Gross employment from renewable energy in Germany in 2009 - a first estimate

Short- and long-term impacts of the expansion of renewable energy on the German labor market: third report on gross employment

Research project commissioned by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

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Introduction

For some years now there has been broad political consensus in Germany on renewable energy, which has enabled the development of a relatively stable market.. Against this backdrop a new industry has been able to establish itself, which is becoming more significant every year and has also notched up a number of major successes internationally.

2009 was a turbulent year for this industry, too. Although the amendment to the Renewable Energy Sources Act (German abbreviation: EEG) - which came into force at the beginning of the year – restored planning security the financial crisis made funding considerably more difficult particularly for large-scale projects. Added to this was the fact that the international markets at times underwent extreme fluctuations during the year which led some experts earlier in the year to assume a slowdown in worldwide RE expansion in 2009. However, recent findings in some sectors have concluded that – not least as a result of various government stimulus packages - the situation in 2009 was not as bad as originally feared. They indicate that the wind energy industry in particular once more enjoyed a record year.

Employment attributable to the renewable energy sector in Germany has continued to rise during the last couple of years. The 2008 version of this report [BMU09] estimated gross employment in the RE sector to be 278,000. Gross employment refers to the number of people employed directly in the manufacturing, operation or maintenance of renewable energy facilities or the supply of fuel for them, as well as to people indirectly employed as a result of the demand of these activities for supplies of goods and services. This current report updates these considerations and estimates and depicts gross employment for 2009. This is done in the context of an ongoing study commissioned by the Federal Environment Ministry (BMU) on the short- and long-term impacts of the expansion of renewable energy on the labor market.

Central to the calculations is the turnover of companies manufacturing renewable energy (RE) facilities in Germany. This turnover stands for domestic and international demand covered by domestic production. It is based on 2009 investments in Germany and estimates of the development of international trade. Based on this turnover, gross employment is determined using Input Output Analysis, taking the 2006 Input Output Table from the Department of Statistics [StaBu09]. The RE sector is represented by technology specific vectors derived from a survey with the base year 2004. Relevant benchmark data, such as the productivity of individual sectors, are adjusted as in the estimates from previous years [BMU06/BMU07a/BMU08/BMU09].

Employment from operations and maintenance of German installations is calculated similarly; employment from the supply of fuels is estimated.

Employment from the expansion of renewable energy ultimately includes the fields of research, public relations and promotion as well as public service. Since there has been a marked increase in research funding, these data have partly been updated in this report.

Employment provided by manufacture of renewable energy installations

First estimates based on data on new installations published by the Interministerial Working Group on Renewable Energies Statistics (AGEE-Stat) indicate that investments in renewable energy (RE) facilities in Germany amounted to about € 17.67 billion (cf. Figure 1) in 2009. This means that investments have once more reached a new high.

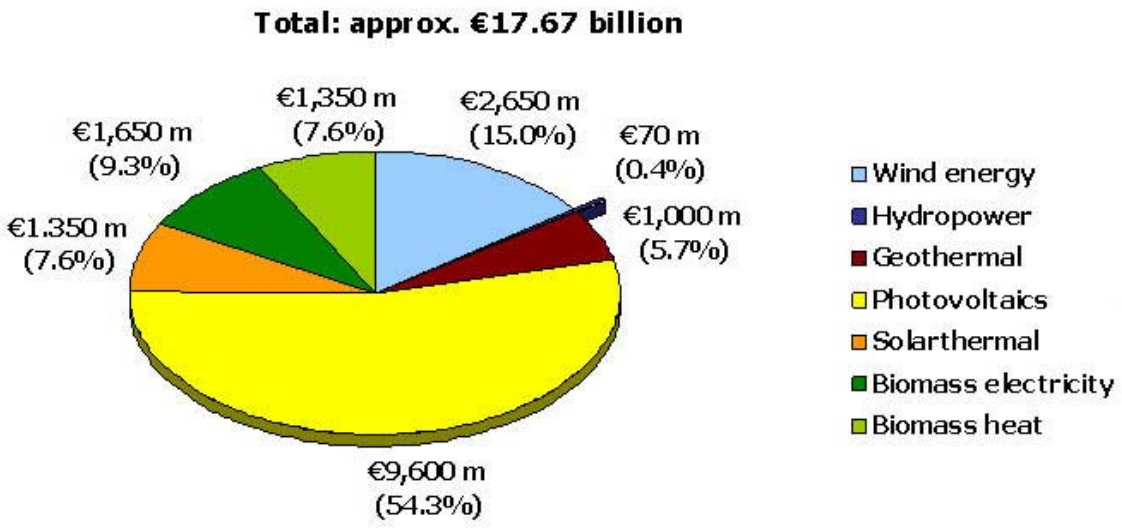

Figure 1: Investments in renewable energy installations in Germany in 2009 [ZSW10].

In 2009, the turnover of German based manufacturers of RE facilities also rose markedly, an initial estimate putting it at € 16.1 billion (cf. Figure 2), resulting in an increase of over 10 % since 2008. After a very poor year in 2008 the biogas sector was able to increase its turnover significantly in 2009. The same applied to companies manufacturing equipment for generating electricity from solid biomass. Increases in turnover were also observed in the wind energy and photovoltaic sectors. By con-

trast, the heat market suffered slight losses in sales.1 This was true for solar thermal systems, heat pumps and biomass. The greatest setback was felt by companies making stationary liquid biomass installations. There were no new installations of this kind in 2009, which had wide-ranging consequences for the overall turnover despite the relatively minor significance this technology had had to date. When comparing investment and turnover figures the overall trade balance shows net imports in 2009 for the first time since 2006, despite considerable export activities particularly from the wind industry. This is largely due to the steep rise in imports in the field of photovoltaics.[2]

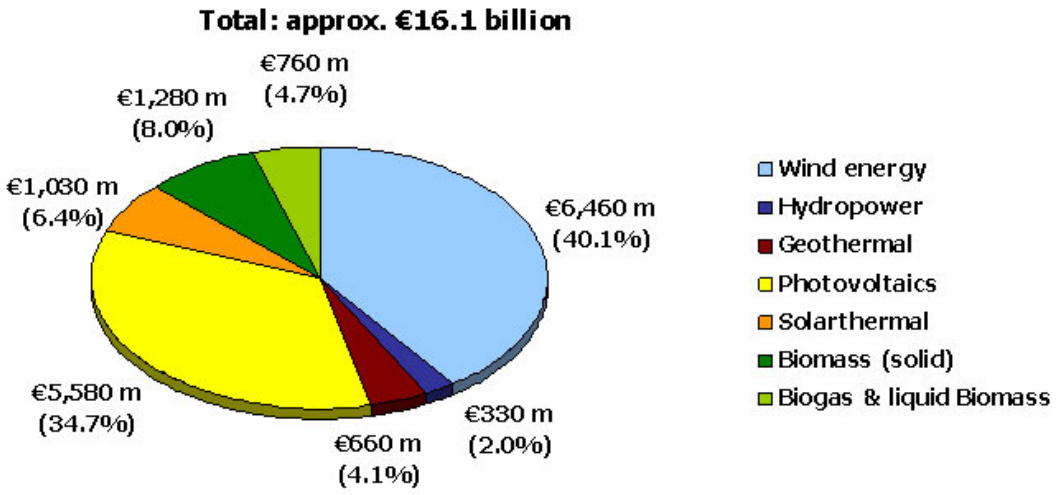

Figure 2: 2009 Turnover of German-based manufacturers of renewable energy installations.

Gross employment resulting from the manufacture of RE facilities in 2009 was roughly 183,800, amounting to an 8 % increase since 2008 (cf. Table 1).

[1] Allocation of funds to recipients of grants or loans under the market incentive programme takes place either before construction begins or after completion of the measure, depending on the particular funding program. It is therefore not possible to infer installation times from payment of funds. Considerable funding was available under the market incentive program in 2009; it was used to finance plant and equipment that was manufactured not only in 2009 but in 2008 or in 2010 as well.

[2] It is important to note here that all figures relating to investment and turnover are first provisional estimates, which will be updated over the course of this year in line with the latest state of knowledge.

Employment generated by the operation and maintenance of installations and by the supply of fuels

The relevant drivers of employment from operations and maintenance (O & M) of existing installations are the costs of operation (without fuel costs) that are calculated as a percentage of the investment costs. With growing installation numbers, employment in O & M becomes increasingly relevant. In 2009 it increased to 53,200 (cf. Table 1).

In the biomass sector employment from the supply of fuels has to be considered in addition to operations and maintenance for both transport and power. Last year employment rose to approximately 57,000. Table 1 shows that employment in the field of biomass supply for stationary use remained constant whereas employment in the biofuel for transport field witnessed an increase.

Breakdown of gross employment

Gross employment arising from the industry's activities in the field of renewable energy in 2009 amounted to about 294,000 jobs. Almost 68% (199,700) of jobs can be attributed to the **electricity generation section including CHP**. Similarly, about 22% (65,800) of jobs can be attributed to the installation and production of **heat generation** facilities while the remaining 10 % of jobs were in the **production of biofuels for transport field**.

The majority of these employment figures in the field of electricity generation facilities (193,000 jobs) can be ascribed to the impact of the Renewable Energy Sources Act. Of that total, 87,100 people work in the field of wind energy, followed by 64,600 in photovoltaics and 38,400 in electricity generation from biomass. The number of people working in hydropower amounted to about 2,300 while another 600 were employed in the geothermal sector. As described in the 2007 EEG-progress report, the number of jobs generated by the Renewable Energy Sources Act in 2006 was 134,000 of a total of 231,300 [BMU07b]. This means that the Renewable Energy Sources Act's relevance for trends in levels of gross employment rose from about 60 % in 2006 to 66 % in 2009.

Employment from public and non-commercial funds

Employment arising from the use of public and non-commercial funds for renewable energy in the fields of research and public relations along with jobs in the public sector itself were last analyzed in detail in 2006 and then estimated at 4,300 jobs. For

2007 and 2008, the 2006 employment figures were used since it was not possible to update all funding consistently. In 2009, the estimate of a portion of the funding provided by the federal ministries (this portion accounted for 53 % of the total effective funding in 2006) will be adjusted because since 2006 there has been a significant increase in the funds available. On this basis, it can be assumed that at least 6,500 jobs were funded through public funds in 2009.

Overall, the number of jobs directly or indirectly attributed to renewable energy can be estimated at 300,500 in 2009; this is an increase of almost 8 % since the previous year (cf. Table 1).

Table 1: Employment from Renewable Energy in Germany in 2009

	Jobs provided by investment (incl. export)	Jobs provided by maintenance & operation	Jobs provided by fuel supply activities	Total no. of jobs in 2009	Total no. of jobs in 2008
Wind	70,000	17,100		87,100	85,100
Photovoltaics	61,800	2,800		64,600	57,000
Solar thermal	12,900	2,100		15,000	17,400
Hydropower	4,700	4,300		9,000	9,300
Geothermal	8,500	800		9,300	9,100
Biomass	16,600	19,900		36,500	34,700
Biogas & liquid biomass	9,300	6,200		15,500	7,400
Biomass fuels for stationary use			28,500	28,500	28,500
Biofuel for transport			28,500	28,500	25,200
Total	**183,800**	**53,200**	**57,000**	**294,000**	**273,700**
Employment from the use of public and common use funds				6,500	4,300

	Jobs provided by investment (incl. export)	Jobs provided by maintenance & operation	Jobs provided by fuel supply activities	Total no. of jobs in 2009	Total no. of jobs in 2008
Total				**300,500**	**278,000**

Background information

In 2009, roughly 1,917 MW of new **wind energy** capacity were installed in Germany – equaling a 15% increase in new capacity since 2008. A special feature of 2009 was the building of Germany's first offshore wind park Alpha Ventus consisting of 12 turbines with a total capacity of 60 MW [DEWI10] supplied by two German based manufacturers. Worldwide, 2009 was another record-breaking year in terms of newly added wind capacity. Overall, 38,312 MW of new capacity were installed, representing an increase of almost 41% since 2008. In the lead here was China adding 13,800 MW, followed by the United States adding 9,922 MW and Spain adding 2,460 MW [WWEA10]. Germany, having steadily expanded its capacity for many years, ranked fourth in the world for the third consecutive year in terms of added capacity. Last year, companies in the wind sector with global operations once more concentrated on establishing and expanding their production locations in the growth markets of the United States and China. In order to estimate turnover figures for the German industry we therefore assumed that in terms of volume exports in 2009 remained more or less constant at the very high level of the previous year. A total turnover of € 6.46 billion is estimated for 2009, representing an 8.6 % increase since 2008, primarily due to domestic installations in Germany. When we take operation and maintenance as well as higher labor productivity into account we arrive at a total amount of 87,100 jobs in the wind sector in 2009.

Last year proved to be particularly turbulent for the **photovoltaic** sector. The collapse of the Spanish market combined with an end to the shortage on the silicon market and an unabated expansion of production capacity in Asia brought about a marked drop in the price of PV modules. As a result, capacity installations in Germany got off to a very slow start in 2009 but then picked up sharply. A total of 3 GW of capacity was added in Germany which was 58 % more than the year before. However, it cannot be concluded that employment in this sector rose to the same extent. In 2009, production of PV modules in Germany increased by about 24 % since 2008, while the production of PV cells increased by about 13% [Photon10]. This clearly shows that the rising demand for new installations was to a great extent met by products from abroad. It is assumed that the installation work itself along with other services was mainly carried out by German companies. This means that the increase in installed capacity did, nevertheless, have a direct influence on employment. Overall, the sales

revenue of German manufacturers in this sector is estimated to have been about € 5.58 billion, an increase of roughly 7 % since 2008. It is important to note in this context that there was also a serious fall in prices of about 30%. These lower prices squeezed companies' profit margins, and their impact was taken into account when estimating employment figures. Taking operation and maintenance into consideration, we calculated an increase in employment levels at 64,600 jobs.

In 2009, the German solar thermal energy market witnessed a slight downturn compared to the previous year. At the same time, initial estimates indicate that the European market fell by about 20% [Sarasin09]. This resulted in German companies suffering a slowdown in sales not only in the domestic market but also in their export markets. For that reason, the sector's turnover in 2009 has been estimated at about € 1.03 billion, representing an 11% drop. Nevertheless, the industry is preparing for the future, which – particularly last year – was reflected in a move to step up automated production in Germany [SWW09a]. Taking operation and maintenance into account, this meant a total of 15,000 jobs in the sector in 2009.

As in previous years, no major changes were observed in the **hydropower** sector. Gross employment here totaled about 9,000 jobs in 2009, which, due to an increase in labor productivity compared to last year, represented a slight decrease.

In the field of **geothermal energy,** investment dropped very slightly in 2009 compared to the previous year. The reason for this was an almost 8 % decrease in demand for heat pumps. By contrast, investment in deep geothermal facilities remained stable. Nevertheless, we believe that the German industry was able to maintain its position and that there was a consequential fall in employment only in the field of installation. The rise in numbers of jobs connected with operation and maintenance was able to offset this fall and a slight increase in numbers of people employed in the geothermal sector is assumed: 9,300 in 2009, compared with 9,100 in 2008.

Following the distinct slump in investment in **biomass** installations in 2008 (-22%), 2009 saw a marked increase of about 60%. This meant that investment in biomass installations reached a new high. However, a positive trend was not observed in all areas of biomass use. There was a drop of about 13% in investment in biomass heat applications. Furthermore, the market for stationary plants that use liquid biomass had disappeared completely. On the other hand, investment in installations for producing electricity from biomass triggered by the amendment to the Renewable Energy Sources Act had increased considerably. In particular, the expansion of biogas installations had, as expected, experienced a steep upturn. In fact, the level of expansion in 2005 – a record year – was almost achieved. However, in terms of turnover, the industry performed far better in 2009 since the relative importance of domestic value added was much higher in 2009 compared to 2005. Overall, it is important to note that the estimate of employment in the biogas sector could be slightly overesti-

mated. Since a number of projects were put on hold in the second half of 2008 in anticipation of better funding conditions under the amendment to the Renewable Energy Sources Act, it can be assumed that they had to a great extent already been prepared in 2008 and that their realization and the associated investment were not taken into account when calculating employment until 2009. Overall, we assume that about 52,000 people were employed in manufacturing and operating biomass installations in 2009.

In connection with **supplying biomass for stationary use,** 28,500 people were directly or indirectly employed in 2009, maintaining the level of the previous year.

Overall sales of **biofuels for transport** dropped slightly in 2009 compared with 2008. Sales revenue from pure fuels witnessed a drop whereas biofuels under the statutory quota system showed a marked increase. The use of bioethanol in particular had risen by a significant 44%. However, for employment in this sector the decisive factor is not sales but production. Bioethanol production increased by 28% to about 591,000 tons and the agricultural land used to grow rapeseed or starch/sugar [BDBe10] for biofuel production was 6% greater in 2009 than in 2008 [FNR10]. Figures for 2008 significantly underestimated biodiesel production in Germany, meaning that in retrospect the employment attributed to the sector for 2008 was too low. Data for biodiesel production in 2009 is not available yet. However, based on production in 2008, we have assumed that production was in the order of magnitude of domestic sales. A more precise investigation and more detailed description of the situation in the biofuel sector and in biomass supply in Germany will be carried out in the final report for the overall project.

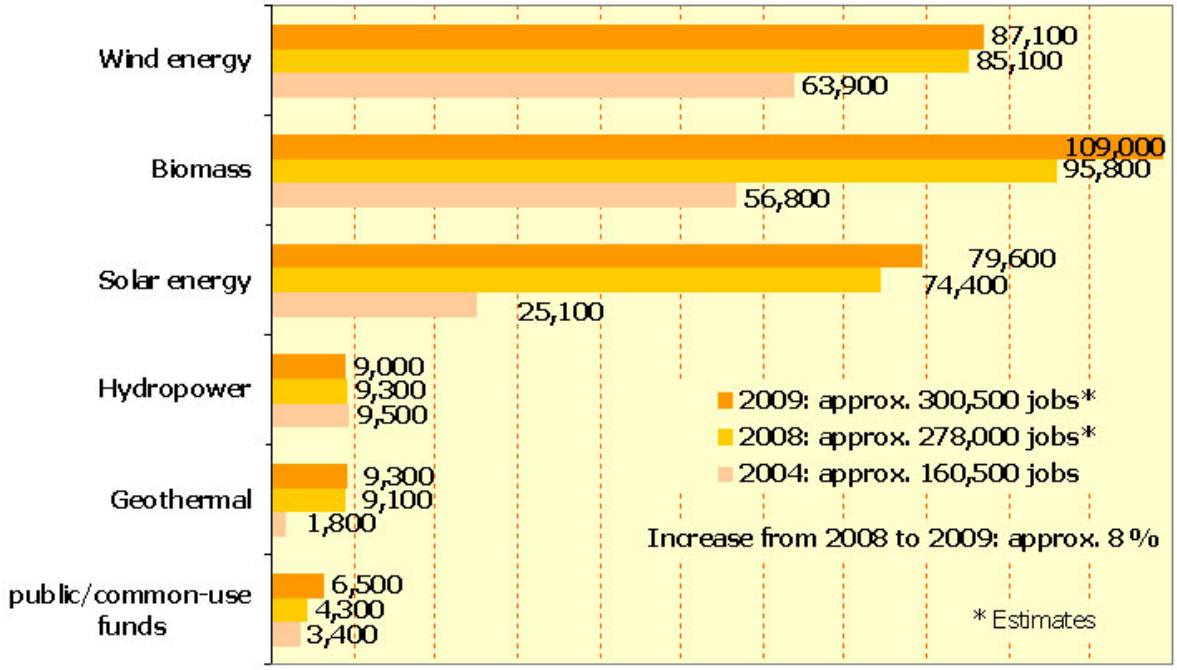

Figure 3: Development of Gross Employment from Renewable Energy in Germany

This initial estimate therefore puts the gross employment figure from renewable energy in 2009 at about 300,500, representing an 8% increase since 2008 (cf. Figure 3). At about 36%, the biomass sector continues to provide the majority of jobs, followed by wind energy at about 29%. In third place is solar energy, which contributes over 26% to gross employment, followed by geothermal and hydropower at 3% each. Jobs that were created by the provision of public- and private-sector funding for research and administration amounted to about 2% of gross employment.

It is important to note one more thing concerning the relevance of domestic markets for the development of domestic industry. In 2009, this link was clearly visible in Spain, China and Great Britain. In Spain, the collapse of the photovoltaic market in 2009 led to factory shutdowns or production being suspended; this produced a marked drop in employment levels [SWW09b]. China also felt the effects of the collapse of the Spanish market. Since China had virtually no domestic market for PV systems that could have offset the collapse of the Spanish market it saw shutdowns in the first half of 2009 with a clear impact on employment levels. At the beginning of 2010, China introduced a feed-in tariff for PV systems [SWW10]; whether this change in policy was directly connected to the realization that the domestic market is indeed a stabilizing factor remains a moot question. In the wind energy sector, Vestas made the headlines: the company closed down its two production sites in Scotland – a country with plenty supply of wind – and transferred its production to the United States [SWW09c] partly because of the lack of political support for an expansion of onshore wind energy.

Again, we would like to point out that – as in previous years – the employment figures for 2009 are first estimates. Over the course of this year, the values for 2007, 2008 and 2009 will be re-calculated. Firstly, further data regarding newly installed capacity and the investment in Germany associated with it will be made available. Secondly, the sector-specific input-output vectors will be updated on the basis of the latest corporate data, which are currently still based on a survey from 2004. Furthermore, a detailed analysis of the fuel for stationary use and biofuel for transport will be conducted, along with a study of key regions for renewable energies. A first cautious estimate of jobs created in Eastern Germany shows an increase to about 69,000 (for comparison: just over 62,000 in 2008). In the field of photovoltaics, direct employment in Eastern Germany was rising since that is where most of the installations were produced. However, indirect employment along the value chain lags behind this increase, partly because the upstream goods and services are still purchased in Germany’s traditional industrial regions and partly because the states in the South of Germany still have the highest number of installed PV systems. In the wind energy sector, employment increased slightly as the share of new installations in the Eastern German states remained constant at 41% in 2009 [DEWI10]. The expansion in biogas installations is especially visible in Eastern Germany, which is why the greatest percentage rise in employment is seen there. The other sectors remained virtually unchanged.

The renewable energies sector: stable throughout the crisis

In 2009, the German economy shrank for the first time in six years – it did so to considerable extent [StaBu10]. The 5% fall in GDP in real terms made this the worst recession of the post-war era. The global dimensions of the crisis have meant that those sectors that in former years drove economic growth – especially the export-oriented sectors - were hit particularly hard. Exports in Germany fell for the first time since 1993 to well below the level of the previous year (-14.7%). At the beginning of 2009, orders in the engineering sector were almost 20% down from 2005 levels, while in January 2008 they were almost 50% above 2005 levels. Orders from within the Euro-zone suffered a particular serious slump. Turnover in the engineering sector fluctuated between -20% and -30% from month and the average fluctuation for the year was -24%. In comparison to other countries, Germany countered falls in sales revenue with short-time working, “working time accounts” (allowing overtime to be “banked” and used later to offset short-time working or temporary shutdowns) and other measures to safeguard jobs. As a result labor productivity, measured as the gross domestic product per worker adjusted for price changes, decreased by almost 5% on average. In some sectors productivity was 15% lower than in 2008.

Overall, investment in Germany slumped severely during the crisis; gross investment in real terms was 12.5% down from 2008 levels.

The 20% rise in investment in renewable energy installations and the industry’s 10% increase in turnover must be seen against this background. Similarly, the potentially negative influence of the financial crisis on financing for renewable energy projects in 2009 did not materialize to any significant extent. Worldwide installation of renewable energy plants and equipment became more dynamic in individual areas, partly because it was a component of government stimulus packages. As a result, trends in German exports on the whole remained steady and in some cases even experienced slight increases.

Manufacturers of renewable energy facilities - facing growing demand - were not on the whole affected by the fall in labor productivity. However, it is conceivable that their suppliers who also manufacture products for other sectors did suffer a slump of this kind. In calculating employment from renewable energy, we initially assumed a normal productivity trend for suppliers based on previous years. However, we did a sensitivity calculation to examine what employment levels in the supply industry could have been if they too had been hit by a slump in demand triggered by the recession. If the fall in labor productivity per worker, as calculated by the Federal Statistical Office, had amounted to an average of 5%, there would have been an additional 9,000 jobs from indirect effects. If we assume a drop of 15% in the manufacturing industry and a drop of 1.5% in the other sectors, 10,000 additional jobs could have been

created. Since such a recession induced drop in labor productivity was completely left out of our estimation of overall gross employment our estimate of 300,500 jobs can be classed as conservative in this regard.

While the rise in crude oil prices that continued until mid-2008 was followed by a fall in prices at the end of the year, prices for other commodities did not begin to fall significantly until the first few months of 2009. Both trends stabilized at a markedly lower level than the previous year. That, on the one hand, caused manufacturing costs for renewable energy installations to fall while, on the other hand, the relative costs of heat and electricity production rose by comparison with fossil energy sources. It remains to be seen how commodity prices will develop in 2010.

Overall, renewable energy has remained stable throughout the crisis. It has become clear that both domestic demand and foreign markets have contributed to the stability experienced by domestic industry. We can also continue to assume that it will be possible to generate at least 400,000 jobs in Germany in the renewable energies sector by 2020 [BMU06]. Within the overall project, an ongoing long-term study of gross employment will be conducted, taking into consideration new insights with regard to global opportunities for development and with regard to German foreign trade. This study will also include an in-depth analysis of future trends in net employment.

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