

March 2006

Solar Energy in Germany

Under the Red-Green government in Germany, solar energy has become a major area of interest for future energy strategy. The present paper is based on information and data published by the German solar energy business and describes central economic and energy aspects of the development of solar power in Germany in the last years.

1. The case for solar energy: energy reserves are becoming scarce, with imports rising

The economy, consumers and the public purse are suffering increasingly from rising energy prices. The cause: energy reserves are becoming scarce. Known oil reserves will last only 46 years, and gas reserves only 66. With consumption levels remaining constant, Uranium will last 49 years at the most.¹ Yet the International Energy Agency expects that annual demand for energy will rise by 59% by 2030.² This will result in the time span of available supplies decreasing even further. The problem is exacerbated by the growing hunger for energy in Asia and the increasing dependence on the crisis-ridden regions of the Near East, where the largest deposits of oil and gas exist.

Germany's demand for energy is met by imports of up to 74%.³ In the European Union, the share of imports will rise from 50% at the end of the 1990s to 70% in 2020.⁴ This perilous dependence can only be solved in the long term by renewables, supply of which is virtually limitless and the costs of which are continually falling.

Exploding energy prices herald scarcity

Long before the ultimate demise of oil and gas, valuable fuel will become scarce. When the reserves have been about half-exploited, extraction rates will drop unavoidably. Experts expect that even before 2010 the extraction maximum (peak oil) will be overstepped. Despite state-of-the-art extraction technology, the quantity of oil and gas extracted will decrease year by year.⁵

Rising demand with diminishing supply is forcing prices skywards. Crude-oil prices have exploded and have tripled since January 2002 to over \$67 a barrel. Even the oil companies are

Sources

¹ BMU, The Turning Point for Energy and Renewables, July 2005

² IEA, World Energy Outlook, 2004

³ BMWA, Energy Data, August 2005

⁴ EU Commission, "Towards a European strategy for the security of energy supply", 2000

⁵ ASPO, www.peakoil.net

aware of the critical trend, and CHEVRON writes in advertisements: "The world consumes two barrels of oil for every new barrel discovered."⁶ Consumers are clearly aware of the greater expense, with the price of heating oil having risen by 69% since January 2004. During this year, the value of all energy imports hit a new record at EUR 53 billion – to the detriment of business and employment.

Renewable energy secures supply

Whilst around ten percent of power supply is covered by renewable energy in Germany thanks to the law on feeding power to the national grid (1990) and the renewable energy sources act (2000), the proportion of renewable energy for heating stands at only four percent. For increased use of bio-energy, geothermal- and solar heat, there is as ever a dearth of statutory provisions that allow investment to be made in favour of modern energy technology and that safeguard this. In this respect, there is an urgent need to update policy.

2. Market data on solar heat and photovoltaic technology in Germany

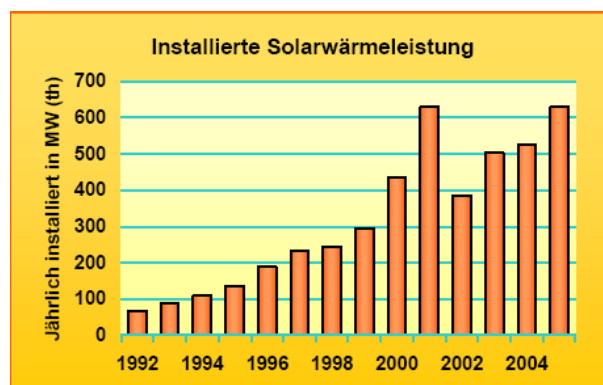
Solar heat (solar heating systems)

Solar heating systems are utilised principally for heating drinking water, heating houses, though also for producing steam or for powering refrigerating machines. In Germany, solar collectors have been used for thirty years. Since the beginning of the 1990s the market has experienced vigorous growth. With its 47% share, Germany today is the largest solar heating market.

The German solar heating sector is a worldwide leader with highly developed systems. In addition to the small- to medium-sized producers of solar power systems, those also providing solar power systems are the heating industry and construction companies such as roof-tile and roof-window manufacturers and façade companies. A growing number of component manufacturers supply all over the world.

Use of solar heat is being promoted by the market-stimulation programme of the German environment ministry. For plants that heat drinking water, investors obtain a subsidy of EUR 135 per square metre of collector area. This is about 15% of the investment outlay.

The solar heat sector employs about 10,000 staff throughout Germany in the production of components and plant, marketing and installation of solar heating systems, achieving a turnover of EUR 550 million in 2004.



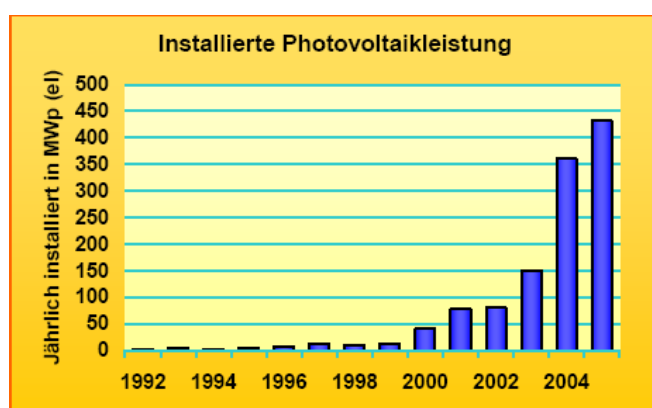
Heat output from installed solar-power plants Installed per annum in MW (th)

⁶ Chevron, www.willyoujoinus.com

Solar power (photovoltaic technology)

Solar power systems have been used for satellites since the 1950s. Following significant price reductions they have been used since the 1970s at ground level. At the beginning of the 1990s, what was proven in the 1,000-roof scheme was that operation of numerous solar power systems in the power grid is completely problem-free. Since the start of the 100,000-roof scheme in 1999 and of the renewable energy sources act (EEG) coming into force in April 2000, the market for solar power has experienced vigorous growth in Germany. In 2003, the 100,000-roof scheme terminated, which allocated credit for solar power systems at favourable rates of interest. Since 2004, they are promoted only with increased compensation as part of the renewable energy sources act, with no more subsidies from the federal budget.

Through the government's market-launch policy, supported by the CDU/CSU, a modern and forward-looking industry was able to develop. Over forty companies produce solar power components at all stages of the production chain. A number of companies are listed on the stock-exchange (*Börse*) and are among the top companies worldwide. The solar power sector employs 20,000 people in Germany, achieving a turnover of EUR 1.7 billion in 2004.



Installed photovoltaic output 1992 – 2004 Installed per annum in MWp (e)

Due to the sustained market-launch policy, Germany has turned into the leading market in solar systems. Photovoltaic technology is currently growing more strongly than solar heat. Market growth has led to the development of a highly dynamic solar-power industry, with 30,000 jobs and turnover of EUR 2 billion in 2004.

3. Solar energy as a driving force for employment

Turnover for the solar power sector in 2005: EUR 2.7 billion

Development in the solar technology market is highly dynamic, and is increasingly becoming a factor in the economy. Over the last five years, the turnover of the German solar power sector has increased by an average of 43% per annum. A turnover of EUR 2.7 billion is expected in the sector for 2005.

The solar-power sector today: 30,000 jobs

The solar-power sector, still in its prime, is effectively a driving force for job-creation. Over 30,000 people are today employed in production, distribution and installation of solar systems (in photovoltaic technology: 20,000; solar heat: 10,000). In the past year alone, 5,000 new jobs were created the booming photovoltaic-technology sector. This is how there will soon be almost as many employed in this sector as in hard-coal mining in Germany.

What makes solar power a driving force for job-creation is the very high proportion of added value of approx. 80% at domestic level compared with conventional energy, together with the high proportion of small- to medium-sized businesses and manual labour. Solar power has enormous growth potential – in Germany and worldwide. German manufacturers have earned a peak position on the international stage in terms of technology. The significance of exports grows continually. Under a suitable regulatory framework, associations involved with solar power are counting on a total of 200,000 jobs over the next fifteen years in Germany.

Renewable energy: 130,000 jobs today

Today already, renewable energy provides employment for 130,000 people in the sectors of wind, water, biomass, geothermal energy, solar heating and solar power. This engages more people than in nuclear energy, hard coal and brown coal put together.⁷ These are splendid prospects: by 2020 it is expected that 500,000 people will be employed in renewables.⁸ This sector achieved a turnover of EUR 11.5 billion in 2004. Of this, EUR 6.5 billion has been invested in new plant for the generation of power, heat and fuels. Renewables make up a highly influential programme for growth, and by 2020 investments totalling EUR 200 billion are expected.²

4. When will solar power become competitive?

From 2018, solar power will be cheaper than conventional power

The German renewable energy sources act envisages a reduction of 5-6.5% per annum in refunds for solar power fed into the grid. The average price of one kilowatt-hour (kWh) of solar power will decrease nominally at 5% per annum from 49 cents today to 23 cents in 2020.

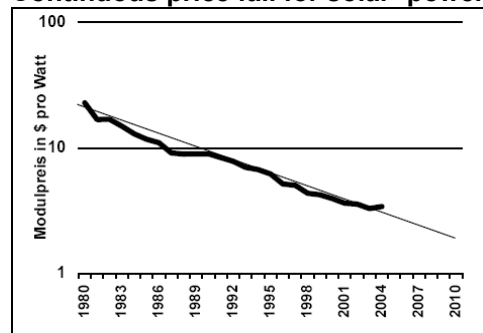
Conventional power on the other hand will become dearer. At a minor increase of 2.5% per annum, the price of power will rise for the private consumer from 19.6 cents/kWh today to 28 cents/kWh in 2020. This way, solar power for the private customer will be cheaper from 2018 than obtaining conventional power.

Solar power systems today are more than 60% cheaper than 1990

The theory of the learning curve shows that every doubling of photovoltaic output leads to a 20% fall in price. This has also been confirmed in Germany: since 1990 the price of photovoltaic systems has fallen over 60% from EUR 13,500 to about EUR 5,000 today. Between 1999 and 2003, the fall in price was 25% in the 100,000-roofs scheme.

By way of international comparison, prices of solar power modules show a continual downward trend. However, further price decreases are only possible if mass-production undergoes further expansion, with thorough research and development in progress at the same time.

Continuous price fall for solar- power systems



(Price of module in \$ per Watt)

Sources

⁷ BMWA, German Nuclear Forum, Society for Nuclear Technology, IGBCE, DEBRIV

⁸ www.unendlich-viel-energie.de, Essen Declaration (Website translation: 'limitless energy')

Solar power systems achieve a 6.5% return

In Germany, almost all solar power systems are linked to the power grid, and feed the generated solar power into the grid. Producers receive a fixed refund over twenty years for this, depending on the size of the system and the installation.

As a result of the guaranteed refund over twenty years, the system operator achieves an annual return which covers his risk. Because large systems are cheaper per unit of power than small systems, lower levels of refund are given for these. In central and northern Germany, the power yield is somewhat lower than in southern Germany, resulting in lower returns.

Typical data of a solar-power system on a private house

Size of plant: 2 kilowatts (kW), 20 m² module area

Price: approx. EUR 5,000 per kW

Power yield: approx. 950 kWh per kW in southern Germany

Refund for feeding power to grid: 54.53 cents/kWh = EUR 518 per annum per kW

Period of refunds: 20 years

Returns: approx. 6.5% per annum with all costs taken into consideration

Being in its prime, photovoltaic technology still has an enormous potential for cost cutting. However, this can only be achieved if the quantities produced continue to rise sharply, and there is thorough research and development in parallel to this. Prices are falling continuously, and bear testimony to the correlation between market- and price trends.

General Data Solar Market Germany 2004

	Solar heat (Solar heating system)	Photovoltaic technology (Solar power)
Amount of power generated	2.3 TWh	1.0 TWh
Power from newly installed plants	525 MW(th)	360 MW (el)
Cell area newly installed	750,000 m ²	3,300,000 m ²
Total cell area installed	5,770,000 m ²	6,900,000 m ²
Number of newly installed systems	83,000	40,000
Turnover	550 Mio €	1.7 bn €
Jobs	10,000	20,000
Market growth	+ 5%	>100%
Market growth for 2005 (forecast)	+ 20%	+20%

Sources:

1. Versorgungssicherheit ohne Solarenergie in Gefahr
2. Marktdaten Solarwärme und Photovoltaik
3. Jobmotor Solarenergie
4. Wann wird Solarstrom wettbewerbsfähig?

All: Bundesverband Solarindustrie
Stralauer Platz 34
10243 Berlin
<http://www.bsi-solar.de/>