Federal Ministry of the Environment, Nature Conservation and Reactor Safety

2009 report from the Federal Republic of Germany

Progress towards achieving the indicative target for the consumption of electricity produced from renewable energy sources in the period to 2010

Report from the Federal Republic of Germany under Article 3(3) of Directive 2001/77/EC of the European Parliament and of the Council of 27 September 2001 on the promotion of electricity produced from renewable energy sources in the internal electricity market

Berlin, October 2009

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1. INTRODUCTION

Directive 2001/77/EC of the European Parliament and of the Council of 27 September 2001 on the promotion of electricity produced from renewable energy sources in the internal electricity market sets the goal of raising the share of renewable energy sources (RES) in the European Community's (EU 25) electricity supply to 21% in 2010.

Article 3(3) of the Directive requires Member States to draw up a report on progress towards achieving the target and on national climate change commitments:

"*Member States shall publish, for the first time not later than 27 October 2003 and thereafter every two years, a report which includes an analysis of success in meeting the national indicative targets taking account, in particular, of climatic factors likely to affect the achievement of those targets and which indicates to what extent the measures taken are consistent with the national climate change commitment.*"

This report fulfils Germany's obligation under the Directive.

In 2007, with RES accounting for 14.2% of total gross electricity consumption, Germany had already substantially exceeded its national indicative target of increasing the RES share of gross electricity consumption to at least 12.5% by 2010, as set by Directive 2001/77/EC.

Germany will continue to develop renewable energy sources in general – though in particular for electricity production – and has set itself new targets. Through its ambitious climate and energy programme, it is making its national contribution to achieving the European Union's common climate protection objectives. In this context, it is pursuing challenging yet feasible targets:

> In 2020, greenhouse gas emissions are to be 40% lower than in 1990; Germany had already achieved a 22.2% reduction by the end of 2008.

> Energy productivity is to raised by 3% per year. This means that energy use will be twice as efficient in 2020 as it was in 1990.

> The combined heat and power (CHP) share of electricity production is to double, to 25%, by 2020.

> The RES share, which has steadily risen over the past few years, is to see a further considerable increase:

- their share of gross electricity consumption is to be increased to at least 30% by 2020, rising steadily thereafter,
- their share in meeting demand for heat energy is to rise to 14% by 2020,
- biofuels' share of total motor fuel consumption is to be increased so as to equate to a 7% net greenhouse gas reduction (about 12% in energy terms),
- by the middle of the century, renewables are to account for about half of energy consumption.

Germany's targets for developing renewables are closely tied in with the current EU objectives, which will see the RES share of total final energy consumption raised to 20% by 2020.

Ensuring the security of the energy supply in the future whilst limiting the climate change that has already set in are two of the key challenges facing us in the 21st century. Ambitious action is therefore called for in all energy- and climate-related fields. In addition to its key strategy of using energy resources economically and achieving high levels of energy efficiency, Germany is aiming to increase the use of renewables, focusing on substantially raising the RES share of electricity supply.

National legislation on the feeding-in of, and compensatory payments for, RES electricity has been in place in Germany since 1991. In Germany, the development of renewables for electricity production was to a large extent begun by the Electricity Feed-In Act (StrEG). Rapid developments in this field – both in terms of energy and technology – led to the adoption of the Renewable Energies Act (EEG) in April 2000, bringing further improvements as regards electricity feed-in. The EEG contains provisions giving priority to electricity produced from renewables, feed-in and compensatory payments. The 2000 EEG was aimed at doubling the RES share of total energy consumption by 2010. The EEG, which provides support for electricity production from renewables, made it possible to further expand their use in the electricity market.

The EEG was extensively amended and adapted to technological progress and changes in the economic climate in 2004 and 2008. These amendments were introduced on the basis of reports on the EEG that had been submitted to the Bundestag.

The 2009 EEG, which entered into force on 1 January 2009, is aimed at increasing the RES share of Germany's total gross electricity consumption to at least 30% by 2020. The 2009 EEG considerably improves the conditions for further development of renewables in Germany, for instance as a result of the new rules on repowering, enhanced conditions for offshore wind farms, the network integration of RES electricity production plants and new feed-in management rules. It will help Germany meet its targets for 2020 and provides longer-term perspectives and investment security for all those operating in the renewables sector. It also transposes Directive 2001/77/EC of the European Parliament and of the Council of 27 September 2001 on the promotion of electricity produced from renewable energy sources in the internal electricity market. In future, the EEG will also provide a basis for achieving the targets set under Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources. In this context, the RES share of the total final consumption of energy in Germany will be increased to 18%. This equates almost to a doubling of the current figure.

A number of Orders adopted pursuant to the new EEG are set to help Germany achieve its targets as regards the development of renewables. For instance, the Order on system services provided by wind energy plants (SDLWindV) entered into force in July 2009. This Order is aimed at increasing the security and stability of electricity grids, including those where wind energy accounts for large shares of the electricity, and at driving forward technical development in this sector.

The sustainability requirements of Directive 2009/28/EC are transposed by two orders: the Biomass Electricity Sustainability Order (BioSt-NachV) and the Biofuel Sustainability Order. The Biomass Electricity Sustainability Order entered into force on

24 August 2009; the Biofuel Sustainability Order was adopted by the Federal Cabinet on 15 September 2009 and will enter into force in autumn 2009.

The sustainability requirements contained in these Orders specify how the biomass used to generate electricity under the EEG is to be produced. In order to safeguard the environment, the climate and wildlife, biomass cultivation must not result in the destruction of areas of high nature conservation value (e.g. rain forests) or areas with a high carbon content (e.g. wetlands, peat bogs, etc.). Moreover, the energy use of biomass must lead to a reduction of at least 35% in greenhouse gas emissions compared with fossil fuels; biomass grown on European farms must also meet cross-compliance requirements.
The Order on the further development of the nationwide equalisation scheme under the Renewable Energies Act (AusglMechV) was published on 17 July 2009. Some of its provisions entered into force on 18 July 2009, whilst others will enter into force on 1 January 2013. This Order is aimed at ensuring greater financial and technical efficiency and more transparency in getting RES electricity subject to compensatory payments under the EEG to consumers.

The EEG is designed to fulfil the obligation to protect the natural bases of life, mindful of the responsibility to future generations, as required by Article 20a of the Basic Law, and to meet the environmental protection objectives set out in Articles 2, 6, 13 and 175 of the EC Treaty, taking special account of the polluter-pays principle.

Given the long-term security and legal guarantees it provides with regard to compensatory payments, the EEG has brought about a considerable increase in the use of renewables to generate electricity in the past few years. This is true in particular of the use of wind energy, as the most important renewable ahead of biomass in all its forms and hydropower. Good progress has also been seen in the photovoltaics and geothermal energy sectors in the past few years.

The EEG is one of the core elements of the German Government's package of environment and energy measures and is the most important and most successful instrument for developing the use of renewables to produce electricity.

2. NATIONAL INDICATIVE TARGET FOR GERMANY

The key aim of the Directive on the promotion of electricity produced from renewable energy sources in the internal electricity market (Directive 2001/77/EC), which entered into force in 2001, is to increase the share of renewable sources in electricity production, from 14% in 1997 to 21% (EU 25) by 2010. The target for Germany is to achieve an RES share in its national electricity market of at least 12.5% by 2010.

The RES share of total gross electricity consumption in Germany had been raised to 15.1% by 2008. Germany's indicative target under Directive 2001/77/EC and the German Government's own target for 2010 had thus already been met and, indeed, substantially exceeded.

The successful development of renewables in Germany to date has helped them become a key pillar of the German energy sector. They therefore also make an important contribution to climate protection and have become a significant economic factor.

3. DEVELOPMENT OF RENEWABLE ENERGY SOURCES IN GERMANY[1]

As a result of the rapid development of renewable energy sources, their share of gross electricity consumption rose to 15.1% in 2008.

The generation of electricity from renewables is making an important contribution to climate protection. According to current estimates, the use of renewables to produce electricity (as substitutes for other energy sources) led to an overall reduction in CO_2 in the region of 72 million tonnes in 2008. In total, the use of all renewables in the electricity, heating and motor fuels sectors led to a CO_2 avoidance of about 109 million tonnes in 2008.

A diverse range of instruments at the federal level – in particular the EEG and federal support schemes (e.g. the Market Incentives Programme) – and other schemes at *Land* and local authority level all fostered growth in the renewables sector.

In 2008, 233 228 GWh of energy was produced from renewables. This included 92 779 GWh in the electricity sector, 103 755 GWh in the heating sector and 36 694 GWh in the motor fuels sector. Electricity production thus accounted for about 40% of the 233 228 GWh of energy supplied by renewables.

A more detailed overview of the development of renewables in Germany, including their environmental impact, is presented in the Federal Environment Ministry's publication "Renewable energy sources in figures - national and international developments", June 2009 (Annex 7).

4. DEVELOPMENT OF ELECTRICITY PRODUCTION FROM RENEWABLE ENERGY SOURCES

The overall growth in renewables is particularly strongly reflected in the electricity market. In 2008, 92 779 GWh of energy was supplied by renewables, and RES electricity accounted for 15.1% of Germany's total gross electricity consumption. This represents more than a trebling of the figure for 1997 (4.3%). Wind energy was the most widely used source and it now also makes the biggest contribution to electricity production. It accounts for about 44% of all RES electricity, ahead of biomass in all its forms and hydropower. Overall, the year-on-year increase in the electricity sector was about 6% in 2008.

[1] Source: Working Group on Renewable Energy Statistics (AGEE-Stat), June 2009.

The structure of electricity production from renewables is shown in Fig. 1.

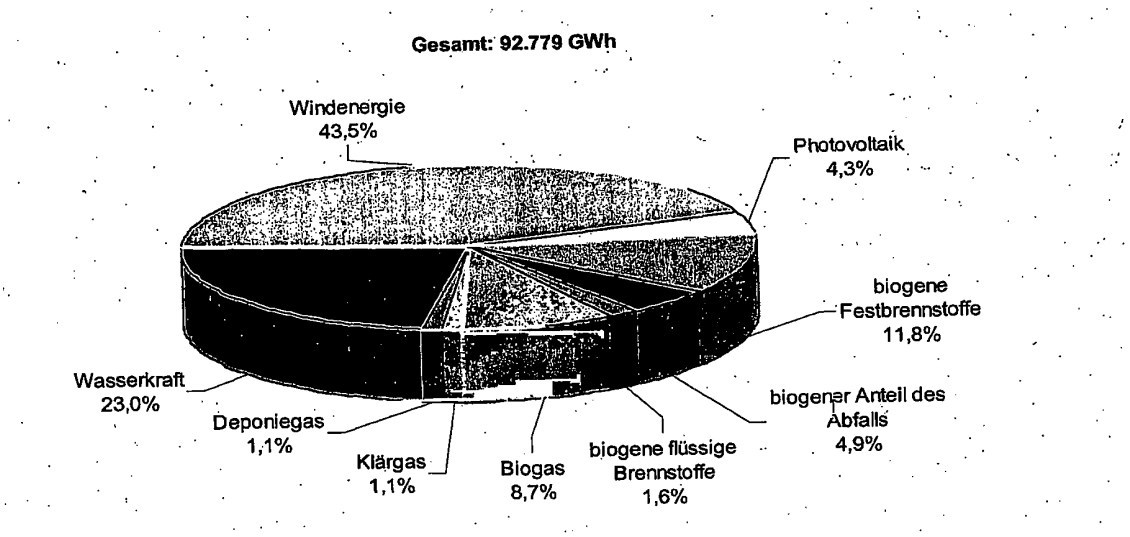


Fig. 1 Structure of electricity production from renewable energy sources in Germany in 2008

[Total: 92 779 GWh; *clockwise from top*: wind power / photovoltaics / solid biofuels / biogenic waste fraction / liquid biofuels / biogas / sewage treatment plant gas / landfill gas / hydropower]

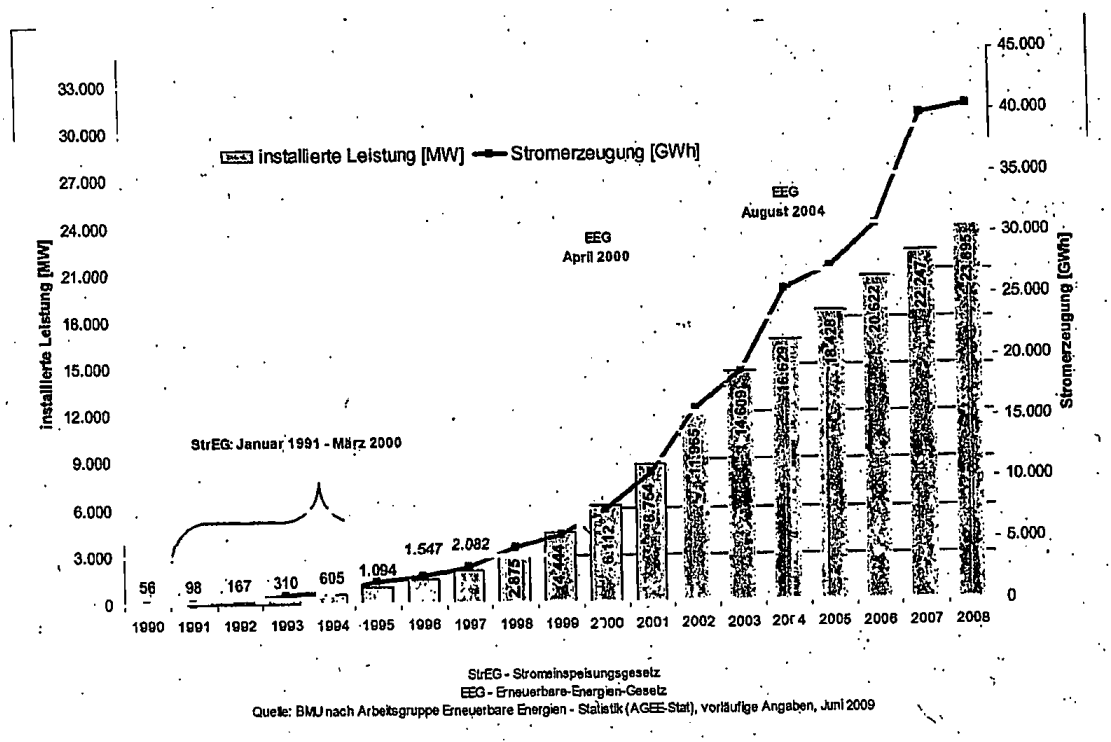
Source: Federal Environment Ministry, based on Working Group on Renewable Energy Statistics (AGEE-Stat), provisional data, June 2009.

5. DEVELOPMENT OF ELECTRICITY PRODUCTION FROM RENEWABLES BY SECTOR

5.1. Wind energy

Altogether, 866 new wind power plants – with a total capacity of 1 665 MW – were installed in Germany in 2008. Thus, at the end of 2008, 20 287 wind power plants with a total installed capacity of 23 895 MW produced 40 000 GWh of energy, equating to 6.6% of Germany's total gross electricity consumption. The use of wind energy achieved a CO_2 avoidance of about 30 million tonnes, accounting for about 28% of the total CO_2 avoidance attributable to the use of renewables in Germany.

The development of wind energy use in Germany is presented in Fig. 2.



[*The above graph shows installed capacity, in MW (bars & left-hand scale) and electricity produced, in GWh (line & right-hand scale); periods marked are January 1991 to March 2000 (StrEG), April 2000 onwards (EEG) and August 2004 onwards (EEG)*]

Source: Federal Environment Ministry, based on Working Group on Renewable Energy Statistics (AGEE-Stat), provisional data, June 2009.

Fig. 2: Development of installed capacity and electricity production from wind energy in Germany

The coming years will see further growth in wind energy's contribution. The development of offshore wind farms will be a new focus. As part of its *Perspektiven für Deutschland* sustainability strategy, the German Government has, under the leadership of the Federal Environment Ministry, presented a strategy for the use of offshore wind energy and identified the first areas suitable for wind farms and conservation zones. More than 20 offshore wind farms with a capacity of about 9 000 MW have already been approved. The first of them, Alpha Ventus, marks the start of offshore wind energy exploitation in Germany. The first wind power installations there were connected to the electricity grid in August 2009. A total of twelve installations are to become operational there by the end of October. This will make it possible to supply 50 000 households with electricity.

The German offshore development target is 25 000 MW of installed capacity by 2030.

This will mean that about 15% of Germany's electricity demand can be covered by offshore wind energy alone.

The replacement of old installations (repowering) is still proceeding slowly. The 2009 EEG created the necessary economic framework conditions for this market segment. A planning guide has been drawn up, in cooperation with the German Association of Towns and Municipalities (DStGB) and the Federal Environment and Transport Ministries, so as

to avoid obstacles relating to planning and permits. An advisory centre for local authorities is also to be set up.

5.2. Biomass

The production of electricity from biomass has seen rapid growth since 2004. The improved conditions introduced by the 2000 EEG, the 2001 Biomass Order, the amended EEG of 2004 and the new EEG (in force since 1 January 2009) brought numerous positive changes that are conducive to further growth in electricity production from biomass. These include the enhanced compensatory payments that are differentiated according to plant size and the introduction of various bonuses for the use of renewable raw materials or forest residues, for new technologies or the operation of plants in CHP mode.

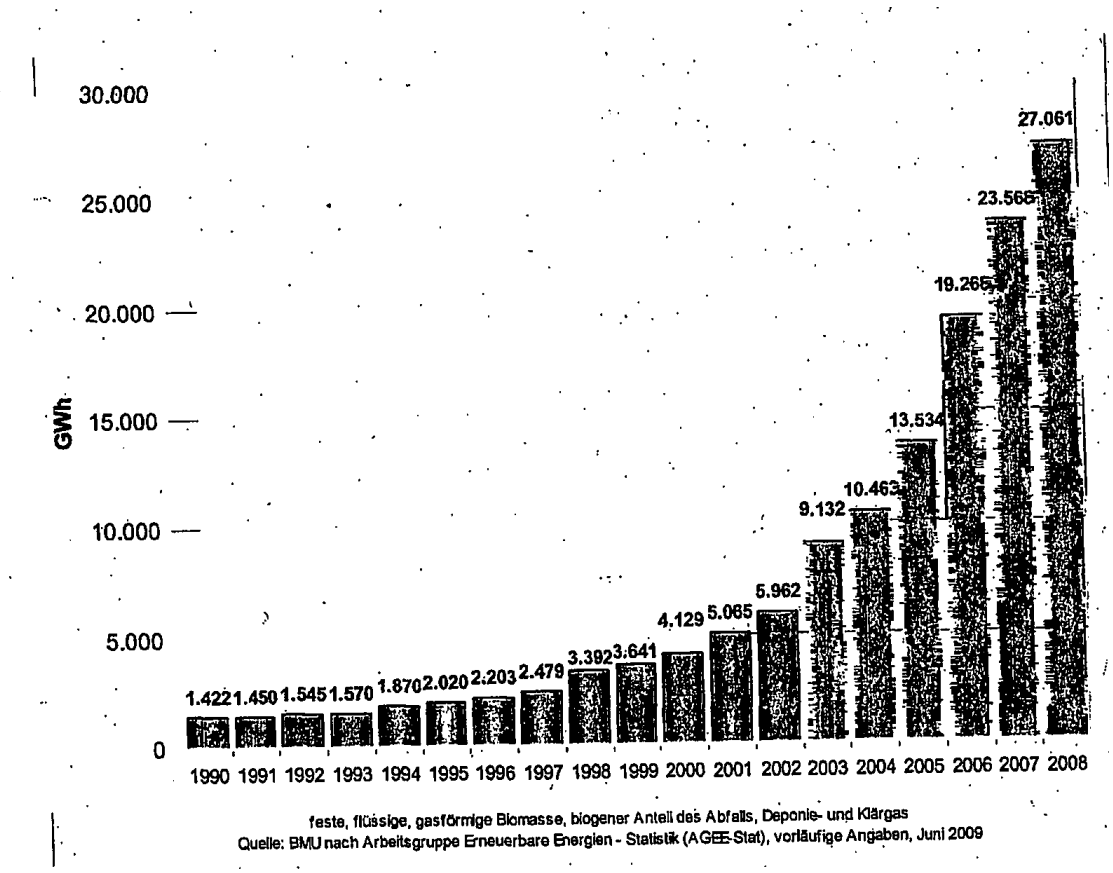
In 2008, 22 518 GWh of electricity was generated from solid, liquid and gaseous biomass (excluding the biogenic fraction of waste). The past few years have in particular seen considerable growth in electricity production from biogas. Electricity production amounted to 8 050 GWh in 2008. The trends in electricity production from whole biomass are shown in Fig. 3.

The share of all biogenic energy sources combined (solid and liquid biomass, biogas, landfill and sewage treatment plant gas and the biogenic fraction of waste) in gross electricity consumption in 2008 was about 4.4%.

In terms of the total final energy of RES electricity production (92 779 GWh), whole biomass (including the biogenic fraction of waste) accounts for about 29% of the total gross electricity production.

Around 209 biomass (heat and) power plants with an installed capacity of about 1 040 MW_{el} were producing electricity from solid biomass in Germany at the end of 2008. In the growing biogas sector, some 4 100 plants – with an installed capacity of about 1 435 MW_{el} – were in operation at the end of 2008 Some 1 400 plants – with an installed capacity of about 310 MW_{el} – were generating electricity from liquid biomass.

In 2008, Germany had a total of around 5 709 power plants – with an installed capacity of about 2 785 MW_{el} – that generated electricity from biomass.



solid, liquid and gaseous biomass, biogenic waste fraction, landfill and sewage treatment plant gas

Source: Environment Ministry, based on Working Group on Renewable Energy Statistics (AGEE-Stat), provisional data, June 2009

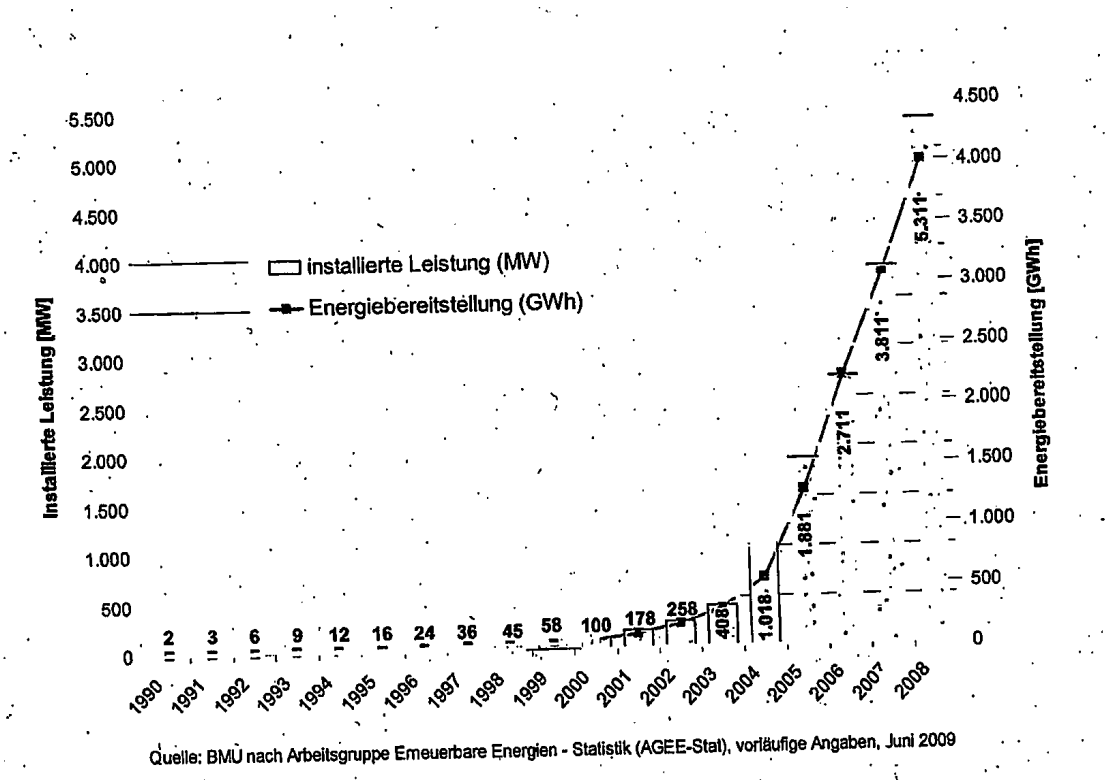
Fig. 3: Electricity production from whole biomass in Germany

5.3. Solar energy

Demand for photovoltaic installations continued to rise sharply in Germany in the past few years. The addition of some 1 100 MW_{peak} in 2007 was exceeded by the 1 500 MW_{peak} that was added in 2008. At the end of 2008, therefore, photovoltaic installations with a total installed capacity of about 5 311 MW_{peak} were feeding electricity into the grid. In 1997, the installations operating had a capacity of only 36 MW_{peak}.

Solar energy's share of total gross electricity consumption in Germany was only about 0.7% in 2008, despite the previous years' rapid increases. Photovoltaics had a 1.7% share of the total final energy obtained from renewables.

Under the 2009 EEG, the degressive rates of compensatory payments are to be adapted to take account of the amount of new installed capacity. The first adaptation is set to take place in 2010, followed by another in 2011.The development of installed capacity and energy supply in electricity production from solar energy is presented in Fig. 4.



[The above graph shows installed capacity in MW (bars) and energy supply in GWh (line)]

Source: Environment Ministry, based on Working Group on Renewable Energy Statistics (AGEE-Stat), provisional data, June 2009

Fig. 4: Development of installed capacity and energy supply from solar energy use in Germany

5.4. Hydropower

The introduction of the EEG resulted in the increased use of small hydropower plants.

About 21 300 GWh of electricity was produced by hydropower in Germany in 2008. The approximately 7 700 hydropower plants – with an installed capacity of about 4 740 MW – accounted for about 3.5% of the total gross electricity consumption. Hydropower is thus an important source of RES electricity.

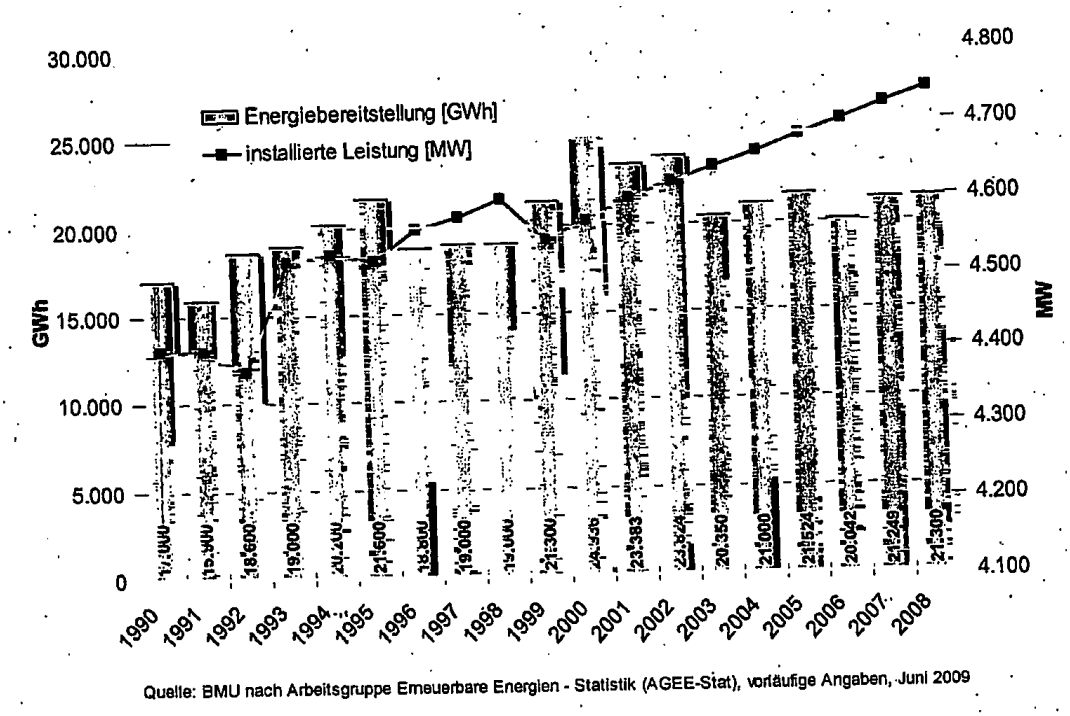
Fig. 5 presents an overview of installed capacities at hydropower plants and energy supply in recent years.

The potential for further developing hydropower lies mainly in the replacement and in the modernisation and expansion of existing plants, as well as in the building of new plants here and there, especially on existing transverse structures. There are also sites that are suitable for reactivating small hydropower plants. The Law on the reorganisation of water legislation will enter into force on 1 March 2010. Section 35(3) of that law requires competent authorities to examine the scope for using hydropower on barrages and other transverse structures whose removal is not envisaged in the long term, and to publish their findings.

Hydropower has been highly developed in Germany for decades and, whilst the EEG did in the past provide impetus for the modernisation and reactivation of old small-scale

plants, this did not lead to any major growth in their use. Hydropower will see its share of electricity production increase slightly in the future, but not to the same extent as wind energy or biomass.

The aim is to tie further hydropower capacity development to improvements in hydro-ecological conditions, whatever the size of the plant. The 2009 EEG provides for increased rates of compensatory payments that are applicable to all plants, irrespective of size. This is contingent on compliance with exacting hydro-ecological requirements. The compensation period for all plants has been set at 20 years (but is still 15 years in the case of large plants).



This graph shows energy production in GWh (bars) and installed capacity in MW (line)

Source: Environment Ministry, based on Working Group on Renewable Energy Statistics (AGEE-Stat), provisional data, June 2009

Fig. 5: Development of installed capacity and energy supply from hydropower use in Germany

5.5. Geothermal energy

Geothermal energy offers interesting prospects not only for heat supply but also for electricity generation.

Electricity was first generated from geothermal energy in Germany in November 2003. The first year-round industrial-scale plant for the production of heat and electricity came on stream at the end of 2007. This plant will produce an amount of electricity equivalent to the annual requirements of 6 000 households. A third plant has been operational since 2008. In 2008, these three plants with a capacity of 6.6 MW generated about 18 GWh of electricity. Other plants in Germany are currently nearing completion or are at the

planning or construction stage. Most of the plants at the planning stage are in southern Germany, in the Upper Rhine Basin, in the Molasse Basin (Molassebecken) and in the North German Basin.

The Federal Government's Report on a strategy for the promotion, development and marketing of electricity produced from geothermal energy and for heat utilisation was published in May 2009. It describes the status of geothermal energy use in Germany, analyses the steps taken by the Federal Government to improve the framework conditions, and makes recommendations for further action. It concludes that the measures taken to date by the Federal Government to promote geothermal energy use (e.g. improved compensation for the electricity sector under the EEG) will stimulate the market considerably.

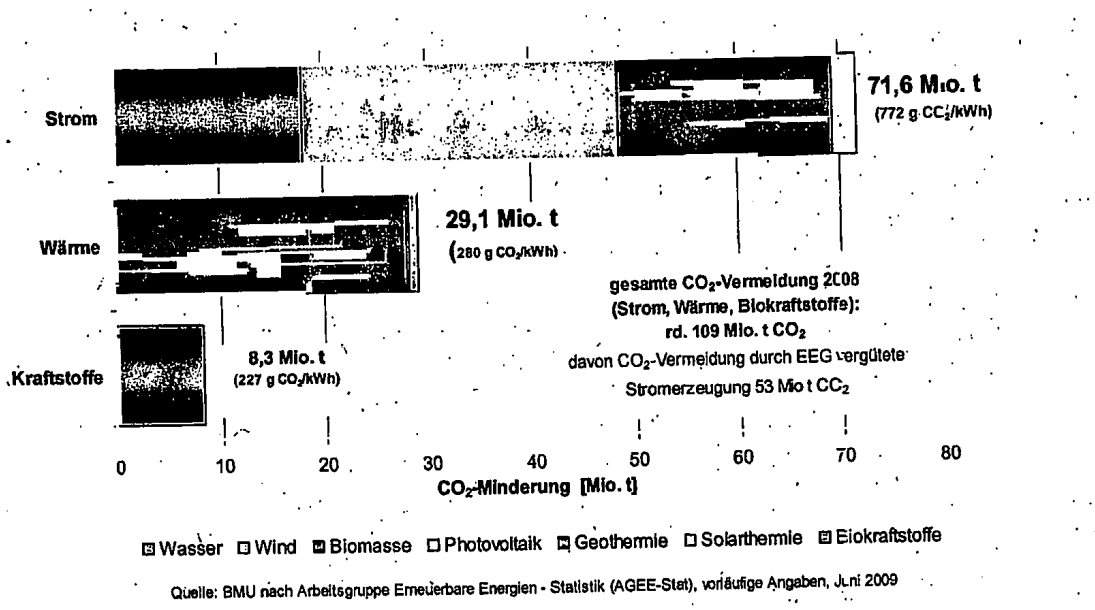
Interest in implementing geothermal projects in Germany remains high. This is evidenced by the approximately 180 permits and authorisations for prospecting for geothermal resources that have already been granted.

6. CHANGES IN EMISSION AVOIDANCE RESULTING FROM THE USE OF RENEWABLES IN THE CONTEXT OF NATIONAL CLIMATE CHANGE COMMITMENTS

The use of renewables in Germany has important implications for the climate and in particular reduces emissions of CO_2 and other greenhouse gases.

The reduction in emissions from using renewables is making an important contribution to achieving Germany's climate protection goals and is actively assisting efforts to meet the European Union's climate protection targets.

Renewables' contribution to climate protection is currently even greater than their contribution to the energy supply (233 228 GWh). For instance, CO_2 avoidance resulting from the use of renewables totalled around 109 million tonnes in 2008. If renewables had not been used, total CO_2 emissions (about 748 million tonnes) would have been about 15% higher. Fig. 6 provides an overview of total CO_2 avoidance resulting from the use of renewables, including emission factors, for 2008.



[This graph shows CO_2 avoidance by sector (left-hand scale: electricity / heat / motor fuels), each of which is broken down according to renewable energy source (from left: hydropower / wind power / biomass / photovoltaics / geothermal energy / solar thermal energy / biofuels)]

Total CO_2 avoidance in 2008 (electricity, heat, motor fuels): approx. 109 million tonnes CO_2, including approx. 53 million tonnes as a result of electricity produced subject to compensatory payments under the EEG.

Source: Environment Ministry, based on Working Group on Renewable Energy Statistics (AGEE-Stat), provisional data, June 2009

Fig. 6: Total CO_2 avoidance resulting from the use of renewables in Germany in 2008

RES electricity production alone accounted for 72 million tonnes of the approximately 109 million tonnes of CO_2 emissions avoided. Electricity produced under the EEG subject to compensatory payments accounts for about 53 million tonnes of this amount. This represents about half of all CO_2 emissions avoidance owing to the use of renewables.

The EEG thus not only makes an important contribution to the exploitation of renewable energy sources but also constitutes the key pillar of climate protection in Germany.

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Communication

from the Government of the Federal Republic of Germany

to the Commission of the European Communities

of 15 October 2009

Reporting obligation of the Federal Republic of Germany under Article 3(3) of Directive 2001/77/EC of the European Parliament and of the Council of 27 September 2001 on the promotion of electricity produced from renewable energy sources in the internal electricity market

The Government of the Federal Republic of Germany presents its compliments and has the honour to forward to the European Commission Germany's report on progress towards achieving the indicative target for the consumption of electricity produced from renewable energy sources in the internal electricity market.

Annexes

Report from the Federal Republic of Germany on progress towards achieving the indicative target for the consumption of electricity produced from renewable energy sources in the internal electricity market

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to the report from the Federal Republic of Germany under Article 3(3) of Directive 2001/77/EC of the European Parliament and of the Council of 27 September 2001 on the promotion of electricity produced from renewable energy sources in the internal electricity market

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