

**Renewable Energy Sources Act
(EEG)**

Progress Report 2007



Renewable Energy Sources Act (EEG)

Progress Report 2007

pursuant to Article 20 of the Act

to be submitted to the German Bundestag

by

**the Federal Ministry for the Environment,
Nature Conservation and Nuclear Safety (BMU)**

in agreement with

the Federal Ministry of Food, Agriculture and Consumer Protection

and

the Federal Ministry of Economics and Technology

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1 Summary

Legal mandate and background:

In view of the dynamic expansion of renewable energies (RE), regular monitoring of the existing support instruments is required, which if necessary should result in the adaptation of the current legal provisions to de facto developments. The Renewable Energy Sources Act (*Erneuerbare-Energien-Gesetz* – EEG) is an important and successful instrument to promote renewable energies; as a result of the Act, the development of renewable energies in the electricity sector is particularly dynamic. Pursuant to Article 20 of the Renewable Energy Sources Act (EEG) of 21 July 2004, the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) shall, in agreement with the Federal Ministry of Food, Agriculture and Consumer Protection (BMELV) and the Federal Ministry of Economics and Technology (BMWi), submit a progress report to the Bundestag on the Renewable Energy Sources Act by 31 December 2007 and subsequently every four years thereafter.

The present Progress Report describes not only the political parameters but also the progress achieved with renewables expansion, and the impacts of the Act itself. As well as addressing cross-sectoral aspects, it describes developments in the individual sectors and formulates policy recommendations on that basis, taking particular account of electricity production cost trends over recent years and desirable developments for the future. With the implementation of these policy recommendations as part of the forthcoming revision of the Renewable Energy Sources Act and through flanking measures outside the scope of the Act itself, the aim is to further optimise the expansion of renewable energies in the electricity sector.

The target set in the current Renewable Energy Sources Act is to increase the share of renewable energies in total electricity generation to at least 12.5% by 2010, with a minimum target of 20% for 2020. These targets must now be reviewed. The Act's revision must also take account of the European Council's decision in spring 2007, under the German Presidency, to set a binding target of a 20% share of renewable energies in overall EU energy consumption (electricity, heating and cooling, fuels) by 2020.

Development of renewable energies: Target for 2010 already reached

Since the Renewable Energy Sources Act entered into force in 2000, the share of renewables in primary energy consumption has more than doubled, from 2.6% in 2000 to around 5.8% in 2006; the same applies to the share of renewables in total final energy consumption, from 3.8% (2000) to around 8.0% (2006). The share of renewable energies in total gross electricity consumption has almost doubled, from 6.3% in 2000 to around 11.6% in 2006. A figure above 13% is forecast for 2007, which means that the expansion target set in the Renewable Energy Sources Act for 2010 will be exceeded as early as 2007.

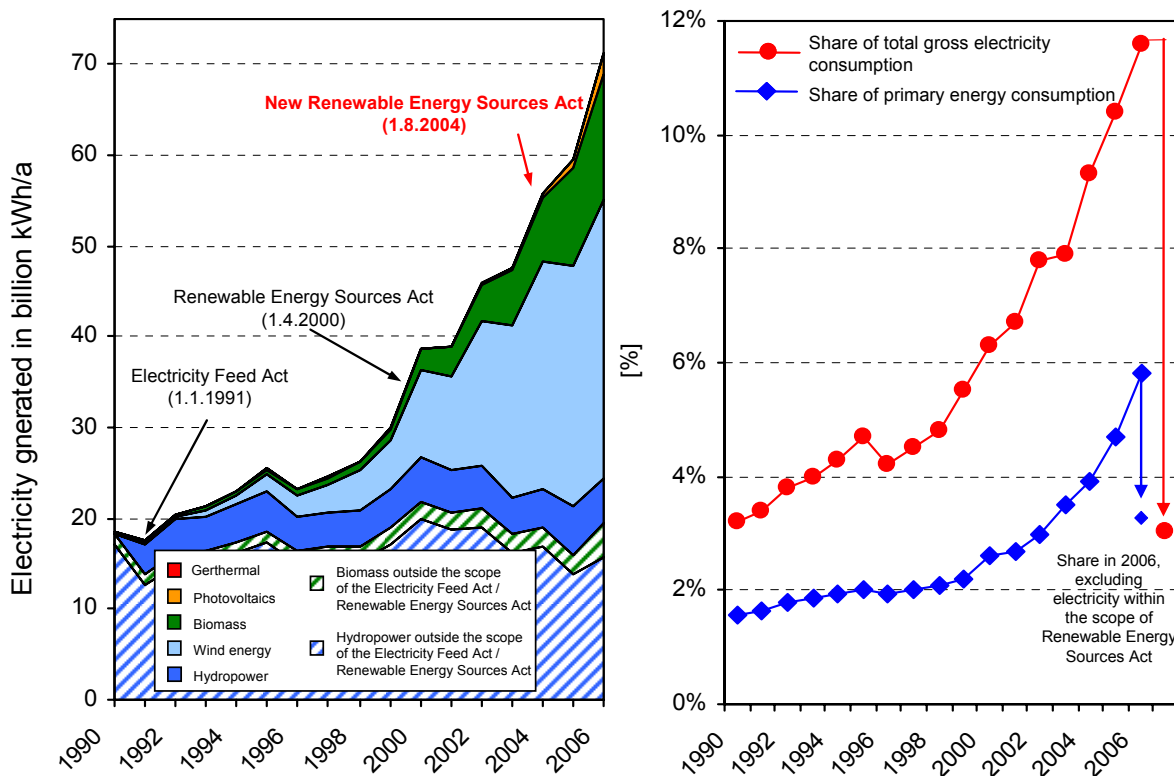


Fig. 1-1: Development of electricity production from renewable energies and their contribution to gross electricity consumption and primary energy consumption for the period 1990-2006 (calculated on the basis of the physical energy content method) [1]

In 2006, wind energy accounted for the largest share of renewables' contribution to gross electricity consumption with around 30.7 billion kWh, i.e. around 5%, followed by hydropower, which remained stable at around 20.7 billion kWh. Electricity generation from biomass (including biogenic waste) showed a strong upward trend, rising from around 8.0 billion kWh in 2004 to around 15.6 billion kWh in 2006, i.e. approximately 2.5% of gross electricity consumption. Electricity generation from photovoltaics increased almost fourfold from 0.6 billion kWh in 2004 to around 2.2 billion kWh in 2006, i.e. around 0.4% of gross electricity generation.

Table 1-1: Development of electricity generation from renewable energies and mine gas in 2006 which is remunerated under the Renewable Energy Sources Act (provisional data, in some cases estimated) [1, 2, 3, 4]

	Number of installed plants	Installed capacity (new construction 2006)	Electricity generated under the EEG (change against 2004)	CO ₂ reduction ⁷⁾	Remuneration paid under the EEG (change against 2004)	Volume of investment	Jobs, including areas falling outside the scope of the EEG
		[MW]	[in billion kWh]	[million t]	[€ million/a]	[€ billions]	
Hydropower (Article 6 EEG)	7,524 ¹⁾	4,700 (+ 20)	4.924 ²⁾ (+6.7%)	22.522	366.6 (+8.6%)	0.07	9,400 ⁸⁾
Landfill gas, sewage treatment plant gas, mine gas (Article 7 EEG)	770	598	2.789 (+7.7%)	3.303	195.6 (+7.4%)		
of which sewage treatment plant gas	290 ⁴⁾	123 ⁴⁾	0.270 (+1.1%)	0.966			
of which landfill gas	330 ⁴⁾	250 ⁴⁾	1.050 (+/- 0)	1.143			
of which mine gas	150	225 (-2) ⁵⁾	1.469 (+33.5%)	(1.194)			
Biomass (Article 8 EEG)	5,262	2,331 (+598.4)	10.9 ³⁾ (+108%)	12.796	1,337.4 (+163%)	1.35	64,000
of which solid biomass	162	1,094 (+76)	5.42 ³⁾ (+66.8%)	8.309			52,600
of which biogas	3,300	1,000 (+335)	4.17 (+208.7%)	3.412			10,600
of which liquid biomass	1,800	237 (+177.4)	1.314 (+1,606%)	1.075			800
Geothermal energy (Article 9 EEG)	1	0.2 (0)	0.0004	0	0.05		Approx. 50
Wind energy (Article 10 EEG)	18,685	20,622 (+2,224)	30.71 (+20.4%)	26.47	2,733.8 (+18.3%)	2.9	82,100
of which repowering		286.8 ⁶⁾ (+140)					
of which offshore	0	0	0	0			
Photovoltaics (Article 11 EEG)	approx. 200,000	2,831 (+950)	2.220 (+298.6%)	1.516	1,176.8 (+316%)	4.28	26,900
of which free-standing	171	187.6 (+74.6)					

¹⁾ plus approx. 155 plants producing electricity which is not remunerated under the EEG

²⁾ plus around 15,749 billion kWh of electricity generated from hydropower which is not remunerated under the EEG

³⁾ plus around 3.6 billion kWh of electricity from the biogenic share of waste and 1.1 billion kWh of electricity from other plants which is not remunerated under the EEG

⁴⁾ 2005 figures; more recent data not available

⁵⁾ In 2006, total installed capacity decreased for the first time.

⁶⁾ As recorded for the period 2003-2006.

⁷⁾ including electricity generated from renewables which is not remunerated under the EEG

⁸⁾ including jobs in those parts of the hydropower sector not receiving remuneration under the EEG

Impacts of the Renewable Energy Sources Act (EEG)

Environmental impacts

In 2006, carbon dioxide (CO₂) emissions were reduced by around 44 million tonnes through the promotion of renewables in the electricity sector (2005: 38 million tonnes of CO₂). No other instrument (e.g. the Act on Combined Heat and Power Generation, emissions trading, the ecological tax reform, the Market Incentive Programme for Renewable Energies, etc.) has resulted in similar CO₂ reductions.

The expansion of renewable energies also makes a contribution to nature conservation. Since 2004, the Act has contained specific provisions to ensure that the expansion of renewables is compatible with nature conservation. This Progress Report therefore also contains an environmental assessment of each of the renewable energy sectors to determine their impacts on nature and landscape.

Economic impacts

The Renewable Energy Sources Act continues to generate considerable impetus for innovation, domestic value added and employment. According to a recent analysis, domestic turnover from the installation and operation of renewable energy systems increased from € 18.1 billion in 2005 to around € 22.9 billion in 2006, with around € 14.2 billion of this being directly attributable to the Renewable Energy Sources Act. Exports will become increasingly important in future: in 2006, for example, the export share of the German wind energy sector was already above 70%, while that of the photovoltaics sector was around 30%.

This has been accompanied by a substantial increase in employment in the renewables industry. The number of people employed in all the renewable energy sectors rose from 160,000 in 2004 to around 236,000 in 2006. Around 134,000 of these jobs, i.e. almost 60%, were created as a result of the Renewable Energy Sources Act. In parallel to these positive employment effects, however, the renewables expansion has also had some negative impacts on jobs. From an economic perspective, this is due to the budget effect: the additional costs of promoting renewables under the Act at present reduce consumers' purchasing power and, as a knock-on effect, lead to lower demand for goods and therefore job losses in other sectors. However, it should be noted in this context that the overall balance is positive: there has been a net gain in employment, even taking into account the negative employment effects of renewables expansion. According to recent studies, the net employment effect in 2006 amounted to between 67,000 and 78,000 jobs [3].

Of these 134,000 jobs resulting from the Renewable Energy Sources Act, wind energy accounted for the major share, i.e. around 82,000 jobs, followed by photovoltaics with 27,000, 22,000 in bioenergy power generation, and around 3,000 in hydropower [3].

Other effects of the Renewable Energy Sources Act (EEG) are significant savings due to avoided energy imports (hard coal and gas imports for electricity generation), and, with conventional power being substituted by electricity from renewables, avoidance of environmental damage from CO₂ emissions and hence its resulting external costs.

**Table 1-2: Contribution of renewable energy sources to electricity generation in Germany
1990 – 2006 [2, 4]**

	Hydropower ¹⁾	Wind energy	Biomass ²⁾	Biogenic waste fraction ³⁾	Photovoltaics	Geothermal	Total electricity generation
	[GWh]	[GWh]	[GWh]	[GWh]	[GWh]	[GWh]	[GWh]
1990	17,000	40	222	1,200	1	0	18,463
1991	15,900	140	250	1,200	2	0	17,492
1992	18,600	230	295	1,250	3	0	20,378
1993	19,000	670	370	1,200	6	0	21,246
1994	20,200	940	570	1,300	8	0	23,018
1995	21,600	1,800	670	1,350	11	0	25,431
1996	18,800	2,200	853	1,350	16	0	23,219
1997	19,000	3,000	1,079	1,400	26	0	24,505
1998	19,000	4,489	1,642	1,750	32	0	26,913
1999	21,300	5,528	1,791	1,850	42	0	30,511
2000	24,936	7,550	2,279	1,850	64	0	36,679
2001	23,383	10,509	3,206	1,859	116	0	39,073
2002	23,824	15,786	4,017	1,945	188	0	45,760
2003	20,350	18,859	6,970	2,162	313	0	48,654
2004	21,000	25,509	8,347	2,116	557	0.2	57,529
2005	21,524	27,229	10,495	3,039	1,282	0.2	63,569
2006	20,673	30,710	13,987	3,639	2,220	0.4	71,230

1) In the case of pumped storage power plants, electricity generated from natural inflow only

2) Until 1998, only feed-in to the general supply grid; includes electricity generation from sewage treatment plant and landfill gas

3) Share of biogenic waste in incineration plants estimated at 50%

Without the support provided under the Renewable Energy Sources Act, renewable energies are still not price-competitive with conventional electricity generation, whereby wind power is closest to being competitive. Plant operators therefore continue to be reliant on the fees paid under the Act. The differential costs, among other things, are of relevance when evaluating the economic impact of the Act. These costs – amounting to around € 3.3 billion in 2006 – are the additional costs resulting from the total fee payments for renewable-generated electricity (€ 5.8 billion in 2006) as compared with energy supply companies' avoided costs of purchasing the conventional electricity that would have been required without the feed-in of electricity from renewable sources under the Act (€ 2.5 billion in 2006). The resultant surcharge payable for renewable-generated electricity was € 0.7 ct/kWh, which amounts to less than 4% of the average price of domestic electricity. The Renewable Energy Sources Act was responsible for around 13% of the electricity price increases for households in the period 2002-2006.

Table 1-3: Development of installed capacity for electricity generation from renewable energies, 1990 – 2006 [2, 4]

	Hydropower	Wind energy	Biomass ¹⁾	Photovoltaics	Geothermal	Total installed capacity
	[MW]	[MW]	[MW]	[MW _p]	[MW]	[MW]
1990	4,403	56	190	2	0	4,651
1991	4,403	98	No data	3	0	4,504
1992	4,374	167	227	6	0	4,774
1993	4,520	310	No data	9	0	4,839
1994	4,529	605	276	12	0	5,422
1995	4,521	1,094	No data	16	0	5,631
1996	4,563	1,547	358	24	0	6,492
1997	4,578	2,082	400	36	0	7,096
1998	4,601	2,875	409	45	0	7,930
1999	4,547	4,444	604	58	0	9,653
2000	4,572	6,112	664	100	0	11,448
2001	4,600	8,754	790	178	0	14,322
2002	4,620	11,965	952	258	0	17,795
2003	4,640	14,609	1,137	408	0	20,794
2004	4,660	16,629	1,550	1,018	0.2	23,857
2005	4,680	18,428	2,192	1,881	0.2	27,181
2006	4,700	20,622	2,740	2,831	0.2	30,893

The figures on installed capacity refer to the year-end status in each case – cumulative

1) Includes total installed capacity from sewage treatment plant and landfill gas plants

Besides the differential costs, various other costs arise as well, including the costs of control and balance energy, transmission system operators' transaction costs, and the additional costs of upgrading the grid, especially to accommodate regionally concentrated wind energy generation, and in future, the costs of connecting offshore wind farms to the electricity transmission grid.

Cross-sectoral aspects: Better grid integration

Due to the desired and expected further rapid expansion of renewables in the electricity sector, it is important to ensure that the total share of electricity from renewable energy sources can continue to be fed reliably into a secure transmission grid, and to facilitate maximum possible feed-in of electricity from renewable energy systems. Various recommendations are made in this Progress Report to reflect these considerations. For example, targeted feed-in management should be introduced so that in the event of grid bottlenecks occurring, only the power flow from those renewable energy plants which are causing the current grid problem is regulated. In order to achieve this, the grid system operator should be able to regulate by remote control all RE plants with a capacity of more than 100 kW. A hardship scheme should be considered for affected renewable energy plant operators. Besides better grid management, grid reinforcement and expansion by grid system operators, plant operators should also make a contribution to grid stability in future: through the delivery of system services at wind energy plants and the use of virtual power plants, load management and energy storage systems. The Progress Report therefore makes recommendations for a new approach to feed-in management and system integration.

It is also recommended that the principle of exclusive use of renewables be elaborated and made more flexible so that in future, electricity generated from a mix of renewable sources can be remunerated under the EEG without any problems. However, as at present, no fees should be payable under the Act for the generation of electricity from a mix of renewable and non-renewable sources in future.

Special equalisation scheme for energy-intensive companies

The special equalisation scheme established under Article 16 of the Renewable Energy Sources Act relieves much of the burden on particularly energy-intensive manufacturing companies and rail operators in the purchase of electricity paid for under the Act. Since entering into force in 2003, this Article has been amended on several occasions and the number of beneficiaries substantially increased, most recently at the end of 2006 with the first Act to amend the Renewable Energy Sources Act (01.12.2006). In 2006, a total of 327 companies, including 45 rail operators, benefited from these provisions, with € 420 million being apportioned under the equalisation scheme, which has generally proved its worth.

As part of the forthcoming revision of the Act, minor adjustments are proposed in relation to the application and processing procedures with the aim of improving the administration of the equalisation scheme. Further modifications should be considered in a review based on the experience gained during the first few years following the entry into force of the first amending Act (01.12.2006).

Hydropower: Harnessing existing potential

As the energy potential of hydropower has already been exploited to a relatively high degree, market trends have remained fairly stable in recent years. The contribution made by hydropower to electricity generation has stagnated at around 3.5% of Germany's gross electricity consumption. In recent years, a small amount of capacity has been added through new construction, reactivation and repowering, resulting in an additional 20 MW per year. The establishment of plants with a capacity of more than 5 MW is viewed positively, and three major projects have been initiated here. This will impact on installed capacity in the next two to three years and will result in an additional 0.7 billion kWh/p.a. of electricity generated from hydropower.

As investments in improving ecological status are generally not economically viable in the new construction of small-scale plants under the existing remuneration system, an increase in the remuneration rates from the present level of 9.67 ct/kWh to as much as 12.67 ct/kWh is recommended here. Moreover, the criteria relating to the improvement of ecological status should in future apply to hydropower plants in all capacity categories. For systems with a capacity of over 5 MW, abolition of the upper capacity limit, the cut-off date and the requirement for modernisation to result in an increase in the electrical energy of at least 15% is recommended. The remuneration period for hydropower plants should be 20 years, in line with the other renewables sectors.

Landfill gas, sewage gas, mine gas: Market largely saturated

The landfill and sewage treatment plant gas market and the mine gas market are well-developed in Germany. The inclusion of mine gas in the Renewable Energy Sources Act in 2000 triggered dynamic market development, but here too, increasing market saturation can be observed since 2005. In order to harness the remaining potential for power generation from landfill and mine gas, the remuneration rate for small-scale plants should be increased, while the rates of remuneration payable to large-scale mine gas plants should be reduced.

Biomass: A booming industry creating value in rural regions

Electricity from biomass (excluding landfill and sewage treatment plant gas) remunerated under the Renewable Energy Sources Act has shown dynamic growth since the new Act entered into force in 2004. Electricity generation has increased from 5.2 billion kWh in 2004 to around 10.9 billion kWh in 2006. This is due primarily to the strong increase in biogas systems, whose total electricity output almost quadrupled between 2004 and 2006 to 1000 MW_{el}. The main reason for this was the introduction of a bonus for the use of cultivated biomass (NawaRo bonus), which is currently claimed by around 60% of all biogas plants. The development of electricity generation from solid biomass, on the other hand, has been relatively stable since 2000, with total installed capacity of 1,100 MW_{el} at the end of 2006. Due to the incentive effects of the NawaRo, technology and CHP bonuses, there is a noticeable trend towards small- and medium-capacity plants up to and including 500 kW_{el}.

There has been a sharp increase in the installed capacity of small-scale cogeneration units which run on vegetable oil, from 12 MW_{el} in mid 2004 to 237 MW_{el} by the end of 2006. The smaller units generally run on rapeseed oil, while larger facilities are fuelled with palm oil. It is calculated that 340,000 tonnes of palm oil per annum are required to run the capacity installed at the end of 2006. In light of the fact that natural areas, including tropical forests, are being cleared to create palm oil plantations, this trend is viewed critically in terms of its environmental impacts. In order to counteract the growing use of biomass from non-sustainable sources, it is recommended that palm oil and soya oil be excluded from the NawaRo bonus scheme until an effective certification scheme to safeguard their sustainable cultivation is in place.

The Federal Government will also lobby at European level for the establishment of sustainability criteria for cultivated biomass. At the same time, the basis for authorisation should be introduced in the EEG for an ordinance to be enacted which defines the sustainability criteria for the cultivation of renewables.

Deficits can still be noted in the use of slurry and the utilisation of waste heat from biogas plants. Many opportunities to exploit the energy potential of these two areas still remain untapped.

It is recommended that the remuneration rates for plants with a capacity below 150 MW_{el} be increased by 1 ct/kWh. The NawaRo bonus for electricity generated from biogas (existing and new plants) with a capacity up to and including 500 MW_{el} should be increased by 1 ct to 7 ct/kWh, with a further 1 ct increase for electricity generated from biogas (existing and new plants) with a capacity up to 150 MW_{el} if at least at least 30% farm manure is used (percentage based on volume or mass). Furthermore, dry fermentation should be excluded from the technology bonus.

In order to provide more effective incentives for the utilisation of waste heat, it is recommended that the bonus for combined heat and power production (CHP bonus) be increased by 1 ct to 3 ct/kWh. It is also recommended that the NawaRo bonus for electricity generated by the burning of wood from landscape cultivation or short-rotation plantations be increased from 2.5 ct/kWh to 4 ct/kWh.

The annual degression in the remuneration rates for new plants, amounting to 1.5%, should be reduced slightly to 1% p.a. All bonuses in the biomass sector should be subject to degression of 1% p.a. from 2010.

Finally, the principle of exclusive use should be made more flexible for biogas plants using cultivated biomass: it should be possible for specific plant by-products which are not eligible for the NawaRo bonus to be used in conjunction with NawaRo biomass in future. This should be based on a positive list. However, the entitlement to the NawaRo bonus should apply solely to the replenishable share of inputs used to generate electricity from biogas.

Geothermal: Further support required for market development

There is still only one plant generating electricity from deep geothermal energy in operation in Germany, namely in Neustadt-Glewe (Mecklenburg-Western Pomerania). However, two other geothermal power plants – in Unterhaching and Landau – are close to completion. Around a dozen projects in the Upper Rhine valley and the Molasse Basin in Southern Germany have reached various stages in the development process. The interest in harnessing the substantial potential afforded by geothermal energy, which is entirely viable if the overall parameters are in place, is evident from the fact that by the end of 2006, 150 exploration licences had already been issued, 125 of them in Bavaria and Baden-Württemberg. The electricity production costs depend to a very substantial extent on the physical conditions on the ground. Furthermore, drilling costs in particular have increased substantially in recent years due to the strong increase in exploration activities in the oil and gas industries. The projects currently in development can only be implemented with additional research funding.

The Progress Report recommends a reduction in the number of capacity categories to just two, i.e. up to and including 10 MW_{el} and over 10 MW_{el}. The basic fee should be increased to 16 ct/kWh for capacities up to 10 MW_{el} and to 10.5 ct/kWh for capacities above 10 MW_{el}. It also recommends the introduction of a heat cogeneration bonus of 2 ct/kWh and a technology bonus of 2 ct/kWh for non-hydrothermal systems (e.g. Hot Dry Rock).

The creation of a fund to cover the exploration risk is also recommended, with special drilling risks to be partially covered by investment subsidies tied to certain conditions (and not exceeding 30% of the total drilling costs) through the Market Incentive Programme (MAP). The Progress Report also recommends increasing R&D funding.

Wind energy: Giving incentives for grid stabilisation and for onshore repowering, safeguarding the breakthrough offshore

Wind energy made by far the largest contribution to total gross electricity production from renewable energies in 2006 with 30.7 billion kWh. At the end of 2006, a total of 18,685 wind energy plants were in operation in Germany, with an installed capacity of 20,622 MW. However, a decrease in the installation of new wind turbines has been noted in recent years which can be attributed primarily to the limited availability of new sites. For that reason, repowering will in future be especially important for any further expansion of capacity; however, initial progress here has been very slow. The further expansion of onshore wind energy and repowering are severely impeded at present by administrative hurdles.

The Progress Report recommends providing greater incentives for repowering by reducing the requisite capacity increase from threefold to twofold (with a maximum limit of a fivefold increase) and making the rules applicable to all plants which have been in operation for more than 10 years. The Progress Report also recommends ensuring that enough suitable sites are made available for repowering and that development is not impeded by overzealous rules on spacing and height restrictions.

In view of the substantial increase in installed capacity in the onshore wind energy sector in recent years and the aim of continuing this development, it is essential that wind farms, too, contribute to grid stabilisation in future. The Progress Report therefore recommends that certain features of wind farms which can help enhance grid stability be made mandatory for all wind farms in future. It is important to determine whether, as a quid pro quo, the remuneration rate should be increased accordingly. The annual rate of depression should be set at a value between 1 and 2% p.a.

There is also major potential to harness offshore wind energy. In all, 18 licences for offshore wind farms, with a total capacity of 6,200 MW, have been granted to date in the area of Germany's exclusive economic zone in the North and Baltic Sea. As yet, however, none of the projects has been implemented. This is due in part to the lengthy licensing procedures for cable routes, but economic factors also play a role. The level of remuneration currently payable under the Renewable Energy Sources Act is judged to be inadequate for the majority of the planned projects.

From an ecological perspective, a special positive effect is that the provisions excluding wind farms from marine protected areas are proving effective, with no further applications having been lodged or licences granted for these areas.

For offshore wind farms, it is recommended that the remuneration rate for the first 12 years be increased from 8.74 to 11-15 ct/kWh, with a reduction in the rate of final fees from 5.95 to 3.5 ct/kWh. The option of postponing the start of depression to 1 January 2013, instead of 1 January 2008, and raising the rate of depression to 5–7% should also be considered.

Photovoltaics: Continuing the expansion of a major international industry, harnessing the potential for further cost cuts

The photovoltaic sector has undergone a period of booming expansion since 2004: with around 2,800 MW_p in 2006, total installed capacity has increased sevenfold compared with 2003. Due to this strong growth, Germany has become the world's most important market for photovoltaic systems, and more than € 1 billion has been invested in new production capacity along all stages of the value chain. Regions in East Germany continue to benefit particularly from this development. Exports are also developing positively, although the share of exports in photovoltaics is relatively low – around 30% – compared with other industrial sectors and there is clearly scope for expansion. Germany's photovoltaic production plant construction is now a world leader and German solar cell manufacturers were also able to increase their world market share very rapidly to more than 20% as early as 2005, despite rapidly expanding total volume in this segment.

Electricity production costs in the photovoltaics sector decreased by around 60% between 1991 and 2003, with the period 1999-2003 alone accounting for a drop of 25 percentage points. This also shows that the high rate of growth in photovoltaics has resulted in a decrease in manufacturing costs for photovoltaic modules. Due to the strong demand overhang and the intermittent shortage of silicon, however, these were not reflected in corresponding price cuts. Nonetheless, financial calculations show that the fees payable under the Renewable Energy Sources Act generally allow optimised photovoltaic systems to

operate economically and, with favourable framework conditions, higher profits can be achieved than calculated.

From an environmental perspective, the provisions on free-standing photovoltaic systems have proved their worth. However, the share of free-standing capacity currently stands at below 10%. Although around 50% of the areas used for this purpose are cropland, no adverse environmental impacts can be observed as these are extensively used sites which can also evolve into valuable wildlife habitats, e.g. for birds.

The Progress Report recommends a 1ct/kWh reduction in the basic rate of remuneration from 1.1.2009 for all photovoltaic systems. The degression for roof-mounted systems should be progressively increased from the current rate of 5% to 7% p. a. from 2009 and to 8% p. a. from 2011. For free-standing systems, the rate of degression should be increased from 6.5% at present to initially 7% (from 2009) and to 8% p. a. from 2011. The introduction of a new category for roof systems with a capacity of over 1000 kW_p and a reduction in the remuneration rate to 34.48 ct/kWh from 2009 is also recommended.

Further prospects: Continued expansion – more ambitious targets

The previous target – to increase the share of renewable energies in electricity generation to at least 12.5% by 2010 – will be exceeded as early as 2007 with an estimated figure of at least 13%. Furthermore, the EU's binding target of a 20% share of renewable energies in overall EU energy consumption (electricity, heating and cooling, fuels) by 2020 means that the national expansion targets must also be adapted accordingly. Current scenarios indicate that renewable energies can feasibly make a 25-30% contribution to gross electricity consumption in Germany by 2020.

Germany's national expansion targets for renewables should be adapted in line with the decisions taken at Meseberg on 23-24 August 2007. At its closed meeting in Meseberg, the Federal Cabinet agreed a future expansion target of 25-30% for renewable energies by 2020, to replace the current target of "at least 20%", with continued steady expansion after 2020. In the medium term, this increase will lead to a corresponding rise in differential costs.

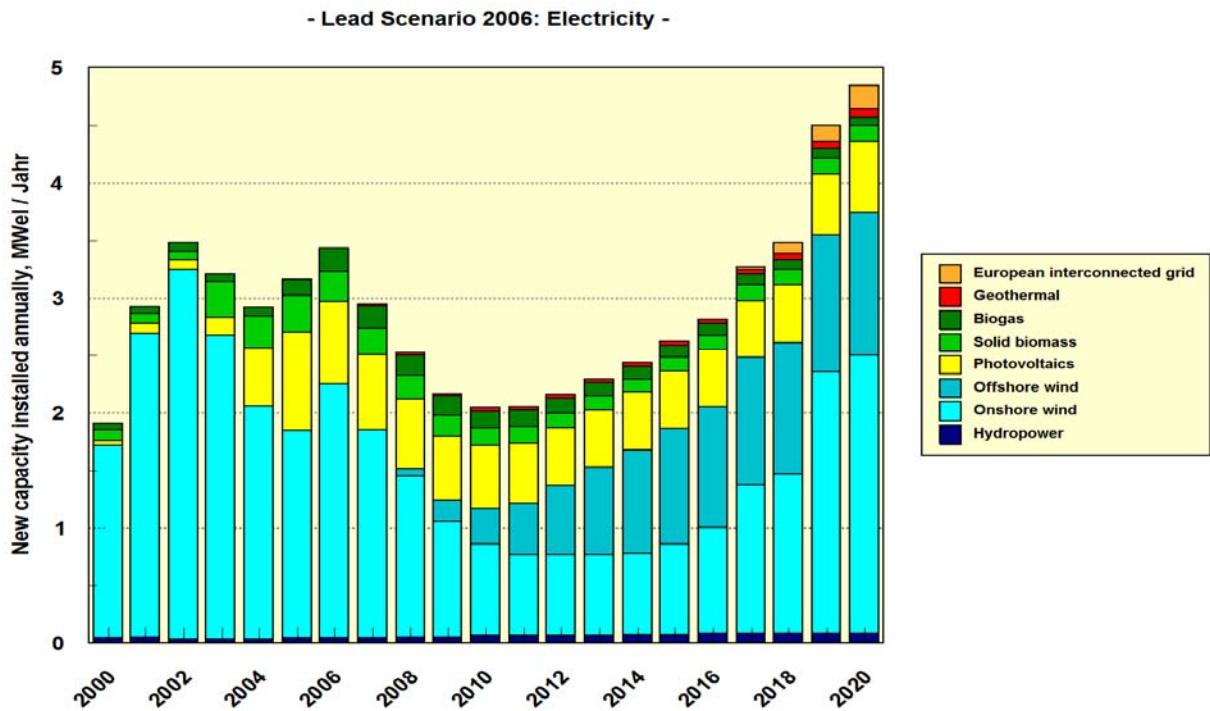


Fig. 1-2: Trends in new capacity installed annually for electricity generation from renewable energies for the period 2000-2020, based on the Lead Study prepared by the DLR Institute for Technical Thermodynamics [5]

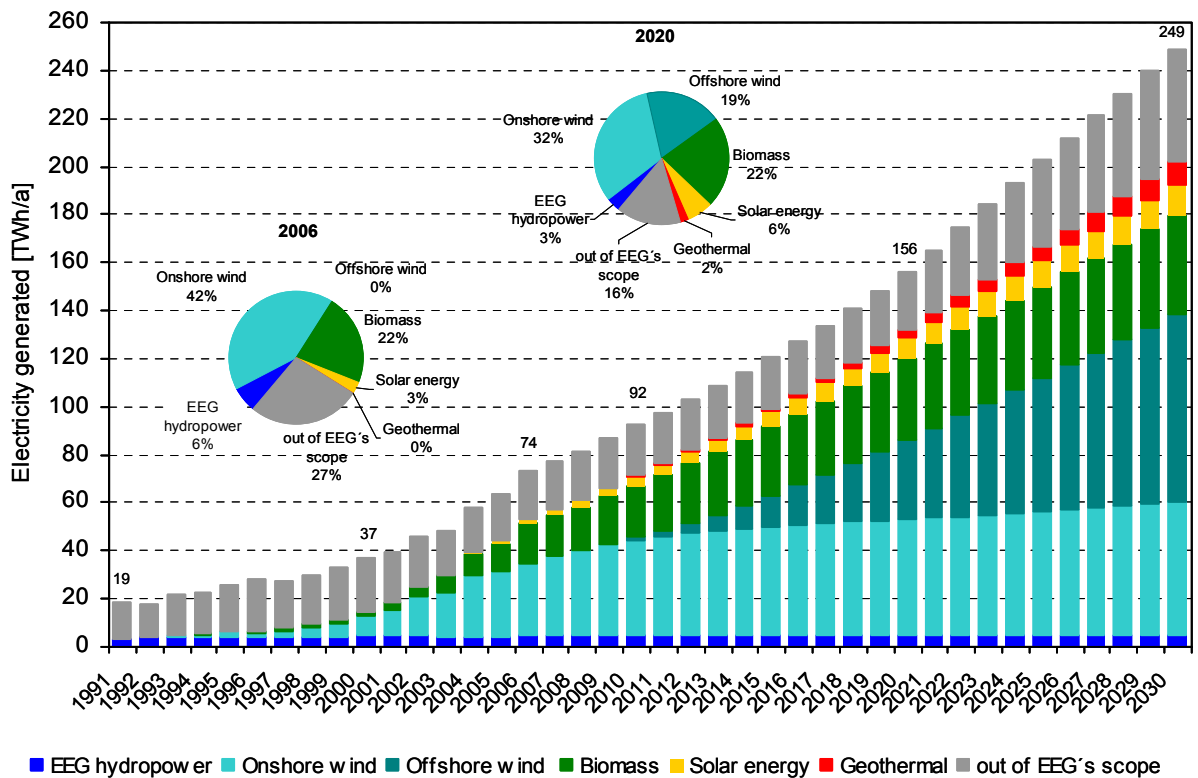


Figure 1-3: Trends in electricity generation from renewable energies 1991-2030, based on the Lead Study prepared by the DLR Institute for Technical Thermodynamics [5]

Key policy recommendations for the revision of the Renewable Energy Sources Act (EEG)

	Provisions within the scope of the Renewable Energy Sources Act Overview (effective as of 1.1.2009)	Flanking measures Overview
Cross-sectoral	<ul style="list-style-type: none"> • A uniform remuneration period of 20 years for all RE sectors • The principle of exclusive use to be elaborated, making payment of fees for electricity generated from a mix of renewable sources more straightforward • Clarification of the prohibition of multiple sale • Feed-in management to involve the use of all economically viable opportunities for grid optimisation using best available technologies • Mandatory use of technologically optimised feed-in management with the aim of safeguarding grid security at the lowest possible cost and maximum possible feed-in from RE plants • Obligation of RE plant operators to ensure that their systems can be regulated by remote control by the grid operator in the event of grid bottlenecks • Introduction of an appropriate hardship scheme for RE plant operators to be considered • Administration of the special equalisation scheme for energy-intensive enterprises to be improved 	
Hydropower	<ul style="list-style-type: none"> • Amendment of fee categories; an increase in the fees paid for plants with a capacity up to and including 5 MW, especially new plants • For systems with a capacity of over 5 MW: abolition of the cut-off date, the upper limit of 150 MW and the requirement for modernisation to result in an increase in the electrical energy of at least 15% • Appropriate modification of remuneration rates due to changed remuneration period 	<ul style="list-style-type: none"> • Development of a strategy to introduce an inter-plant remuneration system for the ecological modernisation of several plants within a single river basin district • Simplification of approval procedure under water law • Remuneration under the Act to be based on clear criteria laid out in the Renewable Energy Sources Act (EEG), Federal Water Act (WHG) and the Environmental Code (UGB)
Landfill gas, sewage gas and mine gas	<ul style="list-style-type: none"> • Increase in the remuneration rate for landfill gas plants with a capacity up to and including 500 kW_{el} • Reduction in fees for mine gas plants with a capacity above 1 MW_{el} • Amendment of capacity categories for mine gas plants to 0-1 MW_{el}, 1-5 MW_{el} and >5 MW_{el} Adaptation of remuneration rates as follows: capacity up to and including 1 MW_{el}: 7.16 ct/kWh (currently 7.16 / 6.16 ct/kWh) 	

	Provisions within the scope of the Renewable Energy Sources Act Overview (effective as of 1.1.2009)	Flanking measures Overview
Biomass	<ul style="list-style-type: none"> • Increase of 1 ct/kWh in basic rate of remuneration for new and existing facilities with a capacity up to and including 150 kW_{el} • Increase from 6 to 7 ct/kWh in NawaRo bonus for electricity from biomass (new and existing facilities) with a capacity up to and including 500 kW_{el} • In addition, increase of 1 ct/kWh in the NawaRo bonus for electricity from biogas (new and existing facilities) with a capacity up to and including 150 kW_{el}, if at least at least 30% farm manure is used • Increase in the NawaRo bonus for electricity generated by the burning of wood from landscape management or short-rotation plantations, from 2.5 ct/kWh to 4 ct/kWh for facilities with a capacity of 0.5-5 MW_{el} • Increase in the CHP bonus from 2 to 3 ct/kWh. • Reduction in the degressive rate of remuneration for new facilities from 1.5% to 1% p. a.; introduction of annual degression of 1% for all (previously non-degressive) biomass bonuses from 2010 • Exclusion of palm and soya oil from the NawaRo bonus scheme until an effective certification scheme to safeguard their sustainable cultivation is in place • The principle of exclusive use to be elaborated and made more flexible; use of certain plant by-products in systems using cultivated biomass; pro rata remuneration based on a positive list 	<ul style="list-style-type: none"> • Regular review and if necessary amendment of regulations concerning good practice in agriculture and forestry • Adoption of measures to reduce methane emissions from biogas facilities • The Federal Government to lobby at European level for the establishment of sustainability criteria for cultivated biomass. At the same time, the basis for authorisation to be introduced in the EEG for an ordinance which defines sustainability criteria for the cultivation of renewables. • Promotion of biogas microgrids via the Market Incentive Programme for Renewable Energies (MAP) / Joint Task of Improving Agricultural Structures and Coastal Protection (GAK) (or through inclusion in the technology bonus scheme).
Geothermal	<ul style="list-style-type: none"> • Reduction in the number of capacity categories from four to two, and increase in basic fees • Introduction of a heat cogeneration bonus of 2 ct/kWh • Introduction of a technology bonus of 2 ct/kWh for non-hydrothermal technologies 	<ul style="list-style-type: none"> • Provision of support for development of local district and district heating networks, to distribute the waste heat utilised, through other funding programmes • Creation of a fund to provide security for the exploration risk, with drilling risks being covered by investment subsidies through the MAP • Further R&D measures
Wind energy	<ul style="list-style-type: none"> • Setting the rate of degression for new onshore wind farms at 1 to 2% p. a. • Improvement of repowering incentive in Article 10 (2) • Increase in grid stability by improving the technical properties of onshore wind farms; appropriate remuneration to be considered • Improvement in fees paid to offshore wind farms under Article 10 (3) by increasing initial fees from 8.74 to 11-15 ct/kWh, with a decrease in the lower rate of remuneration from 5.95 ct/kWh to 3.5 ct/kWh 	<ul style="list-style-type: none"> • Development of a strategy for the utilisation of building planning law in order to boost repowering • Implementation of the strategy in dialogue with the federal states (<i>Länder</i>) with the aim of dismantling administrative obstacles at <i>Land</i> level • Assessment of how the interest of local communities in the establishment or renewal of wind farms (repowering) can be increased

Solar radiation	<ul style="list-style-type: none"> • Stepped increase in degressive rates to a standard 7% from 2009 and to 8% from 2011 • One-off reduction of 1ct/kWh in basic rate of remuneration from 1.1.2009 • Introduction of a new category for roof systems with a capacity of over 1000 kW_p and a reduction in the remuneration rate to 34.48 ct/kWh 	
Future prospects	<ul style="list-style-type: none"> • More ambitious targets to be set in the Renewable Energy Sources Act for the share of renewable energies in electricity generation <ul style="list-style-type: none"> - 25-30% by 2020, to replace the current target of "at least 20%", and - continued steady expansion after 2020 	

- [1] Zentrum für Sonnenenergie- und Wasserstoff-Forschung Baden-Württemberg (ZSW) / Bosch & Partner GmbH / Deutsche Windguard GmbH / Fichtner GmbH & Co. KG / Gentechnische Vereinigung-Service GmbH / Institut für ZukunftsEnergieSysteme gGmbH (IZES) / Internationales Wirtschaftsforum Regenerative Energien / Wuppertal Institut für Umwelt, Klima, Energie GmbH (WI): Vorbereitung und Begleitung bei der Erstellung eines Erfahrungsberichtes gemäß § 20 EEG. Im Auftrag des Bundesministeriums für Umwelt, Naturschutz und Reaktorsicherheit. November 2007.
- [2] Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (Hrsg.): Erneuerbare Energien in Zahlen – nationale und internationale Entwicklung. Berlin, Juni 2007.
- [3] Zentrum für Sonnenenergie- und Wasserstoff-Forschung Baden-Württemberg (ZSW) / Deutsches Zentrum für Luft- und Raumfahrt (DLR) / Deutsches Institut für Wirtschaftsforschung (DIW) / Gesellschaft für wirtschaftliche Strukturforshung (GWS): Erneuerbare Energien: Arbeitsplatzeffekte 2006. Abschlussbericht des Vorhabens „Wirkungen des Ausbaus der erneuerbaren Energien auf dem deutschen Arbeitsmarkt – Follow up“. Im Auftrag des Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit. September 2007.
- [4] Verband der Netzbetreiber e.V. (VDN): Erneuerbare-Energien-Gesetz (EEG) - Jahresabrechnung 2006 (auf Basis WP-Bescheinigungen). Im Internet: http://www.vdn-berlin.de/eeg_jahresabrechnung_2006.asp (Stand 17.Oktober 2007).
- [5] Nitsch, J / Deutsches Zentrum für Luft- und Raumfahrt (DLR), Institut für Technische Thermodynamik: „Leitstudie 2007“. Aktualisierung und Neubewertung der „Ausbaustrategie Erneuerbare Energien“ bis zu den Jahren 2020 und 2030 mit Ausblick bis 2050. Im Auftrag des Bundesministeriums für Umwelt, Naturschutz und Reaktorsicherheit. Februar 2007.

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