,20	37,20	37,20
With respect to 1990					-23,1%	-23,1%	-23,1%
With respect to 2005					-9,1%	-9,1%	-9,1%

Source: FAL, Federal Environmental Agency

2.9 Forestry

A range of measures, oriented to sustainable forest management and to preserving and enlarging the country's forested area, are protecting Germany's carbon stocks in forests.

The Federal Republic of Germany has decided to use additional activities pursuant to Article 3.4 of the Kyoto Protocol to fulfil its reduction obligations. Under the provisions of the Marrakesh Accords (decision 11/CP.7), the CO_2 credits that can be obtained via forest-management measures are limited to about 4.5 million tonnes of CO_2 annually. Energy-related greenhouse-gas emissions from forestry enter into quantification for other sectors (especially the transport and commerce/trade/services).

Apart from general measures designed to protect forests, Germany has not undertaken any forestry-sector measures that are motiviated explicitly by climate policy. Since 1975, support for initial afforestation has been provided, however. In addition, forestry mergers are in place that facilitate reduction of debris from thinning and use of biomass for energy purposes.

Since no differentiated data are available, CO_2 emissions from forestry cannot be separately listed.

2.10 Waste management

2.10.1 Methane

In 1990, the waste-management sector, which generated 38 % of all methane emissions, was the main source of emissions of this greenhouse gas. Even though the sector's emissions have been decreasing sharply, in 2005 the sector still accounted for 22 % of all such emissions. By that year, the sector's emissions amounted to only about half the agricultural sector's CH_4 emissions and to about two-thirds of energy-related CH_4 emissions.

This trend is primarily the result of extensive measures to reduce waste production, and to recover and recycle waste, as well as of a fundamental restructuring of the waste-management

sector, leading away from landfilling. For this reason, CH_4 emissions from landfills decreased sharply in the years 1990 to 2005. One result of this restructuring of the waste-management sector is that emissions from composting and from mechanical and biological waste treatment have been increasing. The pertinent increases have amounted to only a fraction of the emissions from landfills, however.

The key framework for waste management consists of the Technical Instructions on Municipal Waste (TA Siedlungsabfall – TASi) and of provisions of the Act for Promoting Closed Substance Cycle Waste Management and Ensuring Environmentally Compatible Waste Disposal (KrW-/AbfG), the Ordinance on Environmentally Compatible Storage of Waste from Human Settlements and on Biological Waste-Treatment Facilities (AbfAblV), the Ordinance on installations for biological treatement of waste (30th Ordinance Implementing the Federal Immission Control Act (BimSchV)) and the Amendment of the Ordinance on incineration and co-incineration of waste (17th BImSchV) – provisions which, as of June 2005, largely prohibit landfilling of untreated waste (and, thus, landfilling of organic substances responsible for relevant gas formation), by requiring other types of waste disposal, such as incineration of mechanical-biological waste treatment.

2.11 Summary of the effects of measures and instruments introduced under climate-protection policy

The following Table summarises the total effects of measures, and contrasts those effects with the pertinent effects under the "without-measures" scenario.

Tab. 13: Development of greenhouse-gas emissions in the "without-measures" scenario (OMS) and "with-measures" scenario (MMS), and relevant effects

THG	**ACTUAL**		**Without measures**			**With measures**			**Effect**		
	2000	2005	2010	2015	2020	2010	2015	2020	2010	2015	2020
Millions of tonnes of CO_2 equivalents											
CO_2	883	873	892	893	905	831	772	767	-61	-121	-138
CH_4	65	51	46	41	37	46	41	36	0	0	-1
N_2O	84	67	63	62	61	63	61	60	0	-1	-1
HFCs	6	9	19	19	20	11	10	10	-8	-9	-10
PFCs	1	1	2	2	3	1	1	1	-1	-1	-2
SF_6	5	5	8	9	11	4	5	6	-3	-4	-5

Total	**1044**	**1005**	**1027**	**1027**	**1036**	**940**	**874**	**863**	**-61**	**-122**	**-140**
* The base year is 1990 for CO_2, CH_4 and N_2O, and 1995 for HFCs, PFCs and SF_6											
Source: Federal Environmental Agency (CSE, NIR), Öko-Instut et.al. (unpublished): Entwurf des Endberichtes zum Forschungsprojekt "Politikszenarien für den Klimaschutz" (draft of the final report for the research project "Policy Scenarios for Climate Protection") (FKZ 205 46 434), p. 246ff, 248.											

3 "With additional measures" scenario: description of additional possible measures and instruments for climate protection, and quantification of their effects

3.1 Framework data and description of the "with additional measures" scenario

3.1.1 Demographic, economic and other framework data for scenario development

The framework data for the "with additional measures" scenario are the same as those for the "without-measures" and "with-measures" scenarios. Detailed relevant information is provided in Section 2.1.1.

3.1.2 The "with additional measures" scenario

The "with additional measures" scenario (MWMS) analyses the scenario effects of various climate-policy and energy-policy measures and instruments (or targets) that could be introduced in addition to the measures and instruments already planned and in effect ("with-measures" scenario). The measures described have not been approved, nor would they necessarily be approved. The "with additional measures" scenario identifies possible additional climate-policy measures and their effects. The Federal Government has not endorsed, either as a political guideline or as a recommendation, the measures and instruments selected for discussion in the present context.

3.2 Overarching measures and instruments

3.2.1 Carbon dioxide (CO_2)

3.2.1.1 Creation of an energy efficiency fund

A well-designed energy efficiency fund could serve as an overarching framework for supporting achievement of potential savings and enhancement of energy efficiency. It could be focussed on centralised tendering, financing, co-ordination and implementation of programmes for supporting energy-efficient technologies and introducing them to the market, for promoting energy-saving use of devices and for providing training and further training. An energy efficiency fund would provide an opportunity to use competitive processes to boost development of innovative, broadly effective ideas and concepts for intensified implementation of energy-saving measures.

In the industry and commerce sectors, such a fund could support the following measures:

- Energy-oriented modernisation of air-conditioning and ventilation systems,

- Enhancement of the efficiency of pumps and other energy-relevant cross-cutting technologies,
- Optimisation of heating systems in large buildings,
- Financing of deficiency guarantees for contracting companies,
- Expansion of information services relative to efficient energy use,
- Intensified advising for small and medium-sized enterprises (SMEs).

Energy efficiency funds are already in place in a number of countries (UK, U.S., Netherlands, Denmark and Norway).

3.2.1.2 Intensified efforts to reduce electricity consumption

The measures and instruments proposed in the "with additional measures" scenario, relative to reducing electricity consumption, are oriented firstly to further reductions in the energy consumption of large household electrical appliances. Additional measures in this area could include binding minimum efficiency standards for other household electrical appliances, as well as tightening of existing binding regulations concerning product labelling.

To be successful, both instruments would necessarily have to be dynamic, i.e. their technical standards would have to be regularly adapted to technical progress and innovation in energy efficiency. Such adaptation could follow the example of Japan's "top-runner" approach, whereby the most energy-efficient product in a given product group sets the standards for that group. Once such a standard has been set, all manufacturers' and importers' products must conform to it, on average, within a certain, predetermined period of time.

Expanded use of binding minimum efficiency standards could result in electricity savings of about 9 TWh by 2020. An alternative approach, tightening and dynamising binding product label information for household electrical appliances, would yield savings of only about 6 TWh.

Secondly, measures and instruments should be considered that can help intensify exploitation of available technical opportunities for reducing standby losses in electrical and electronic devices in private households. Standby losses occur because devices' "off" states are not really "off"; i.e. many devices are not separated completely from the power grid when they are switched off. Requiring manufacturers to install switches that would truly separate devices from the power grid could completely eliminate such losses in the medium term. Estimates indicate that this instrument could save about 1 TWh per year through 2020.

Another possible instrument for reducing standby losses would be a requirement that devices be labelled to show their electricity consumption in standby mode. That instrument could yield savings of about 6 TWh by 2020. An alternative approach would be to establish minimum efficiency requirements for consumption in standby mode. Such instruments could also achieve the potential savings – possibly, within an even shorter time. Where useful, information campaigns could support measures and instruments for reducing the power consumption of devices. Their effects have already been included within the effects of the measures and instruments under discussion.

3.3 Energy sector

3.3.1 Carbon dioxide (CO_2)

3.3.1.1 Modification of emissions trading

Continual reductions of emissions budgets, within the coming period until 2020 and beyond, would play a central role in determining the magnitude of emissions reductions that could be achieved via emissions trading in a "with additional measures" scenario.

If Germany's emissions are to be reduced by 40 % by 2020, the cap for installations subject to emissions trading would have to be markedly reduced by 2020, in keeping with the available potential for reductions (a potential which is disproportionately large in comparison to the non-emissions trading sector).

3.3.1.2 Doubling of CHP-based electricity generation

Extension of the CHP Act (KWKG), along with expansion of the group of installations eligible for subsidies for electricity fed into the grid, could double the volume of CHP-based electricity generation by 2015, and triple it by 2030, with respect to the corresponding volume in 2000.

It is assumed that the feed-in subsidy for small CHP installations (≤ 2 MWel) will be increased by 50 % in 2011 and then maintained at a constant level. Such an increase would translate into a feed-in subsidy of 2.91 cents/kWh. In the category of larger CHP installations, the group of installations eligible for feed-in subsidies is expected to be extended to include new installations. In all likelihood, the feed-in subsidy for such installations will also be increased by 50 %, in 2011, and then maintained at a constant level (2.39 cents/kWh).

3.3.1.3 Electricity generation from renewable energies

The projections in the "with additional measures" scenario are based on the current "Lead Study 2007" [29] of the BMU (Nitsch, DLR 2007). That study, in turn, is based on general framework data of EWI/Prognos (2005). In the 2006 lead scenario, renewable energies' share of Germany's electricity generation increases to a solid 27 % (156 TWh) by 2020. At the same time, imports of renewably generated electricity increase (about 2 TWh in 2020).

In comparison to the "with-measures" scenario, the largest change is seen in wind energy, which in 2020 generates 83 TWh of electricity. The necessary basis for such a development would include successful integration of the fluctuating wind-based supply within the general electricity supply, as well as a favourable framework for conflict-free expansion of land-based wind-energy use. Expansion of offshore use is also an important part of this scenario. Sea-based production of 11 GW is expected by 2020. The real expansion would occur only thereafter. Projections regarding the timeline for offshore utilisation in Germany are still highly uncertain, especially in light of utilisation at large distances from coastlines and in deep water.

Use of all available biomass for electricity generation, including biogenic waste, would contribute 37 TWh by 2020, thereby playing a significant role in intensified electricity generation from renewable energies within the "with additional measures" scenario. Liquid biofuels would continue to play a minor role in electricity generation. To accelerate development of biomass in electricity generation, the relevant support framework should be reviewed, taking the market's development into account, and adjusted as necessary. The scenario does not expect any further increase in use of biogenic waste for electricity generation.

In the area of photovoltaic generation, an increase to nearly 10 TWh is expected by 2020 in the "with additional measures" scenario. Strong market growth, both domestic and international, would generate learning effects that would help reduce costs. For this reason, it would be useful for domestic support policies to be co-ordinated with international activities. Important approaches in this connection include relevant initiatives, such as feed-in co-operation, and co-ordination of support policy throughout Europe. In addition, further efforts in research and development could help to enhance the competitiveness of solar power.

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[29] Of the two scenarios prepared in that study, the "2006 Lead Scenario" was selected as a basis.

In the "with additional measures" scenario, geothermal electricity generation would amount to about 3 TWh in 2020. The future development is difficult to predict, especially since geothermal electricity generation is still in a trial phase in Germany.

3.3.1.4 Use of CCS technology in new power stations

The scenarios do not take account of the CCS option, since that technology is not expected to be cost-effective before 2020. Nonetheless, CCS technology has the potential to reduce emissions.

Since CCS technology is currently in a trial phase, and since no reliable cost data is yet available, only a simplified estimate is provided here. To this end, it is assumed that CCS power stations would not incur any costs for CO_2 allowances within the emissions trading system, since they emit little or no CO_2[30]. It is conceivable that as of 2020 coal-fired power stations would be licensable only if they were equipped with CCS systems. What is more, logically, CCS power stations should be commercially successful only if they offer cost advantages over comparable power stations without CCS. They would be able to do so especially if CO_2 costs were high.

The sensitivity analysis shows that if CCS power stations offered only slight cost advantages (10 %) over comparable non-CCS power stations, only a hardly noticeable increase of electricity generation in lignite- and hard-coal-fired power stations (with CCS) would result by 2030, and thus only slight additional CO_2 reductions would result in comparison to the situation under the "with additional measures" scenario. If they offered comparatively large cost advantages (30 %), CCS power stations (both lignite- and hard-coal-fired) with electricity production of about 18 TWh would be added to the grid. That figure corresponds approximately to three large blocks à 800 MW. The additional power-station capacities would come online at the expense of natural-gas-fired power stations, especially gas-fired CHP installations. The additional CO_2 reduction in comparison to the "with additional measures" scenario would amount to about 13 million tonnes of CO_2. When indirect effects resulting from reduced CHP electricity generation, along with emissions from operation of CCS power stations, are taken into account, that reduction contribution would decrease somewhat.

In comparison to the "with additional measures" scenario, CCS would thus not be a CO_2-reduction option within the scenario period until 2020. In the time frame until 2030, its potential

[30] Analyses to date (IPCC 2005, UBA 2006c, MIT 2007) indicate that CCS power stations will not have zero CO_2 emissions. The emissions they might have are not considered in the framework of this analysis, however.

as a CO_2-reduction option would be limited in comparison to other measures and instruments already taken into account in the scenario.

3.3.1.5 Heat generation from renewable energies

Cf. Section 3.6.1.6

3.4 Industry sector

3.4.1 Carbon dioxide (CO_2)

3.4.1.1 Introduction of minimum efficiency standards for electric motors and electrical systems

A survey undertaken by the European Commission in 2005 found that the largest category of electrical power use by industrial and trade companies – accounting for nearly two-fifths of all power used by such companies – is use of power in electric motors, for providing mechanical energy.

Various studies (for example, UBA 2005) agree in concluding that the area of electrical drive systems holds considerable, cost-effective potential for reducing power use. This potential can be tapped via intensified use of electronic rotation-speed control (10 TWh) as well through use of high-efficiency motors and energy-oriented optimisation of the devices driven by motors (pumps, compressors, ventilators, etc.). In recent years, while the numbers of energy-saving motors (EFF2 class) have increased sharply, high-efficiency motors (EFF1 class) do not yet account for a share of even 10 %.

Introduction of minimum efficiency standards could help realize the cost-effective electricity savings available through use of such motors (about 6 TWh) in the medium term. Experience gained in other countries has shown that within just a few years such standards can increase high-efficiency motors' share to about 70 %, thereby helping to tap the available potential for saving electricity.

What is more, it is estimated that some 26 TWh of electricity could be saved, cost-effectively, via optimisation of the most important types of motor-driven equipment. Introduction of minimum energy-efficiency standards for such equipment could pave the way to tapping such potential.

3.4.1.2 Tightening and expanding maximum-consumption standards for electrical devices, using a dynamic approach

Cf. Section 3.2.1.2.

3.4.1.3 Introduction of energy-management systems for industrial companies, along with reductions of electricity and energy taxes

Introduction of energy-management systems for industrial companies is one way of systematically determining the energy-saving potential available in companies. As a rule, such systems identify highly attractive potential savings, since many companies – especially small and me-

dium-sized companies – have been slow in considering energy costs in their efforts to optimise their operations. Companies with such systems remain free to make their own decisions regarding implementation of measures for realising the potential savings that the systems identify.

Reductions of energy taxes for companies could be made contingent on whether companies have introduced energy-management systems.

The current energy and climate-protection programme calls for an agreement to be reached with German industry, by no later than 2013, concerning linking of tax reductions to introduction of energy-management systems.

Introduction of energy-management systems in industry will also help reach the aim, as defined within the Federal Government's sustainability strategy, of doubling energy productivity by 2020, with respect to the corresponding level in 1990.

3.5 The commerce/trade/services sector

3.5.1 Carbon dioxide (CO_2)

3.5.1.1 Further tightening of the EnEV

The "with additional measures" scenario calls for the EnEV to be tightened by 25 %, for both new and old buildings, beginning in 2012. In the model calculations, it is assumed that, in the old-building sector, 65 % of total possible energy savings (in that sector) would be realised. The resulting savings that could be achieved by 2020, including both old and new buildings, would amount to only 2 million tonnes of CO_2. The savings that can be achieved by improving use of the potential available in renovation and modernisation of old buildings, from 32 % to 65 %, are nearly three times as large. In the short-to-medium term, it is thus more effective to enhance implementation of the existing EnEV than to further tighten the EnEV. In the long term, the latter measure could provide additional savings, however.

3.5.1.2 Doubling of use of the savings potential inherent in building renovations

"Use of savings potential" refers to the degree to which homeowners take the opportunity, as part of building renovations that would otherwise take place anyway, to carry out energy-efficiency-oriented renovation. The "with additional measures" scenario calls for use of savings potential to double, from 32 % to 65 %. Relevant efforts would give needed new impetus to inclusion of thermal insulation in modernisation. A range of individual measures could help achieve these goals.

Thorough renovation and modernisation is often to be preferred to patchwork repairs focussing on defective, obsolete components. Incentives for such modernisation would increase its frequency. And that, in turn, would be tantamount to shortening the current renovation cycles for building components.

Modernisation quality can be improved by encouraging use of thermal insulation in roofs and on facades and ensuring that insulated surfaces meet the requirements of the EnEV.

This measure could provide savings of about 5 million tonnes of CO_2 by 2020.

3.5.1.3 Intensified use of highly efficient heating boilers and heating systems

Condensing boiler systems are considerably more efficient, in function and use, than the low-temperature boilers still widely in use today. Such boiler systems are products of a mature technology that almost completely exploits the available physical potential. In the area of building energy systems, condensing boiler technology is the most energy-efficient marketable technology. At present, condensing boiler systems account for a share of about 45 % of the new oil- and gas-fired boilers installed annually. Intensified introduction of such systems could increase that share to such a degree that only condensing boiler systems would be in operation at the end of the relevant time horizon.

In most cases, homeowners continue to operate old, inefficient boiler systems as long as the systems still function. They do so either because they lack information regarding alternatives or because they lack the necessary capital for a replacement. An evaluation of data collected by chimney sweeps (Kleemann et al. 2003) found that oil-fired boilers are currently replaced when they are from 15 to 38 years old (the average is 26 years), and gas-fired boilers are replaced when they are from 13 to 32 years old (the average is 22 years). These figures translate into an average renovation cycle of about 24 years for both oil-fired and gas-fired boilers. Since homeowners have been replacing their systems at longer and longer intervals, the average age of existing systems will continue to increase, unless the modernisation impasse is resolved.

The savings calculations in the "with additional measures" scenario use a renovation cycle of 18 years, since it is assumed that boiler systems that are more than 18 years old no longer conform to the state of the art and tend to function highly inefficiently.

Currently, solar systems are also installed in connection with about 8 % of all newly installed condensing boiler systems. Combination of highly efficient, cost-effective condensing boiler technology with solar-thermal systems yields is considered a highly suitable approach. In the

"with-measures" scenario, the share of such combined installations would increase from today's level of 8 % to 80 % by 2020 (Kleemann 2007).

3.5.1.4 Increasing shares for biomass, solar-thermal and environmental-heat systems

Cf. Section 3.3.1.5.

3.6 Private households

3.6.1 Carbon dioxide (CO_2)

3.6.1.1 Further tightening of the EnEV

Cf. Section 3.5.1.1.

3.6.1.2 Doubling of use of the savings potential inherent in building renovations

Cf. Section 3.5.1.2.

3.6.1.3 Intensified use of highly efficient heating boilers and heating systems

Cf. Section 3.5.1.3.

3.6.1.4 Increasing market shares for biomass and solar-thermal systems

Cf. Section 3.5.1.4.

3.6.1.5 Intensified efforts to reduce electricity consumption

Cf. Section 3.2.1.2.

3.6.1.6 Heat generation from renewable energies

Use (combustion) of solid biofuels, of solar-thermal systems and of environmental heat (via heat pumps) are particularly sustainable ways of meeting building heating requirements. Use of these technologies is now increasing, and they are already relatively advanced in terms of their technical maturity. Biomass is now burned in heating plants with local heating networks, and it is being used especially in small, non-central systems in private buildings. Use of pellet-fired heating systems is playing an increasingly important role in the latter sector, for example.

Solar-thermal systems are particularly suited for heating water and for supporting heating systems. In addition to being used in non-central applications, they can feed into local heating networks. Along with systems that use solid biomass, solar-thermal systems are a second pillar in efforts to increase use of renewable energies.

A third pillar consists of systems that used renewable environmental heat, with the aid of heat pumps. Electrical heat pumps can be a particularly suitable way of meeting building heating requirements sustainably. The technologies for such systems are now finding increasing use, and they are already relatively mature. Heat pumps use renewable environmental heat, stored in the ground, in groundwater and in the surrounding (outdoor) air, for space-heating and water-heating purposes. Environmental heat systems that use heat energy in the ground or in groundwater are the most common types of such systems.
The KfW banking group's market incentives programme, which was launched in 1999, is boosting use of renewable energies. With regard to building heating systems, and among the programme's various support areas, the support provided for solar-thermal and biomass systems in buildings is particularly important, due to the large volumes involved (cf. Section 2.2.1.6).
As a result of intensified use of renewable energies, renewable energies' contribution is expected to increase from 191 PJ (53 TWh) in 2005 to 365 PJ by 2020.

3.7 Transport sector

3.7.1 Carbon dioxide (CO_2)

3.7.1.1 Introduction of a CO_2-based motor-vehicle tax

Motor-vehicle taxes would be restructured, in a revenue-neutral manner, and with retention of differentiation in accordance with emissions standards, by including CO_2 emissions within the basis for tax calculation. This would provide incentives for purchase of low-emissions vehicles.

3.7.1.2 Mineral-oil tax

3.7.1.3 Retention and tightening of maximum-consumption standards for new vehicles

This measure would continue the ACEA voluntary commitment described in Section 2.7.1.3. It is described in terms of assumptions regarding the technological development of CO_2 emission factors, i.e. the average CO_2 emissions of new automobiles in Germany should be 130 g/km in 2012 and 100 g/km in 2030. The CO_2-emissions level at the end of 2006 is used as a basis, and it is assumed that the targets will actually be reached. In 2010, this measure would result in a CO_2-emissions reduction of 0.8 million tonnes. By 2020, the reduction would increase to 10.7 million tonnes.

3.7.1.4 Determining the costs of air traffic

Air traffic creates environmental burdens. It emits climate-harmful CO_2 and, indirectly, it interferes with natural cloud formation. At cruising altitudes, it emits NOx that affects ozone concentrations (WBGU 2002). According to the IPCC (2007), air traffic now accounts for a 2-to-8 % share of anthropogenic climate change. The WBGU (WBGU 2002) estimates the pertinent derivable external costs at € 3 to 30 billion per year.[31] To date, like other sectors, the air-traffic sector does not bear its own external costs. For socio-economic reasons, therefore, ways of internalising such costs should be sought.

3.7.1.4.1 Integration of air traffic within the EU-ETS as of 2013

This measure would integrate air traffic within the EU-ETS as of 2013. The allowance prices used would gradually be priced into the system and then apportioned to air-traffic costs, in keeping with specific consumption. As a result, as of 2013 the air-traffic sector would be able to grow only through purchase of allowances from other sectors or by reducing specific consumption.

This measure could reduce the air-traffic sector's greenhouse-gas emissions by 0.5 million tonnes of CO_2 in 2010 and by 1 million tonnes of CO_2 in 2020. Further emissions reductions would occur in other sectors, via exports of allowances into the air-traffic sector. The potential reductions depend largely on the manner in which the EU agrees to structure the system. The central elements in such structuring include the cap and the defined share for auctioned emissions allowances.

3.7.1.4.2 Europe-wide introduction of a kerosene tax

The scenario calls for Europe-wide introduction of a kerosene tax of € 302 per 1000 litres, as of 2013. To ensure that the two measures are of comparable magnitude, a kerosene density of 0.8 kg / litre, and an emissions level of 3.16 kg CO_2 emissions per 1 kg kerosene, would be assumed. As a result, in the case of the tax, one would obtain an equivalent CO_2 price of € 119 per tonne.

[31] The range covered by the estimated external costs is explained in that a range of different adaptation strategies can be chosen – for example, in keeping with the different ways in which the climate impacts of aircraft emissions are assessed.

The calculated greenhouse-gas reductions would amount to 9.1 million tonnes of CO_2 in 2010 and 13.7 million tonnes of CO_2 in 2020.

3.7.1.5 Expansion of the road-use toll for trucks

This measure would expand application of the truck road-use toll, as of 2015, to the secondary long-distance road network and to trucks with at least 3.5 t permissible total weight. The toll rate was assumed to remain constant at 12.4 ct / vehicle-km.

This measure would result in savings of 0.6 million tonnes of CO_2 in 2010 and of 5.0 million tonnes of CO_2 in 2020.

3.7.1.6 Extension to the network of main traffic arteries

3.7.1.7 Increases in truck-use costs

The cost structure for truck-transport costs consists of three main components – various fixed and variable costs, fuel costs and road-use fees. Increases in one or more of these components, resulting in a doubling of nominal truck-use costs, would lead to significant structural changes in the various different modes of transport and to considerable CO_2 reductions.

The resulting reductions would amount to 2.3 million tonnes of CO_2 in 2010 and 7.8 million tonnes of CO_2 in 2020.

3.7.1.8 Use of low-friction tyres and oils

Wide use of low-friction tyres and oils holds great potential for reducing CO_2 emissions, as various studies (such as UBA 2003) have shown. These instruments are to be recommended especially on the basis of their cost-effectiveness (Kolke 2004).

The CO_2 reductions that could be achieved via use of low-friction tyres and oils would amount to 2.9 million tonnes in 2010 and 7.7 million tonnes in 2020.

3.7.1.9 Increasing renewable biofuels' share of the fuel market

Concepts for increasing biofuels' share of the fuel market are oriented to the market introduction of biofuels as described in Section 2.7.1.4. As of 2015, biofuels' share of the total fuel market could be expected to stagnate at a share of 8 %. In the measure described here, biofuels' share would be successively further increased. By 2020, that share would reach about 12.5 % of the overall fuel market, measured in terms of energy units, while by 2030 it would reach about 25 %.

As a result, the measure would reduce CO_2 emissions by 2.8 million tonnes in 2020 and by 14.4 million tonnes in 2030.

3.7.1.10 Harmonisation of diesel taxes with petrol taxes

As of 1 January 2003, the mineral-oil tax rates for sulphur-free fuels are 65.4 ct/l for petrol and 47 ct/l for diesel. As a result, the tax on diesel is 18.4 ct/l lower than that on petrol. The large differences between diesel and petrol taxes emerged at the end of the 1980s, when the majority of diesel fuel was being consumed by commercial trucks. The preferential taxing of diesel fuel was introduced to minimise the burdens on commercial truckers resulting from increases in the mineral-oil tax. For purposes of compensation, motor-vehicle taxes for the few diesel automobiles on the road were made higher than those for petrol automobiles.

Since the 1990s, Germany has experienced strong growth in new registrations of diesel automobiles, however. By 2004, such vehicles had attained a market share of 44 % (February 2007: 48.7 % market share). For a number of reasons, therefore, the lower mineral-oil tax on diesel fuel seems a questionable policy. The lower tax rate was intended as a way of reducing expenses for trucks, not for automobiles. The tax rates for petrol and diesel should be harmonised as soon as the tax-policy framework within the European Community (tax harmonisation) makes it possible to carry out such a step without incurring major fiscal and environmental-policy setbacks.

In 2020, the resulting savings – assuming the necessary framework is in place – could amount to 1.9 million tonnes of CO_2.

3.7.1.11 Elimination of the distance-based tax benefit for commuters

This measure is based on a sudden elimination of the distance-based tax benefit in 2010. It would result in reduced commuter mileage and, in the long term, would tend to reduce employment-related commuting by encouraging commuters to change their living and/or working locations.

This measure could save 2.2 million tonnes of CO_2 in 2020.

3.8 Agriculture sector

3.8.1 Methane (CH_4) and nitrous oxide (N_2O)

As a result of agricultural policy trends, further reductions in cattle herds can be expected [32], and thus a reduction in CH_4 emissions from enteric fermentation can also be expected. In addition, an increase in the percentages of liquid manure fed into biogas systems is conceivable. The increase could lead from the current level of 5 % to 30 % or more. Furthermore, N_2O emissions could be reduced via various measures for increasing N efficiency – for example, via even stronger growth in the organic farming sector and via additional reductions of livestock herds.

3.9 Further reductions in HFC, PFC and SF_6 emissions

For a further decrease in HFC emissions, it is assumed that

- leakproofness of relevant systems would improve, and that further substitution of HFCs, with halogen-free refrigerants, would be carried out for other refrigeration/air-conditioning systems,
- in foam production (PU hard foam and XPS), HFCs would gradually be phased out completely,
- in technical and cosmetic aerosol sprays, all HFC use would be discontinued, while such use would largely be discontinued in dose inhalers (substitution, use of alternative delivery techniques), and
- no further HFC-based fire retardants would be introduced.

Recently, additional measures and instruments for reducing emissions of fluorinated greenhouse gases have been discussed in Germany. Specific quantification of such measures and instruments remains to be carried out, however. The measures and instruments under discussion include:

- Further substitution of HFCs with halogen-free refrigerants in commercial refrigeration systems, especially in supermarket refrigeration systems,
- An earlier date for phase-out of R 134a from mobile air-conditioning systems, and intensified introduction of halogen-free refrigerants,

[32] If the most recent world-market price trends prove lasting, then this assessment may have to be revised.

- Inclusion of mobile air-conditioning systems in existing emissions-reduction regulations, and
- Tightening of requirements pertaining to the leakproofness of refrigeration and air-conditioning systems, in national transposition of existing EC regulations.

As a result of the sharp increase in use of pure SF_6 in aluminium cleaning that has occurred since 1998, consumption of that substance in aluminium and magnesium production increased ten-fold from 1995 to 2005. To provide an SF_6-emissions reduction in relation to 1995, substitution requirements in the nonferrous metals industry would have to be implemented by 2009.

3.10 Summary: Results of the projections

The following Table presents the overall effects of measures and instruments, in the various scenarios.

Tab.14: Development of greenhouse-gas emissions in the "without-measures" scenario (OMS), "with-measures" scenario (MMS) and "with additional measures" scenario (MWMS)

THG	**ACTUAL**		**Without measures**			**With measures**			**With additional measures**		
	2000	2005	2010	2015	2020	2010	2015	2020	2010	2015	2020
Millions of tonnes of CO_2 equivalents											
CO_2	883	873	892	893	905	831	772	767	799	695	631
CH_4	99	51	46	41	37	46	41	36	46	40	36
N_2O	84	67	63	62	61	63	61	60	62	61	59
HFCs	6	9	19	19	20	11	10	10	9	8	6
PFCs	1	1	2	2	3	1	1	1	1	1	1
SF_6	5	5	8	9	11	4	5	6	3	4	5
Total	**1078**	**1005**	**1027**	**1027**	**1036**	**940**	**874**	**863**	**923**	**812**	**743**
* The base year is 1990 for CO_2, CH_4 and N_2O, and 1995 for HFCs, PFCs and SF_6											
Source: Federal Environmental Agency (CSE, NIR), Öko-Instut et.al. (unpublished): Entwurf des Endberichtes zum Forschungsprojekt "Politikszenarien für den Klimaschutz" (draft of the final report for the											

research project "Policy Scenarios for Climate Protection") (FKZ 205 46 434), p. 246ff, 333.

3.11 Results of sensitivity analyses

Several sensitive parameters could influence the calculation results significantly, depending on their magnitude. Sensitivity analyses are a tool for estimating the influence and impacts of such parameters. In the relevant process, the pertinent reference value underlying the scenario is varied by a certain amount, both up and down. Sensitivity analyses have been carried out for the buildings sector, landfilling of waste with organic components, air traffic and the CO_2-allowance price.

The results of the sensitivity analyses in the buildings sector are as follows:

- Variation in the new-construction rate: Pursuant to statistics of the Federal Statistical Office, the annual new-construction area decreased from about 47 million m^2 in 1995 to nearly 28 million m^2 by 2003. That change represents a decrease of about 40 % in eight years. Since the future development of the new-construction rate has a strong influence on CO_2 emissions of residential buildings, a sensitivity analysis was carried out for the "with-measures" scenario. The analysis considered three cases, with 10 million m^2, 20 million m^2 (reference case) and 30 million m^2. The analysis showed that the future new-construction rate is an extremely sensitive parameter. If the new-construction area were 10 million m^2 smaller per year, CO_2 emissions would amount to about 5.4 million tonnes in 2030. Similarly, they would increase by 5.4 million tonnes of CO_2 if the new-construction area were 30 million m^2/year.
- Change in use of available potential: When the use of available potential in connection with renovation of building exteriors is varied by 10 percentage points up or down, the CO_2 emissions in 2030, in the "with-measures" scenario, vary by 2.4 million tonnes of CO_2 (either up or down). The higher the degree of use of available potential, the lower the emissions.
- Renewable energies' contribution in the buildings sector: When renewable energies' contribution in 2030 is varied by 10 %, emissions, with respect to the energy mix in the "with-measures" scenario, vary by about 1.5 million tonnes. Increases of renewable energies' contribution lower CO_2 emissions, while decreases of the contribution raise emissions.

- Variation of the shares for heating oil and natural gas: Since the emission factor for natural gas is smaller than that for heating oil, CO_2 emissions increase if the pertinent natural-gas quantity decreases and the pertinent heating-oil quantity increases by the same amount. If the relationship is reversed, CO_2 emissions decrease. If the contribution made by natural gas in 2030 is varied by 50 PJ, to the detriment of heating oil, CO_2 emissions change by about 1 million tonnes.

The sensitivity analyses for the buildings sector show, in all cases, a linear relationship between the parameter variation and the resulting change in CO_2 emissions. When all studied parameters are varied simultaneously, within the aforementioned ranges, CO_2 emissions in 2030 change by about ±8 to ±10 million tonnes. In terms of CO_2 emissions in 1990, those figures represent a relative change of ± 6 % to ± 8 %. In the variation of the energy price, the discrepancy ranges from ± 3 to ±10%.

By contrast, the sensitivity analyses for the CO_2-allowance price and air traffic indicate that variation of independent variables either has no major impact on the resulting emissions or that other factors (such as elasticity, variable categorisation) determine the course taken by emissions.

4 Institutional measures and instruments relative to the Kyoto Protocol

4.1 Responsibilities at the Federal level

4.1.1 "CO_2-Reduction" IWG

By resolution of 13 June 1990, the "CO_2-Reduction" Interministerial Working Group (IWG) was established. It is charged with working at the national level, in an interministerial role, to identify potential for reducing greenhouse gases, propose relevant measures and develop and implement an overall concept for CO_2 reduction and climate protection.

The IWG is chaired by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU). Within the "CO_2-Reduction" IWG, a total of seven working parties have been established, oriented to the following topic areas:

I "Energy supply" (chaired by the Federal Ministry of Economics and Technology (BMWi))

II "Transport" (chaired by the Federal Ministry of Transport, Building and Urban Affairs (BMVBS))

III "Buildings sector" (chaired by the Federal Ministry of Transport, Building and Urban Affairs (BMVBS))

IV "New technologies" (chaired by the Federal Ministry of Economics and Technology (BMWi))

V "Agriculture and forestry" (chaired by the Federal Ministry of Food, Agriculture and Consumer Protection (BMELV))

VI "Emissions inventories" (chaired by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU))

VII Joint Implementation and CDM

4.1.2 The working group "Emissions trading for combatting the greenhouse effect" (AGE)

On 18 October 2000, acting in the framework of the National Climate-Protection Programme, the Federal Cabinet established the working group "Emissions trading for combatting the greenhouse effect" (AGE), under the chairmanship of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU). In connection with the 2005 climate-protection programme, the Federal Cabinet explicitly welcomed the deliberations of AGE and extended its

mandate. This working group has the tasks of studying issues that arise in connection with use of emissions trading within the context of climate-protection measures and of providing recommendations for the structure of this new instrument. The AGE conducts its deliberations in light of relevant discussion at the international level (UN Framework Convention on Climate Change, Kyoto Protocol) regarding the use of so-called "flexible mechanisms" and the design and implementation of the European Climate Change Program (ECCP).

4.1.3 Single National Entity and the National System of Emissions Inventories

The **Federal Environmental Agency**, Section I 4.6 "Emissions Situation", is the responsible "Single national entity" (national co-ordinating agency) for reporting pursuant to the UN Framework Convention on Climate Change and the Kyoto Protocol. A country's Single National Entity is responsible for preparing the country's national inventory, working for continual improvement of the inventory, supporting those persons involved in the national system and preparing decisions of the Co-ordinating Committee.

A **Co-ordinating Committee**, representing all concerned departments, has been established to deal with all questions arising in the framework of the National System, and to be responsible for official discussion and approval of the inventories and the reports required pursuant to Articles 5, 7 and 8 of the Kyoto Protocol. The Committee supports all pertinent processes in this framework. The Committee is directed by the BMU.

For **preparation of the national inventory**, data are used, for calculations of emissions and reductions, that are required pursuant to the provisions of Art. 3 (1) of Decision 280/2004/EC and of Art. 2 (1) of the implementation rules for calculating emissions in source categories and removals from sink categories. Inventories are prepared on an annual basis. In addition, quality assurance in keeping with the requirements of Art. 12 of the rules must be carried out. Furthermore, reliable documentation and archiving are required. The responsibilities for such tasks are assigned to ministries as follows:

For source category 1 (Energy) – with the exception of source categories 1.A.3 (Transport) und 1.A.5a (Energy: other), where emissions sources of the German Federal Armed Forces (Bundeswehr) are concerned – the **Federal Ministry of Economics and Technology (BMWi)** has responsibility.

For source categories 2 (Production processes) and 3 (Use of solvents and other products), the **Federal Ministry of Economics and Technology (BMWi)** has responsibility.

For source category 1.A.3 (Transport), the **Federal Ministry of Transport, Building and Urban Affairs (BMVBS)** has responsibility.

For source category 1.A.5a (Energy: other), where emissions sources of the German Federal Armed Forces (Bundeswehr) are concerned – the **Federal Ministry of Defence (BMVg)** has responsibility. Where data are subject to secrecy provisions, the Federal Environmental Agency takes the relevant secrecy requirements into account.

For source and sink categories 4 (Agriculture) and 5 (Land use, land-use changes and forestry), the **Federal Ministry of Food, Agriculture and Consumer Protection (BMELV)** has responsibility.

For source category 6 (Waste) and source category 7, and well as for issues related to greenhouse-gas emissions from biomass combustion, the **Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU)** has responsibility.

The **Federal Ministry of Food, Agriculture and Consumer Protection (BMELV)** is also responsible for preparing tables in the standardised reporting format pursuant to Art. 2 (2) letter a of Decision 2005/166/EC (implementation rules) for source and sink categories 4 and 5.

In addition, the relevant authorities, as determined by the pertinent statistics regulations, are responsible for tasks relative to official statistics, including data delivery, quality assurance and data documentation and archiving. Co-operation between a) the statistical offices of the Federal Government and the Länder and b) the agencies concerned with reporting is co-ordinated via the Federal Statistical Office. In the process, secrecy requirements pertaining to statistics are to be complied with.

4.1.4 DEHSt

The German Emissions Trading Authority (DEHSt) is the responsible national authority for implementation of the market-based climate-protection instruments "emissions trading" and "project-based mechanisms" under the Kyoto Protocol. It carries out a broad range of tasks. The EU Emissions Trading Directive, the Greenhouse Gas Emissions Trading Act (Treibhausgasemissionshandelsgesetz – TEHG), the 2007 Allocation Act (ZuG 2007) and the Project Mechanisms Act (ProMechG) define its responsibilities more precisely. The DEHSt works closely with German industrial companies whose installations are subject to EU emissions trading, and it supports the expert agencies involved in emissions trading. In addition, the DEHSt serves as a point of contact for the BMU, the Länder and the competent Land (state) immissions-control authorities.

4.1.5 Joint-Implementation Co-ordination Agency (JIKO)

In 1995, the BMU established the Joint-Implementation Co-ordination Agency (Joint-Implementation-Koordinierungsstelle - JIKO). Its tasks include promoting, approving and monitoring the sorts of Joint-Implementation (JI) and Clean-Development-Mechanisms (CDM) projects called for by Arts. 6, 12 of the Kyoto Protocol. JIKO's overarching aim is to create a suitable framework in Germany for promoting and carrying out concrete JI/CDM projects in keeping with the aims of the Kyoto Protocol. With the entry into force of the Project Mechanisms Act (ProMechG) on 30 September 2005, responsibility for the formal co-operation required for individual CDM and JI projects, under relevant international provisions, passed to the Federal Environmental Agency. JIKO's activities are now concentrated on implementing and refining project-based mechanisms at the political level. In addition to providing expert support for development of the ordinances issued under the ProMechG, as well as for national implementation of the review process called for by the EU Linking Directive, JIKO focuses on international co-operation. Activities within such co-operation include signing of of Memoranda of Understanding with all relevant CDM/JI host countries, and collaborating on development of project-overarching instruments such as Green Investment Schemes (GIS) and sectoral CDM.

Furthermore, JIKO supports the BMU's assigned supervision of execution, by the Federal Environmental Agency, of project-based mechanisms, and it functions as the secretariat for working party VII of the "CO_2-Reduction" IWG.

In addition to supporting the BMU in legislative processes and in supervising execution of project-approval procedures, in future JIKO, working in the framework of publicity-generating events (conferences, workshops, etc.), will also support information provision and networking among parties involved in project mechanisms: municipalities, potential investors and financing institutions, entrepreneurs and government authorities of host countries. Such work has already included preparation of brochures and information materials – especially including a CDM/JI manual – and provision of technical support for the database for CDM and JI projects.

4.1.6 Focal Point for education relative to climate protection

In the framework of implementation of Article 6 of the UN Framework Convention on Climate Change, a National Focal Point for education on climate protection has been established, within the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) (climate-education@bmu.bund.de). The Focal Point's tasks include highlighting the wide range of educational activities taking place in the area of climate protection, as a key area of sustainable development, and thereby providing a basis for further development of such activities. The

Focal Point serves as a platform for public and private stakeholders in the education sector. The many different state and non-state stakeholders in the education sector, and their wide range of educational activities, need to be linked more effectively within the Federal system framework. In addition, intensive exchanges can enhance use of relevant synergies.

4.1.7 Competence Centre for climate change and adaptation strategies

In the interest of designing a national strategy for adaptation to climate change, the BMU has established a Competence Centre, sited within the Federal Environmental Agency, for "climate change and adaptation strategies" ("Klimafolgen und Anpassung" - KomPass). KomPass will provide a technical and conceptual basis for identification and implementation of such a strategy.

KomPass will also accelerate relevant implementation processes, by networking technical expertise on the impacts of climate change and on adaptation strategies and helping to make such expertise available to decision-makers and to the public. KomPass will help promote relevant communication and co-operation with, and between, decision-makers involved in the adaptation process. As a result, KomPass will strive to facilitate the efforts of all parties – in companies, administrations and industry and environmental associations – focussing on climate risks and on adaptation to climate change.

4.1.8 Standing bilateral working groups on "Environment and Energy"

Working on the basis of bilateral government agreements in the environmental sector, the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) participates in "environment and energy" bilateral working groups in place with the Czech Republic, Russia and Ukraine. In addition to co-operation and governmental advising in general issues of climate-protection policy, the working groups' tasks especially include project-based co-operation and promotion of bilateral use of the Kyoto mechanisms. Recently, deliberations of these working groups have focussed primarily on the following climate-policy issues:

- Designing the framework for systematic, thorough national climate-protection policies, covering all relevant areas
- Using the flexible Kyoto mechanisms (emissions trading, CDM/JI), and working especially in the areas of project development and financing strategies,
- Designing additional climate-protection instruments, such as ecological tax reforms, strategies for promoting renewable energies, and monitoring projects..

4.2 Work structure of the Conference of Environment Ministers (UMK)

In November 2004, in the framework of restructuring of the UMK, a decision was taken to form 8 Federal Government / Länder working groups (Bund-/Länder-Arbeitsgemeinschaften – BLAG) that would serve as working bodies for the UMK. One of these is the "Sustainable Development" BLAG. The work structure for this BLAG is currently being established. In a matter about which it has reached broad consensus, the "Sustainable Development" BLAG has agreed that the topic area "climate / energy / transport" is to be one of its work focuses. In keeping with a resolution of 9 March 2005, a separate, standing subcommittee for this topic area is to be established. That subcommittee will then function as the central working body for co-ordination of climate-protection activities of the Federal Government and the Länder. The resolution remains to be approved by the 35th Länder Senior Officials Conference (Amtschefkonferenz der Länder – ACK) / 64th Conference of Environment Ministers (UMK).

5 Measures for participation in flexible mechanisms

As part of its efforts to achieve the reduction target for Germany – to reduce emissions of the six Kyoto greenhouse gases, in the 2008-2012 period, by 21 percent in comparison to the relevant 1990 / 1995 levels – the Federal Government continually reviews and refines measures already taken. There are no plans to carry out a state programme for purchase of emissions allowances from CDM and / or JI projects, as a way of reaching the national Kyoto target. Instead, the Federal Government is working to ensure that Germany fulfils its international obligations, by helping to develop the EU emissions trading system, by expanding and improving measures to enhance energy efficiency and increase use of renewable energies and by enacting additional regulatory measures. At the same time, the increase in the quota for utilisation of CDM / JI allowances, to 22 percent of the allocated quantity, in the framework of submission obligations of companies involved in emissions trading, via Paragraph 18 of the Act concerning the national allocation plan for greenhouse-gas emissions allowances in the 2008-2012 allocation period (Allocation Act 2012), opens up the possibility of using this cost-effective option for purchase of allowances.

With the Project Mechanisms Act (ProMechG), which entered into force on 30 September 2005, the Federal Government has created the legal basis for carrying out CDM and JI projects. At the same time, with the Act it has transposed the EU Linking Directive of November 2004. In this context, the Federal Environmental Agency has been named as the competent authority, and it has been reported to the UNFCCC as the Designated National Authority (DNA) and Designated Focal Point (DFP).

By means of various efforts, the Federal Government supports German companies that wish to become involved in JI and CDM activities:

- Initial deposits in the KfW climate-protection fund, for support of climate-protection projects in the area of renewable energies, for JI and CDM outside of Germany (with a total volume of € 50 million, of which up to € 8 million from the Federal Government).
- With regard specifically to JI in the Baltic Sea region, the Federal Government is pursuing a similar aim by depositing € 5 million in the multilateral "Testing Ground Facility" (TGF, with a total volume of € 15 million), within the Baltic Sea Energy Cooperation (BASREC) framework.

- The Joint Implementation Co-ordination Agency (JIKO, sited within the BMU) offers advising, for potential project developers and investors, regarding the principle conditions and possibilities for using CDM and JI instruments. Application-oriented advising is provided by the German Emissions Trading Authority (DEHSt), which is sited within the Federal Environmental Agency. The DEHSt provides information materials relative to project development and applications:
- Development of project portfolios in east European countries, such as Romania, Russia and Ukraine, and in China, by the German Energy Agency (Deutsche Energieagentur - dena) and GTZ (Gesellschaft für technische Zusammenarbeit).
- Study on the potential for using renewable energies in the framework of CDM, illustrated with two sample cases (Egypt, Thailand)
- A project database with information for the public, regarding JI and CDM projects with German participation in investor or host-country roles

In addition, the Federal Ministry for Economic Cooperation and Development (BMZ), working via the GTZ, supports developing countries in establishing CDM structures such as designated national authorities (DNA) and in building suitable staffing resources, with the aim of developing CDM projects in the partner countries. The key partners for such efforts to date have included China, India, Indonesia, Ghana and Chile.

Germany has bilateral Memoranda of Understanding (MoU), for promotion and definition of framework conditions for bilateral CDM projects, in place with Egypt, Mexico, Peru and Tunisia.

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