Bundesministerium
für Umwelt, Naturschutz
und Reaktorsicherheit

# 2005 Report by the Federal Republic of Germany on achievement of the indicative target for electricity consumption from renewable energy sources by 2010

Report by the Federal Republic of Germany pursuant to Article 3, paragraph (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.

**Courtesy translation!**

Berlin, October 2005

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## 1 Introduction

One of the Federal Government's key policy objectives is to achieve a sustainable energy supply. Our main concern is to safeguard the energy supply of future generations while making allowance for both ecological objectives and economic growth. A core component of this strategy entails significantly increasing the proportion of energy supply from renewable energies so as to protect finite energy resources and safeguard the interests of environmental and climate protection. In accordance with Article 1 of the Act on Granting Priority to Renewable Energy Sources (Renewable Energy Sources Act – EEG), Germany is aiming to increase the proportion of electricity generated from renewable sources to at least 12.5 % by the year 2010, and to at least 20 % by the year 2020. After 2020, these targets will be substantially upgraded. By the year 2010, it is hoped that renewable energies will account for at least 4.2 % of total energy consumption, and around half of energy consumption by the middle of the century. The Federal Government is keen that renewable energies should become competitive in the internal energy market in the medium to long term. Renewable energy sources will only be able to play a permanent supporting role in the energy market when they are able to assert themselves on the market without the aid of financial support. Consideration of the various external costs (in particular, long-term environmental and climate damage) of both conventional and renewable energy sources while ensuring economic viability remains an important goal at both national and international level.

The Renewable Energy Sources Act (EEG) is a pivotal element of the Federal Government's raft of environmental and energy policy measures. The Act was adopted by the *Deutscher Bundestag* (Lower House of Parliament) on 29 March 2000, and entered into force on 1 April 2000, replacing the Act on the Sale of Electricity to the Grid (StrEG) in force since 1991, which likewise contained a supply and fee payment system in favour of regenerative electricity. Hence, when developing the EEG, we were able to draw on 10 years of experience with the StrEG. The EEG was adapted in line with the conditions of the liberalised electricity market and a number of significant improvements were added. In particular, the new system of fees, differentiated according to the various renewable energy segments, served to balance out the remaining competitive disadvantages of renewable energies versus conventional electricity generation, and cleared the way for the use of biomass, solar power and geothermal energy in electricity production.

In 2004, the EEG was comprehensively updated for the first time, bringing it into alignment with the Federal Government's sustainability strategy, implementing Directive 2001/77/EC, and offering longer-term prospects to the affected players. Specifically, the amendments

- improved the incentives for improved energy efficiency and technical innovations to renewable energy plants, e.g. by offering a bonus for cogeneration plants
- created better supply conditions for the energetic use of biomass and geothermal energy, and included the modernisation of large hydropower plants in the compensation scheme
- adjusted the fees for windpower, and in part significantly increased the rates for solar power, to compensate for the expiry of the 100,000 roofs programme
- increased the annual degression in the fees for new installations to strengthen the incentives for technical innovations and cost-cutting,
- incorporated a number of provisions designed to increase transparency and consumer protection, and
- made enforcement of the law easier.

With particular regard for the polluter pays principle, the provisions of the law serve to implement the requirement to protect the natural bases of life in view of our responsibility toward future generations, as stipulated in Article 20a of Germany's Basic Law, as well as implementing the environmental protection targets set out in Articles 2, 6, 10 and 175 of the Treaty Establishing the European Community.

In recent years, the EEG has effected a significant increase in the use of renewable energy sources to generate electricity, by offering guaranteed fee rates secured over a period of many years. This is particularly true in the case of windpower, which has developed to become the leading source of electricity generation ahead of hydropower.

The emission savings that are made by generating electricity from renewable energies are particularly beneficial from an environmental and climate policy viewpoint: As a result of the EEG and the annexes initiated by its preceding law and later incorporated into the EEG, some 33 million tonnes of carbon dioxide were saved

in 2004 alone.[1] Once the set targets have been met, this figure will rise to more than 50 million tonnes of carbon dioxide in the electricity sector alone by the year 2010. The growth in renewable energies is a major factor in reducing emissions of greenhouse gases in Germany by 21 percent during the 1st commitment period of the Kyoto Protocol, within the context of burden sharing within the EU.

In 2004, some 52.2 million tonnes of $CO_2$ were avoided in total thanks to the generation of electricity from renewable energies (installations with and without entitlement to fee payment under the EEG).[2] Emissions of other pollutants were also avoided as a result of electricity generation from renewable energies. In 2004, these included some 28,700 tonnes of $SO_2$, 32,900 tonnes of $NO_x$, 16,700 tones of CO and 700 tonnes of non-methane volatile organic compounds (NMVOC).

Additionally, $CO_2$ savings of around 14.6 million tonnes were achieved in the heating sector in 2004 thanks to the use of renewable energies, while the use of biofuels led to savings of around 3 million tonnes in the same year. Overall, then, the use of renewable energies in Germany led to $CO_2$ savings of around 70 million tonnes.[3]

Directive 2001/77/EC of the European Parliament and of the Council of 27 September on the promotion of electricity produced from renewable energy sources in the internal electricity market aims to increase the share of electricity supply from renewable energy sources in the European Community (EU25) to 21 percent by the year 2010. Article 3, paragraph (3) of EU Directive 2001/77/EC obligates the Member States to prepare a report on target achievement and on national climate protection 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 serves to implement our obligations arising from that Directive.

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[1] The significant increase in this figure compared with that given in the previous report of 2002 has arisen as a result of the growth in the use of renewable energies for the generation of electricity under the EEG, and current figures on the $CO_2$ emissions avoided in the electricity sector as a result of renewable energies.

[2] The significant rise in this figure compared with that given in the previous report of 2002 has arisen as a result of the growth in the use of renewable energies for the generation of electricity under the EEG, and current figures on the $CO_2$ emissions avoided in the electricity sector as a result of renewable energies.

[3] $CO_2$ emission factor with the current energy mix in Germany: Reduction in emissions via the use of renewable energies by 0.935 kg $CO_2$/kWh for electricity, 0.229 kg $CO_2$/kWh for heat and 0.351 kg $CO_2$/kWh for biofuels.

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## 2. National indicative target for Germany

The national targets in the EU Directive on the promotion of electricity produced from renewable energy sources in the internal electricity market are based on the indicative target of doubling the share of renewable energy sources in the Community by 2010. As its contribution, Germany aims to achieve a market share of at least 12.5 % of the national electricity market from renewable energies by the year 2010. This is roughly equivalent to a doubling in the share of renewable energies compared with the year 2000. Table 1 shows renewable energies as a share of gross electricity consumption until the year 2004. For the year 2005, we anticipate a further substantial increase in electricity generated from renewable sources; precise figures are not yet available. Assuming that its measures to increase the use of renewable energies are continued, the Federal Government anticipates that the EU's indicative target for Germany will be met by 2010, whereby the EEG will act as the principal mechanism for this purpose.

**Table 1**: Renewable energies as a share of gross electricity consumption[4]

| | 1997 | 1998 | 1999 | 2000 | 2001* | 2002* | 2003* | 2004* | | 2010** |
|---|---|---|---|---|---|---|---|---|---|---|
| Gross electricity consumption [TWh] | 549.9 | 556.7 | 557.3 | 578.1 | 582.8 | 584.0 | 595.8 | 600.0 | | - |
| Renewable energies as a share of gross electricity consumption (%) | 4.5 | 4.7 | 5.4 | 6.7 | 6.7 | 7.8 | 8.0 | 9.3 | | 12.5 |

* Provisional figures for gross electricity consumption, estimated in part

** Indicative target for Germany pursuant to EU Directive 2001/77/EC

Source: AG Energiebilanzen / DIW Berlin, 2005; AG Erneuerbare Energien Statistik / ZSW 2005

4 In view of the validated data for renewable energies now available, recalculation has resulted in a number of minor changes to the share of renewable energies in prior years.

## 3. Development of electricity generation from renewable energies

The share of gross electricity consumption attributable to renewable energies has increased from around 4.7 % in 1998 to 6.7 % in 2000 to around 9.3 % in 2004. Within electricity generation from renewable energies, windpower (44.8 %), hydropower (37.6 %) and biomass (16.8 %) account for the lion's share. In 2004, electricity generation from wind power overtook hydropower. Table 2 shows the development in the supply of renewable energies over time until 2004.

| | Hydropower | Wind power | Biomass electricity | Photovoltatics | Geothermal electricity | **Sum total of electricity generation** | **Share of gross electricity consumption** | Biomass heat | Solar thermal energy | Geothermal heat | Sum total, heat generation | Biodiesel | Bio-ethanol | Sum total, fuels | **Sum total of final energy supply** | **Share of final energy consumption** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | [GWh] | | | | | | [%] | [GWh] | | | | | | | [%] | [%] |
| **1990** | 17,000 | 40 | 1,422 | 1 | 0 | **18,463** | **3.4** | not given | 130 | not given | not given | not given | 0 | **0** | not given | not given |
| **1991** | 15,900 | 140 | 1,450 | 2 | 0 | **17,492** | **3.2** | not given | 166 | not given | not given | 2 | 0 | **2** | not given | not given |
| **1992** | 18,600 | 230 | 1,545 | 3 | 0 | **20,378** | **3.8** | not given | 218 | not given | not given | 52 | 0 | **52** | not given | not given |
| **1993** | 19,000 | 670 | 1,570 | 6 | 0 | **21,246** | **4.0** | not given | 279 | not given | not given | 103 | 0 | **103** | not given | not given |
| **1994** | 20,200 | 940 | 1,870 | 8 | 0 | **23,018** | **4.3** | not given | 351 | not given | not given | 258 | 0 | **258** | not given | not given |
| **1995** | 21,600 | 1,800 | 2,020 | 11 | 0 | **25,431** | **4.7** | not given | 440 | 1,425 | not given | 310 | 0 | **310** | not given | not given |
| **1996** | 18,800 | 2,200 | 2,203 | 16 | 0 | **23,219** | **4.2** | not given | 550 | 1,383 | not given | 517 | 0 | **517** | not given | not given |
| **1997** | 19,000 | 3,000 | 2,479 | 26 | 0 | **24,505** | **4.5** | 48,546 | 695 | 1,335 | 50,576 | 827 | 0 | **827** | **75,908** | **2.9** |
| **1998** | 19,000 | 4,489 | 2,800 | 32 | 0 | **26,321** | **4.7** | 51,613 | 857 | 1,384 | 53,854 | 1,033 | 0 | **1,033** | **81,208** | **3.1** |
| **1999** | 21,300 | 5,528 | 3,020 | 42 | 0 | **29,890** | **5.4** | 50,951 | 1,037 | 1,429 | 53,417 | 1,343 | 0 | **1,343** | **84,650** | **3.3** |
| **2000** | 24,936 | 9,500 | 4,129 | 64 | 0 | **38,629** | **6.7** | 54,314 | 1,279 | 1,433 | 57,026 | 2,583 | 0 | **2,583** | **98,238** | **3.8** |
| **2001** | 23,383 | 10,456 | 5,065 | 116 | 0 | **39,020** | **6.7** | 55,326 | 1,626 | 1,447 | 58,399 | 3,617 | 0 | **3,617** | **101,036** | **3.8** |
| **2002** | 23,824 | 15,856 | 5,962 | 188 | 0 | **45,830** | **7.8** | 54,626 | 1,955 | 1,483 | 58,064 | 5,683 | 0 | **5,683** | **109,577** | **4.3** |
| **2003** | 20,350 | 18,919 | 7,982 | 333 | 0 | **47,584** | **8.0** | 59,248 | 2,465 | 1,532 | 63,245 | 8,267 | 0 | **8,267** | **119,096** | **4.7** |
| **2004** | 21,000 | 25,000 | 9,367 | 459 | 0.4 | **55,826** | **9.3** | 59,806 | 2,573 | 1,558 | 63,937 | 10,747 | 424 | **11,171** | **130,934** | **5.1** |

**Table 2**: DEVELOPMENT OF ENERGY SUPPLY FROM RENEWABLE ENERGES OVER TIME, 1990 – 2004, final energy

In November 2003, Germany began to generate electricity from geothermal energy for the first time, representing a major step forwards for the use of geothermal energy. Additional sites are now being developed with the aim of expanding geothermal electricity production.

A detailed overview of the development of renewable energies in Germany, including its impacts on the environment, may be found in the Federal Environment Ministry (BMU) publication "*Erneuerbare Energien in Zahlen – nationale und internationale Entwicklung*" (Renewable Energies in Figures – National and International Development) (last edited: June 2005) (Annex 5).

## 4. Development of emissions avoided thanks to the use of renewable energies in conjunction with national climate protection commitments

Increasing the use of renewable energies helps to avoid climate-relevant gases released during the use of fossil energy fuels and therefore constitutes an indispensable component of Germany's climate protection strategy. Beneficial effects have been achieved by increasing the use of renewable energies thanks to the Renewable Energies Sources Act (EEG), the Biomass Ordinance within the framework of the EEG, the Federal Government's market incentive programmes, and various other measures.

Overall in 2004, around 70 million tonnes of $CO_2$ emissions were avoided thanks to the generation of electricity and heat from renewable energy resources and via the use of biofuels (cf. Table 3).[5]

| | **Electricity** [1)] | **Heat** [2)] | **Total**[3)] |
|---|---|---|---|
| Final energy | **55,826 GWh** | **63,937 GWh** | **approx. 131 GWh** |
| $CO_2$ reductions | approx. 52.2m t | approx. 14.6m t | approx. 70 m t |

[1)] Emission factor: Reduction in $CO_2$ emissions by 934.5 g/KWh

[2)] Emission factor: Reduction in $CO_2$ emissions by 228.5 g/KWh

[3)] Including biofuels (emission factor: Reduction in $CO_2$ emissions by 351.2 g/KWh)

**Table 3:** EMISSION REDUCTION AS A RESULT OF ELECTRICITY AND HEAT GENERATION AND BIOFUELS FROM RENEWABLE ENERGIES, 2004

[5] The significant rise in this figure compared with that given in the previous report of 2002 has arisen as a result of the growth in the use of renewable energies for the generation of electricity in particular, and current figures on the $CO_2$ emissions avoided in the electricity sector as a result of renewable energies.

The 70 million tonnes of $CO_2$ emissions avoided thanks to the use of renewable energies in 2004 are broken down as follows: approximately 52 million tonnes for electricity supply, approximately 15 million tonnes for heat supply, and approximately 3 million tonnes for fuel supply.

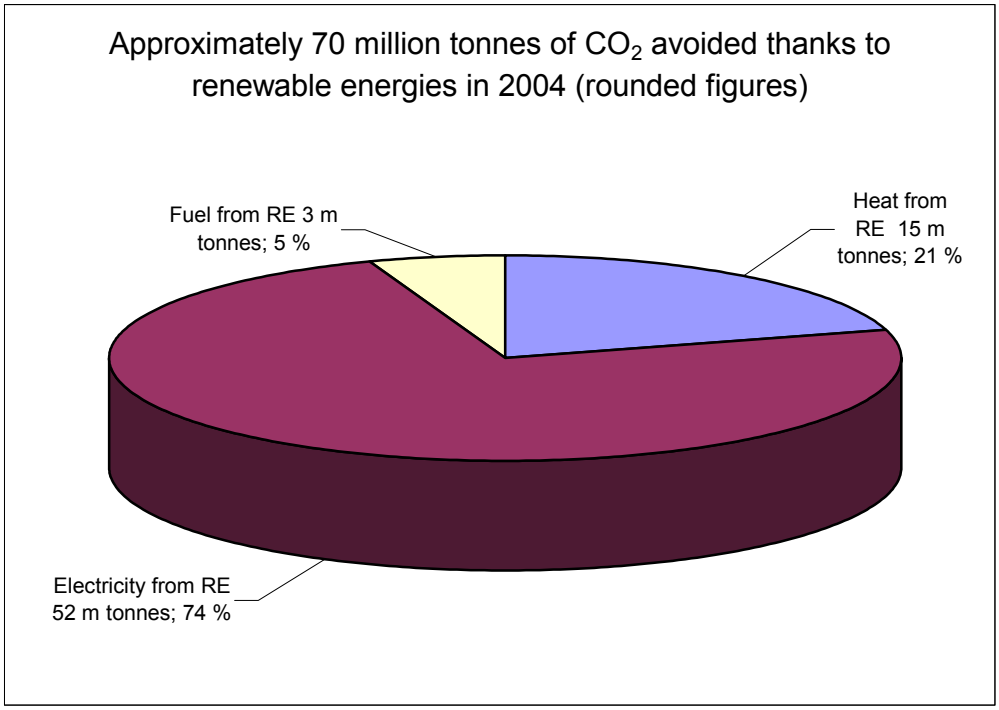


**Figure 1:** $CO_2$ EMISSIONS AVOIDED BY THE USE OF RENEWABLE ENERGIES IN 2004 (ROUNDED FIGURES)

## 5. Sector-by-sector development of electricity generated from renewable energies

### *Wind power*

Of all the renewable forms of energy, windpower, particularly offshore wind farms, has the greatest medium-term potential for expansion for the electricity sector in Germany.

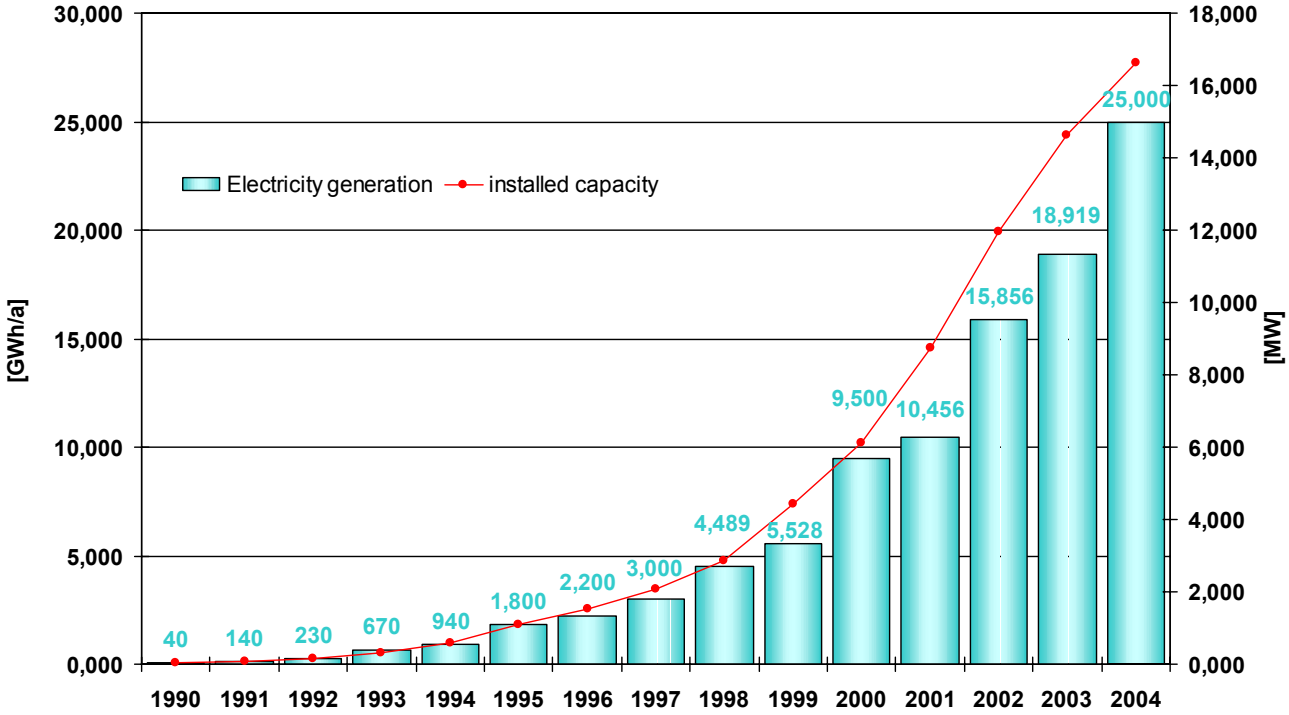


**Figure 2:** DEVELOPMENT OF WINDPOWER USE IN GERMANY

Germany is home to approximately one-third of the installed capacity worldwide and roughly half of the capacity installed in the EU. 2004 saw the installation of a further 2,037 megawatts. In total by the end of 2004, there were 16,543 wind turbines installed throughout Germany with an overall capacity of 16,629 MW. In 2004, windpower in Germany contributed some 4.1 % to gross electricity generation with approximately 25 TWh.

However, there are signs of a downward trend in the installation of new onshore wind farms. This trend is partly due to natural constraints, in view of the limited number of favourable sites available, and partly attributable to lower levels of fees and the higher degression of fees specified in the amendment to the EEG in 2004 of 2 % per

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annum, coupled with the 60 % ruling which states that wind farms in poor locations are no longer entitled to minimum feed-in fees under the EEG. The new, tighter provisions governing distance and height limitations imposed by certain Federal *Länder* have also significantly reduced the technical and economic potential for onshore expansion. The improved system of repowering under the EEG - i.e. the replacement of old, small wind farms with more modern and powerful installations – is also affected by these provisions of the *Länder*.

Given the limited number of onshore sites, in January 2002 the Federal Government presented its "Strategy for the Use of Offshore Windpower" as part of its wider sustainability strategy. The strategy identifies potentially suitable areas and areas expected to be suitable for wind farms in Germany's Exclusive Economic Zone (EEZ) in the North and Baltic Seas. The new Federal Nature Conservation Act of 25 March 2002 improved the legal framework for the formal designation of particularly suitable areas and the designation of protected areas within the Exclusive Economic Area. Additionally, the expansion of the Federal Regional Planning Act (ROG) of 2004 to include the Exclusive Economic Area (Article 18a of the ROG) created the legal foundations for long-term regional planning. Regional planning for the EEA is currently under preparation.

According to the Federal Government's strategy for the use of offshore windpower, under the current conditions, around 2000 to 3000 MW capacity can be achieved in the medium term (by 2010) on the area currently thought to be available. In the long term, i.e. by 2025 or 2030, an installed capacity of approximately 20,000 to 25,000 MW will be possible, provided cost-effectiveness can be achieved. To this end, investors in offshore wind farms and the electricity industry will need to provide for the transportation of electricity generated offshore on this scale. Such use of offshore windpower would be equivalent to 15 % of electricity consumption in Germany, measured against the reference year 1998. With this, onshore and offshore windpower will be capable of contributing 25 % of overall electricity generation within approximately 25 years.

The German Energy Agency (dena), in collaboration with the energy supply companies, representatives of the renewable energy industries and the competent Federal Ministries, has commissioned a fundamental study into the future development of renewable energies and their integration into the existing electricity

supply structure (hereinafter referred to as the dena grid study)[6] . The study confirms that the Federal Government's target for increasing the supply of renewable electricity is realistic, and identifies a number of requirements that need to be put into place. The Federal Government anticipates that by the year 2020, renewable energies will account for 20 % of the electricity generated. According to the dena study, in an ideal scenario this could be achieved as early as 2015.

On the basis of the scenarios outlined in the dena grid study, the following development is thought to be conceivable for the continued expansion of wind power and other renewable energy generation until 2020: The total installed windpower capacity will increase from its current level of just under 17 GW to 36 GW. The annual volume of electricity supplied to the grid from wind turbines will increase from 25 TWh to 77 TWh. Electricity from all renewable energies will total approximately 120 TWh, or around one-fifth of the total electricity generated, by the year 2020. In short, renewable energies will become a supporting pillar of electricity supply in Germany. Nevertheless, fossil fuels will remain the backbone of electricity supply for the foreseeable future.

The dena grid study suggests that a number of expansion measures are needed in order to ensure optimum integration of renewable energies into the extra-high voltage grid. By the year 2020 at the latest, various grid sections covering an overall length of approximately 400 km will need to be reinforced. Routes spanning some 850 km will need to be completely rebuilt. Additionally, the grid will require a series of upgrades. The existing extra-high voltage grid needs to be extended by around 5 %. The expansion of the extra-high voltage grid that is required for the purpose of windpower is technically feasible and of a financially viable magnitude.

The windpower available for electricity supply does not remain constant over time, due to varying wind conditions, and is impossible to precisely predict. As a result, the expansion of windpower will entail increased control and spare capacity requirements. However, the dena grid study suggests that the additional flexibility required is of a manageable scale. The control and reserve requirements necessitated by the expansion of windpower can be provided by the upgraded stock of power stations, as per the dena grid study.

As a result of the additional windpower supplied, the electricity produced by conventional means will be approximately 10 % lower by the year 2020. Capacity

[6] *Deutsche Energie-Agentur* (German Energy Agency): Energiewirtschaftliche Planung für die Netzintegration

utilisation levels in the fossil fuel power stations will drop. It must therefore be possible to reduce the use of fossil fuels, and $CO_2$ emissions will be 23 to 39 million tonnes lower compared with a scenario without the expansion of windpower. The capacity of the stock of conventional power stations may be reduced by just under 6 % of the installed windpower capacity thanks to the continued expansion of windpower energy over this period.

## Biomass

The framework conditions for the use of biomass as a renewable fuel were significantly improved by the EEG of 2000 and its amendment in 2004, with higher feed-in fees specifically for small installations, as well as the Biomass Ordinance (BiomasseV) within the context of the EEG. Especially in the electricity sector, this led to a significant expansion of capacity and electricity production; the same was also true of the heating sector, albeit on a smaller scale, thanks to the bonus offered for the use of cogeneration. The framework conditions for the use of biomass as a renewable fuel were significantly improved by the market incentive program to promote renewable energies and loan programmes by the banks (KfW, DtA), and led to a substantial rise in bioenergies (refer to Figure 3). Research and development subsidies play a key role in the development of new, innovative technologies.

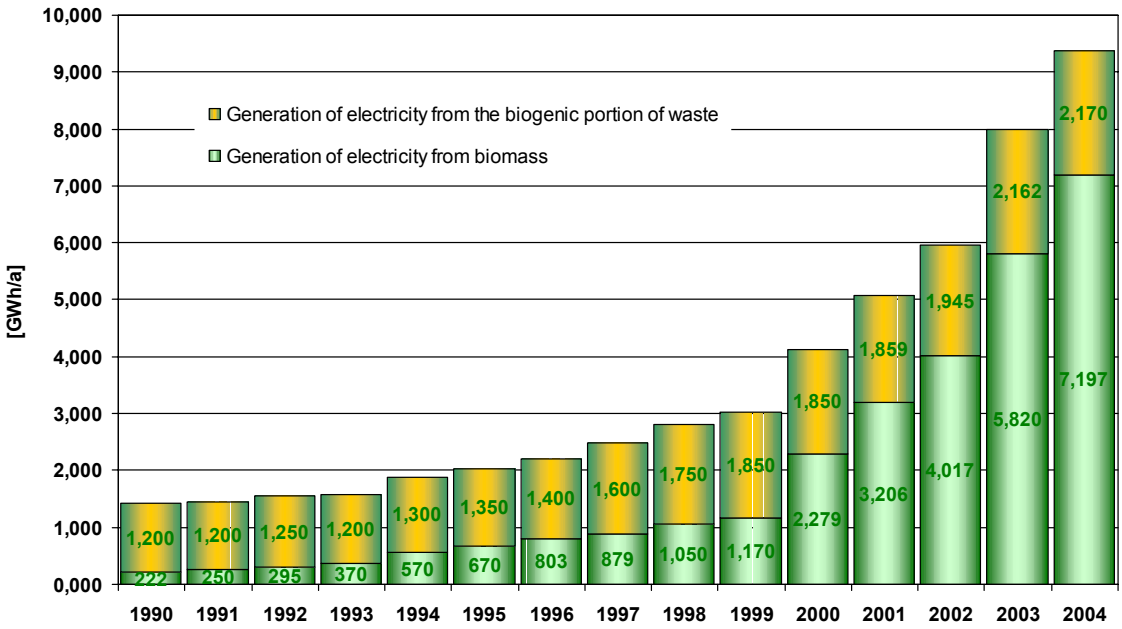


**Figure 3:** DEVELOPMENT OF BIOENERGY USE IN GERMANY

von Windenergie in Deutschland an Land und Offshore bis zum Jahr 2020, Berlin 2005.

Biomass – i.e. wood, specially cultivated energy crops, biowaste, slurry and other substances of plant and animal origin – has the potential to contribute substantially to energy supply.

Biomass can be used to generate both heat and electrical power with the aid of steam and gas turbines, combustion and Stirling engines, as well as fuel cells. The Biomass Ordinance entered into force on 27 June 2001 within the framework of the EEG (Annex 3). This laid the foundations for climate-friendly generation of electricity from renewable raw materials and biogenic residues and wastes, and also helped to free up an investment backlog in this area. The Biomass Ordinance was amended on 9 August 2005 as a result of new EU provisions.[7]

The use of biomass shows major growth potential in Germany, although it is limited by the amount of space available. Towards the end of 2004, biomass contributed around 93 % of heat generated from renewable energies, and around 17 % of electricity generated from renewable energies. Recent studies suggest a long-term potential of approximately 10 % of total electricity supply and roughly 20 % of total heat supply. As per the end of 2004, there were 2,280 biomass installations in Germany, including 110 biomass (heating and) power stations using solid biofuels, with an electrical capacity of approximately 810 $MW_{el}$; 2,010 biogas installations (247 $MW_{el}$); and 160 district heating power stations (12 $MW_{el}$) fuelled by vegetable oil.

***Solar power***

Solar electricity production has developed rapidly in Germany in recent years due to the high fee levels available; its contribution has increased from 188 million KWh in 2002 to 459 million KWh in 2004 (cf. Figure 4). However, its share of overall electricity consumption remains comparatively low, at 0.07 %.

[7] Adaptation in line with EC Regulation 1774/2002 of the European Parliament and of the Council of 3 October 2002 laying down health rules concerning animal by-products not intended for human consumption, most recently amended by Regulation No. 93/2005 of the Commission of 19 January 2005 (OJ EU No. L 19 page 34).

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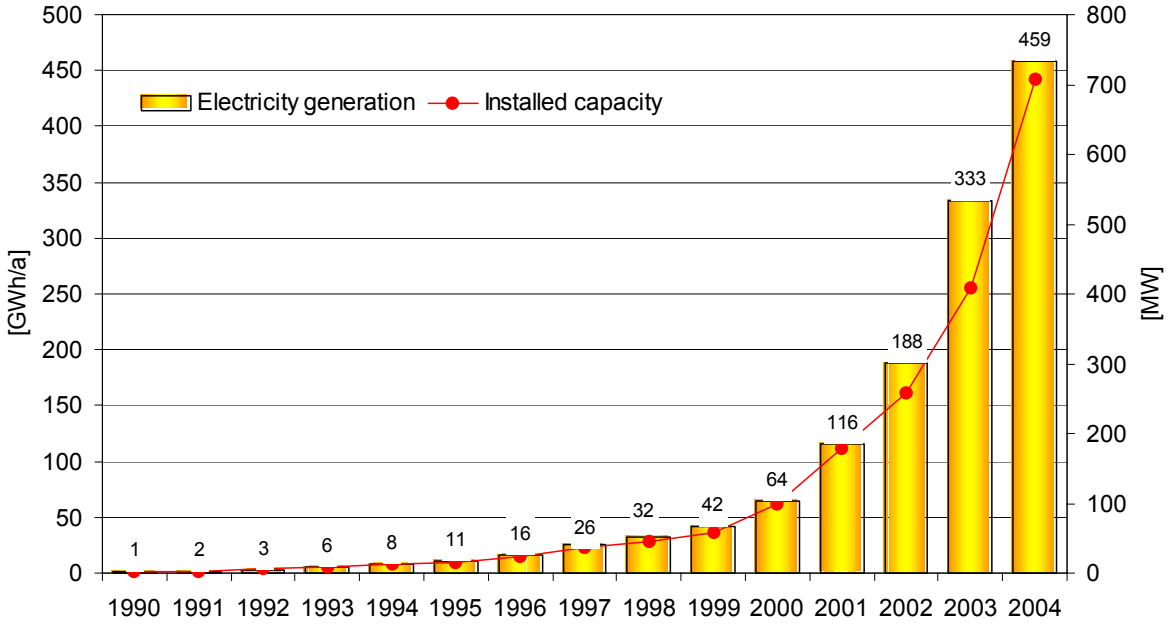


**Figure 4:** DEVELOPMENT OF SOLAR POWER USE IN GERMANY

The 100,000 roofs programme to promote solar electricity launched in 1999 drew to a successful close in 2003. Under the scheme, a capacity of approximately 350 $MW_p$ was installed on more than 60,000 roofs in Germany. In fact, the bulk of the total photovoltaic capacity installed by the end of the programme (408 $MW_p$) was subsidised by this scheme. Under the amendment to the EEG in early 2004, the fees for electricity from solar power were increased in order to compensate for the loss of subsidies from the 100,000 roofs programme. This increase prompted the installation of solar installations with a capacity of around 300 $MW_p$ in 2004, so that by the end of 2004 Germany had a total installed PV capacity in excess of 700 $MW_p$ .

***Hydropower***

In 2004, hydropower contributed around 3.5 % of electricity supply with approximately 21 TWh.

Provisional results suggest that the installed capacity has increased somewhat.

Whereas in previous years, the number of large installations remained more or less constant, the StrEG introduced in 1990 and the EEG in force since 2000 prompted a revival among small hydropower plants and put a halt to the threatened decline in this area (see Figure 5).

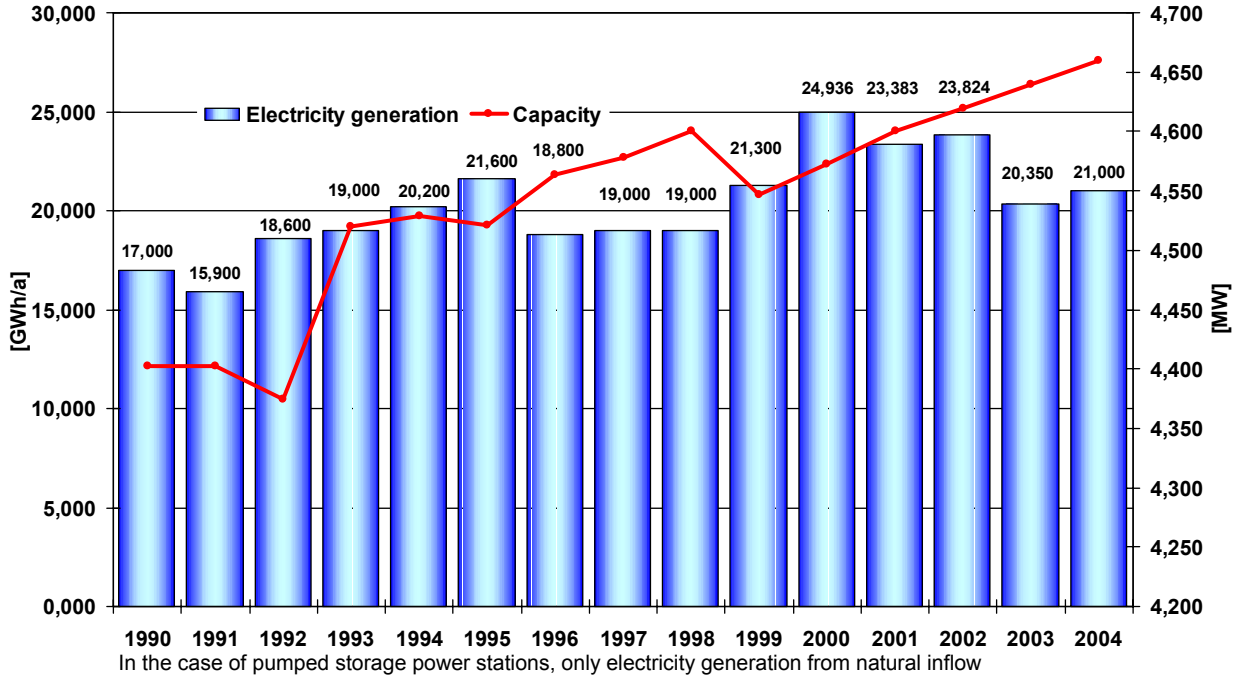


**Figure 5:** DEVELOPMENT OF HYDROPOWER USE

*Geothermal energy*

Geothermal energy uses the heat available deep in the earth's core. There are currently some 34 large installations for thermal recovery in Germany with a thermal capacity of around 88 MW. Each year, they provide some 1,558 GWh of heat. Further installations are planned over the next few years. Electricity has been generated from geothermal energy in Germany since November 2003. In addition to the provisions outlined in the EEG, however, further research, development, demonstrations and market launches are needed in the field of geothermal electricity production. Geothermal energy receives subsidies, both within the framework of R&D and demonstration projects, and via the market launch programme for renewable energies. The Federal Government also subsidises the research, development and demonstration of pioneering energy forms as part of its future investment programme (ZIP). For the period 2001 to 2003, an additional € 150 million was made available under this scheme. The programme's main emphasis is on geothermal electricity generation, solar thermal power stations and accompanying ecological research for other divisions of renewable energies, particularly windpower and biomass.

Geothermal energy is available around the clock and may be regulated to suit requirements at any given time. As such, goethermal power stations for the supply of

heating and electricity are capable of making an important contribution to the base load supply.

A study by the Institute for Energetics and Environment (IE) commissioned by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) estimates that the technical generation potential for geothermal electricity production in Germany – disregarding possible restrictions on the demand side – is approximately 200 TWh per annum. This is equivalent to approximately 35 % of Germany's current gross electricity consumption. According to these figures, geothermal energy commands a leading position compared with other options for the generation of electricity from renewable energy sources, and provided the remaining technical problems (particularly with regard to minimising the high-cost drilling risk) can be resolved, it may develop into a central component of a future energy system comprised to an increasing extent of renewable energies.

**Enclosures**

(1) Erneuerbare-Energien-Gesetz *(Renewable Energy Sources Act)* (EEG) of 21 July 2004

(2) Biomasse-Verordnung (BiomasseV) within the framework of the EEG of 21 June 2001 (*Biomass Ordinance*); 1. Verordnung zur Änderung der Biomasseverordnung (*First Ordinance to Amend the Biomass Ordinance*) of 9 August 2005

(3) Nachhaltigkeitsstrategie der Bundesregierung sowie Fortschrittsbericht zur Nachhaltigkeitsstrategie 2004 *(Federal Government's sustainability strategy and progress report on the sustainability strategy 2004)*

(4) Erneuerbare Energien in Zahlen, Stand Juni 2005, Publikation des Bundesministeriums für Umwelt, Naturschutz und Reaktorsicherheit in deutsch und englisch *(Renewable Energies in Figures, June 2005, a publication by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety in German and English)*