



Renewable Energy Policy Review

Germany

May 2004



European Renewable Energy Council
26, rue du Trone
B-1000 Brussels

Tel.: (+32) 2 546 1936
Fax: (+32) 2 546 1934
www.erec-renewables.org
erec@erec-renewables.org

GERMANY

1. General information Population and geography

The Federal Republic of Germany is situated in the heart of Europe. It has nine neighbors: Denmark in the north, the Netherlands, Belgium, Luxembourg and France in the west, Switzerland and Austria in the south, and the Czech Republic as well as Poland in the east. The Federal Republic of Germany covers an area of about 357,000 square kilometers. The furthest distance from north to south as the crow flies is 876 kilometers, from west to east 640 kilometers. The total length of the country's borders is 3,758 kilometers. Germany has a population of about 83 million, the largest in Europe after the Russian Federation, followed by the United Kingdom and France.

Table 1: Bundesländer population

Federal states	Population	Capital
Baden-Wuerttemberg	10.37	Stuttgart
Bavaria	12.04	Munich
Berlin	3.45	Berlin
Brandenburg	2.55	Potsdam
Bremen	0.68	Bremen
Hamburg	1.71	Hamburg
Hessen	6.03	Wiesbaden
Lower Saxony	7.82	Hanover
Mecklenburg-Vorpommern	1.82	Schwerin
North Rhine-Westphalia	17.95	Duesseldorf
Rhineland-Palatinate	4	Mainz
Saarland	1.08	Saarbruecken
Saxony	4.55	Dresden
Saxony-Anhalt	2.72	Magdeburg
Schleswig-Holstein	2.74	Kiel
Thuringia	2.49	Erfurt

Source: Statistisches Bundesamt

The German constitutional state is based on the following principles: Germany is a republic and a democracy; it is a federal state based on the rule of constitutional law and social justice. The head of state is the elected Federal President. Germany became a member of the European Union in 1957.

Germany is a Federal Republic comprised of 16 States (*Länder*). The national (or federal) level decides on the general legislative framework through the constitution, the "Basic Law" (*Grundgesetz*) as well as national laws and acts. The states may take up national laws and acts and develop them further, as long as they do not contradict the national law. Communities also have legislative power through the instrument of decrees.

Public responsibility has been apportioned in such a way that law-making is actually predominantly in the hands of the central state, the Federation, whereas the states are primarily responsible for administration, in other words, implementation of the laws. The significance of this separation of powers is that the power of the state is qualified by mutual checks and balances. It thus protects the individual's freedom.

The Federal Republic of Germany is one of the major industrial countries. In terms of overall economic performance it is the third largest, and with regard to world trade it holds second place. In 1999, the gross domestic product (GDP), that is to say, the value of all finished goods produced and services in the course of a year, came to a record DM 3,8771.1 billion in Germany. Statistically speaking, this amounts to DM 107,400 per gainfully employed person. The aim of the Federal Government has been and continues to be to strengthen competition and provide more efficient services for the people.

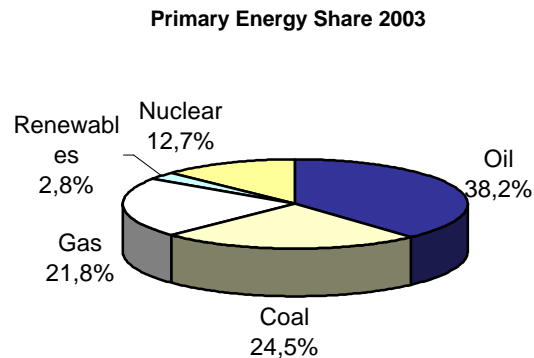
2. Renewable Energy Policy

Energy and Renewable energy country profile

Country Profile

Population	83	Millions
Area	357,021	km ²
Total Primary Energy Supply	343.100	Mtoe
Electricity Production	581.582	TWh
Electricity Prod. by source		
Fossil Fuel	63.56	%
Hydro	4.28	%
Nuclear	29.46	%
Other Renew	2.71	%

Source: CIA World Factbook 2001
Sources EUROSTAT 2002



Source: EUROSTAT

Germany has limited domestic fossil-fuel resources and therefore relies on imports to meet its energy needs. In 2001, gross imports accounted for 64% of Germany's total primary energy consumption. Oil accounted for 41% of domestic German energy consumption in 2001, followed by natural gas (23%), coal (23%), and nuclear power (11%). (source EIA country analysis briefs Germany sept. 2003) (to replace following paragraph?)

In 2000, the government set a goal to double the proportion of renewable energy sources by 2010. In the context of the EU's burden sharing arrangements, Germany has committed itself to reducing its average emissions of greenhouse gases by 21 per cent between 2008 and 2012 compared with their 1990 levels and implement a reduction of CO₂ emissions by 25% of 1990 levels by 2005) (source EIA country analysis briefs Germany sept. 2003)

Renewable Energy Sources

Renewable energy country profile

Renewable energy technology in 2003 in capacity

Germany	
SPV (MWc)	
Grid connected	375,00
Off grid	22,60
Total	397,60
STH (square meter installed)	4.263.000 m ²
Average surface for 1000 (2001 figure)	52 m ²
SHP (2001 figure)	1 421 MW
Biogaz (Mtep) (2002 figure)	659
Wood (Mtep) (2002 figure)	8.00
Wind (MW)	14609

Source Euroserv'ER 2003/ Sun in Action 2/EWEA

The unification of Germany has resulted in a bipolar energy economy. The western part has a highly diversified energy base, while the eastern part is almost entirely fossil fuel-dependent. More than half of the electricity generated in Germany comes from coal. A further 30 % of Germany's electricity is produced by nuclear energy. An increasing quantity of Germany's electricity is produced from natural gas, the greatest growth of natural gas (increasing at over 5% per annum) comes from domestic demand. Natural gas accounted for 23% of Germany's primary energy consumption in 2001, compared to less than 10% in 1980. In 2001, Russia provided 42% of Germany's natural gas imports, the Netherlands 26%, Norway 25%, the United Kingdom 4% and Denmark 3%. (source EIA country analysis briefs Germany sept. 2003)

Renewable energy contributed 3,5% of Germany's total energy supply and 8% of total electricity supply in 2003 compared to EU averages of 5,8% and 15.5% respectively. (IEA Renewables Information 2003)

Biomass

The general conditions for the use of biomass as a renewable source of energy have been clearly improved through the EEG Act, the Biomass Regulation, the market incentives programme promoting renewable energy, and the loan programme of the credit institutions (KfW, DtA) and have led to a notable expansion of bio-energy. The promotion of research and development has made a significant contribution to developing new, innovative technologies.

On 27 June 2001, the Federal Government's Biomass Regulation entered into force, laying the foundations for generating electricity not harmful to the climate from sustainable raw materials and biogenic residues and waste. The use of biomass in Germany has considerable potential for growth. At the end of 2002, biomass contributed about 3.4% to heat generation and about 0.8% to gross electricity production. The long-term potential corresponds to an approximate 10% share in power supply and about 20% in heat supply. Whether and to what extent this potential can be realised will largely depend on how soon the various techniques for biomass utilisation become competitive. At the end of 2002, there were about 100 operational biomass heating plants in Germany with an electricity output of about 400 MW. At the end of 2002, there were about 1 900 biogas installations in the country with an electricity output of about 250 MW, i.e. more than 3 times as many biogas installations as at the end of 1999. (source Part I Report from the Federal Republic of Germany on reaching the target for the consumption of electricity from renewable energy sources in 2010 - Report from the Federal Republic of Germany in accordance with Article 3(3) of Directive 2001/77/EC of the European Parliament and of the Council of 27 September 2001 on the promotion of electricity produced from renewable energy sources in the internal electricity market Berlin October 2003)

In Germany a large amount of wood (energy crops and forestry waste) is used for the production of heat and electricity. Primary energy production from wood came to 5.0 Mtoe in 2000. Gross annual production of biogas in 2000 was 525 ktoe. From all biogas resources, agricultural biogas has shown the greatest growth in Germany. In 2000, 400 new installations of this type went into operation.

Wind

To date, the growth in wind capacity and generation in Germany has been the success story of increased renewable energy use in the world over this decade. The newly installed capacity in the wind sector stood at 4.500 MW by mid 2002. After a massive growth of 8.700 MW by the end of 2001, the total installed capacity had reached 11.900 MW by the end of 2002 (source Richtziel der Bundesrepublik Deutschland für den Verbrauch von Strom aus erneubaren Energiequellen im Jahr 2010 und Massnahmen zur Verwirklichung des Richtziels page9 A further increase to 14.609 MW by the end of 2003. (source EWEA) Germany produces over one-third of electricity from wind power worldwide and about half that in the EU. In 2002, wind power contributed about 16.5 TWh (i.e. 3%) to electricity production in Germany. In 2002, about 3250 MW were installed and in 2001 about 2650 MW. In the first half of 2003, 536 new wind energy installations were set up in Germany, with a total output of 835 MW. Thus, 14 283 wind energy installations with a total output of 12 828 MW are now operating throughout Germany. This corresponds to an approximate 7% increase over 2002. Overall, there is a shift from the coast to areas further inland. During the first half of 2003, most wind energy installations were set up in Brandenburg, North Rhine-Westphalia, Sachsen-Anhalt and Sachsen. The EEG Act has made a decisive contribution to this success. The amendment of the Building Code (BauGB) in 1998 was an additional important factor for expanding wind energy, under which wind energy installations in undesignated outlying areas are now given priority. With favourable general conditions continuing, installed land-based wind energy output can be further expanded in Germany. In the near future, old, small wind installations will be renewed or replaced by more modern and more powerful ones (repowering). While ten years ago state-of-the-art wind energy installations were in the 100 KW class, nowadays standalone installations of 1.5 MW upwards are at the same location capable of producing 20 times as much electricity a year.

In this way, repowering can unleash a huge additional wind energy potential. As the use of land-based wind energy is limited, the Federal Government proposed in January 2002 a strategy for offshore wind energy production in the framework of its strategy for sustainable energy. To this end, potentially suitable areas and areas eligible for wind farms have been identified in the German economic exclusion zone (EEZ) in the North Sea and the Baltic. The legal framework for the formal designation of special suitable areas and of protected areas within the EEZ was established with the adoption of the new Federal Nature Protection Act of 25 March 2002. In the framework of the offshore wind energy strategy, it will under current conditions be possible in the areas currently deemed available to attain a total output of at least 500 MW in the start-up phase and up to 2006, and in the medium term - up to 2010 - about 2 000 to 3 000 MW output. In the long term - i.e. up to 2025 or 2030 – once the system has proved cost effective, it will be possible to achieve an installed output of about 20 000 to 25 000 MW. For this purpose, it is necessary that investors in offshore wind farms and the electricity sector create the conditions for the transport of power generated offshore in this order of magnitude. This level of use of offshore wind energy would account for 15% of electricity consumption in Germany, in relation to the reference year 1998. Overall it will make it possible for land-based and offshore wind energy to contribute 25% to total energy production in a period of about 25 years.

Solar

In recent years there has been a rapid development of electricity generation from solar energy in Germany. However, in 2002 its contribution to overall electricity production was relatively minor at around 180 million kWh, i.e. 0.03%. Installation of about 62 MWp has become possible through the loan committed in the first half of 2003 by the *Kreditanstalt für Wiederaufbau* [credit institution for reconstruction] under the programme for solar energy for 100 000 rooftops. While in 2002 facilities with a total output of about 80 MWp were installed.

(source Part I Report from the Federal Republic of Germany on reaching the target for the consumption of electricity from renewable energy sources in 2010 - Report from the Federal Republic of Germany in accordance with Article 3(3) of Directive 2001/77/EC of the European Parliament and of the Council of 27 September 2001 on the promotion of electricity produced from renewable energy sources in the internal electricity market Berlin October 2003)

Solar PV

Electricity from PV plants, that have come into operation since the end of 2001, receive a payment of 50.62 Eurocent/kWh. For plants that came into operation throughout 2002, receive a payment of 48.1 Eurocent/kWh. Until now PV has had the least part in electricity production but it is now exhibiting the highest growth rate of all renewable energies. (source Richtziel der Bundesrepublik Deutschland für den Verbrauch von Strom aus erneubaren Energiequellen im Jahr 2010 und Massnahmen zur Verwirklichung des Richtziels page7)

Renewable Energy Law (with a valuable feed-in tariff for PV) and the “100,000 Rooftops Solar Power Programme (1999- 2003)” have been important drivers for the growth of the German PV market. The introduction of this programme and the entering into force of the EEG renewables act, saw installed PV capacity rise from 67 MWp in 1999 to 111 MWp in 2000. A further 67 MWp was attributable to the “1000 Roofs Programme” in 2001 (same source)and offers loans on favourable terms to support this goal. Between 1997 and 2000, the total installed capacity increased from 41.9 MW up to 113.8 MW. In the year 2000, 44.3 MW of PV capacity was installed. Most of the PV capacity is grid-connected (88 % in 2000) and there is a trend towards an increasing average size of PV plants.

Solar Thermal

After a strong increase up to the beginning of the eighties, the market went down and stabilised at a low level. Only a few small companies continued to work on solar thermal systems and improved the technique involved. Since the end of the eighties the market has risen continuously due to increased environmental awareness and the improved solar thermal systems now available. In the period from 1995 to 2001 the German solar thermal market showed furthermore a very good development. The demand for solar thermal systems rose by an average of 30% per year. There were three main reasons for this market success. First the public awareness of solar energy and therefore the interest in the use of solar thermal increased . the government strengthened subsidies for solar thermal systems. Third the solar branch – with established solar companies and several new companies – worked very hard to build up the market and to activate plumbers to sell and install solar systems. In 2002 the market dropped by about 40% for several reasons. The consumption in general decreased due to the uncertainty of the public because of the new Euro, the terrorism of 11 September 2001, the general elections and the increasing economic problems of Germany. In addition, the amount of subsidies was reduced in March and July 2001. At the beginning of 2003 the amount of subsidies increased and the interest in solar thermal systems is growing again.

(source Sun in Action 2)

The "Solarthermie 2000" programme ran from 1993-2002 and aims for 10,000 m² of installed collector surface, for the provision of hot water in small and large scale systems for a cost of between DM 0.2-0.3 per kWh_{th}. The

technical potential of such systems has been estimated at 130 ktoe/year by 2000 and up to 50 Mtoe/year in the longer term.

Germany is the European leader in terms of total installed solar collector area, with a total of 3.3 m² in 2000. The German market has undergone considerable growth due to an effective campaign for promotion of solar thermal energy. Between 2000 and 2001, the growth rate was 46 %.

Hydro

Hydro power accounted for the majority of total renewable electricity consumption, standing at 4.4% of total electricity production in 2001, generating 19.800 Mio. KWh (according to the VDEW/Verband der Elektrizitätswirtschaft source Richtziel der Bundesrepublik Deutschland für den Verbrauch von Strom aus erneubaren Energiequellen im Jahr 2010 und Massnahmen zur Verwirklichung des Richtziels page11)

Currently hydropower in Germany accounts for just over half of electricity production from renewable sources of energy. In 2002, it contributed about 24 TWh or about 4% to electricity supply. Initial, provisional figures suggest that installed output has remained more or less the same. According to information provided by the *Arbeitsgemeinschaft Energiebilanzen* [Energy Balance Association], electricity production from hydropower in the first half of 2003 is about 13% below that of the previous year due to regional and seasonal fluctuations in water flow in the first half of 2003. While in recent years the number of major installations remained virtually constant, the StrEG Act introduced in 1991 and the EEG Act which entered into force in 2000 have given an impetus to smaller hydropower plants.

(source Part I Report from the Federal Republic of Germany on reaching the target for the consumption of electricity from renewable energy sources in 2010 - Report from the Federal Republic of Germany in accordance with Article 3(3) of Directive 2001/77/EC of the European Parliament and of the Council of 27 September 2001 on the promotion of electricity produced from renewable energy sources in the internal electricity market Berlin October 2003)

Geothermal

Geothermal energy makes use of heat that is present in deep strata inside the earth. In Germany, there are currently 34 major heat extraction plants with a thermal output of about 88 MW. Each year they supply about 1 050 GWh of heat. There are plans for constructing additional plants in the next few years. In the field of geothermal electricity generation, there is still a need for research, development, demonstration and marketing. Consequently, geothermal energy is promoted in the R&D framework and through demonstration measures as well as through the market introduction programme for renewable energy and under the EEG Act. Moreover, through its *Zukunfts- Investitions-Programms (ZIP)* [Future Investment Programme], the Federal Government supports research, development and demonstration of future-oriented forms of energy. For a three-year period (2001-2003), an overall additional amount of €150 million is earmarked under this programme. The emphasis is on geothermal energy generation, solar thermal power plants and ecological supportive research in other sectors of renewable energy, in particular wind energy and biomass. Geothermal energy is available around the clock and can be regulated according to actual need at any time. Accordingly, geothermal power plants can make a significant contribution to basis heat and electricity supply.

(source Part I Report from the Federal Republic of Germany on reaching the target for the consumption of electricity from renewable energy sources in 2010 - Report from the Federal Republic of Germany in accordance with Article 3(3) of Directive 2001/77/EC of the European Parliament and of the Council of 27 September 2001 on the promotion of electricity produced from renewable energy sources in the internal electricity market Berlin October 2003)

RE Policy Outlook

Targets/Strategy/Climate change

German energy policy continues to be characterised by efforts to reconcile political, economic and environmental objectives. The Chancellor's declaration in April 1995 to reduce CO₂ emissions by 25% by the year 2005 relative to 1990 has resulted in a range of policies and measures for renewable energy promotion. Perhaps the most effective renewable energy promotional policy to date has been the *Electricity Feed Law (EFL)*, which is at the heart of renewables promotion and guarantees a market for renewable electricity at very favourable buy-back rates. Other government promotional policies include economic incentives for increased use of solar and biofuels, R&D programmes, favourable treatment of renewables in building codes and information and training. Green pricing (a private initiative) is available in some parts of Germany. As the German government and administration are organized in accordance to the federal structure of the country, federal, regional and local authorities are promoting the use of renewable energy sources in many different programs.

The programmes can be described as follows:

- The **Federal Ministry of Economics and Technology (BMWi)** supported the application of renewable energy technologies with around €1/2 billion in the period 1999-2003. In addition there will be another €1/2 billion for the 100.000 Roofs-PV-Programme between 1999 and 2004.

- The **Federal States** (Länder) have defined their own programmes, mainly to support the application of renewable energy and energy conservation.
- The **Federal German Environmental Foundation** (DBU, established in 1990) supports development and demonstration in the field of renewable energy sources and energy conservation with about DM 15 million annually.
- Since 1991 the "**Electricity Feed Law**" **has been** regulating the input and favourable payment of electricity from renewable energies by the utilities. In 2000 the law was replaced by the "**Renewable Energy Law (EEG)**"
- A number of **utilities** have launched initiatives to build demonstration and pilot systems or to provide advice and information.

The federal government is responsible for regulating the energy sectors through the "Act on the Supply of Electricity and Gas" - Energy Industry Act (*Energiewirtschaftsgesetz*) which was amended in November 1997 and came into force in April 1998. The act aims at a supply of electricity and gas via supply lines that is as secure, low-cost and environmentally compatible as possible in the interest of society as a whole. The amendment approved on 28 November 1997 regulates the linkage of the Energy Industry Law and the Electricity Feed-In Law in a so-called Article-Law (*Artikelgesetz*). The community owned power supply companies will buy and "deliver" the electricity which a customer within the company's service area has purchased from a supply company outside this customer's service area. Furthermore, the amendment maintains the present feed-in tariffs and a 5 % cap for RES. This means that after reaching 5 % of electricity fed-in from RES (of the annual over-all turn-over of electricity from one power supply company) the grid operator has to re-imburse the additional costs thereof to the power supply company. After the national elections of September 1998 the new government of SPD and Bündnis 90/Die Grünen (the Greens) under Chancellor Schröder has announced to amend the Electricity Feed-In Law once again in order to delete some of the disadvantages of the 1997 version. The Environmental policy and regulation takes place on the national, state and local level.

Electricity

The RES-E Directive sets the national indicative target for the share of gross electricity consumption to be met from renewable energy sources at 12,5% in 2010;

The main financial promotion and stimulation instrument for electricity produced from renewable energy sources (RES) on the national level is the "Act on the Supply of Electricity Generated from RES into the Public Grid" - Electricity Feed-In Law (*Stromeinspeisungsgesetz*) which first came into effect in 1991. This requires utilities to buy renewable electricity generated from third parties at prices between 65-90% of consumer electricity prices. These high buy-back rates have made renewable electricity generation a commercially attractive option, and has led to a significant increase in renewable electricity generation and capacity since the EFL's introduction in 1990. Since April 2000, the new government introduced a new Renewable Energy Law (REL), or Erneuerbare-Energien-Gesetz (EEG), that is in place and replaces the EFL. With the introduction of this law the real success story for renewables in Germany began. With The overall objective of the law is to contribute towards doubling the share of renewable energy in the electricity market from 5 to 10% by 2010. It is important to mention that this objective is fully in line with the targets set in the European Commission's 1997 Renewable Energy White Paper. The REL deals with the purchase of, and compensation to be paid for electricity generated exclusively from hydrodynamic power, wind energy, solar radiation energy, geothermal energy, gas from sanitary landfills, sewage treatment plants, mines or biomass. This law is not the only one to participate in the RES development in Germany but it is the only one exclusively created to this purpose.

Electricity market

The German electricity power sector has a mixture of public and private enterprises. Installed electricity generating capacity is slightly greater than 108,000 MW, making Germany one of the world's largest electricity producers. Regional producers and distribution companies are often locally-owned. Environmental lobbies are powerful. Regional and nation "green" parties rose in importance during the 1980s and now play major roles in both Länder and federal governments

The national indicative target for renewable energy sources in gross electricity consumption is set by the RES-E Directive at 12.5% in 2010. German renewable energy policy defined a longterm target, i.e. a minimum share of power from renewables of 50% in 2050. In April 2000, the Renewable Energy Law came into force, improving the Feed-In Tariff Law. This law continues the system of guaranteed grid access (a purchase obligation on grid companies). It also features legally fixed feed-in tariffs for small hydropower, biomass (up to 20 MWel, and excluding sludges, mixed MSW and landfill gas), geothermal energy, wind power, and solar PV. Support prices are in the range of 7.03 cents €/kWh and 4.03 cents €/kWh (clearly out of this range is solar PV, which gets 49 cents €/kWh). The feed-in tariff system has a decreasing price element to stimulate continuous technological development and efficiency improvements. The Germany system is based on the Purchase Obligation and Pay Compensation, this means that the grid operators shall be obliged to connect to their grid electricity generation installations from renewable energy, to purchase electricity from these installations as a priority and pay compensation. The compensation payments are then distributed to all consumers via a mechanism that shares the additional prices over the whole country.

The 200-million DM programme and the "Nutzung erneuerbare Energiequellen" program provide investment subsidies for RES-E (biomass, solar PV, solar thermal, wind, CHP, small hydro). Total amounts (not percentages of total investment) are granted. The 250-MW-Wind Programme provides investment subsidies of up to 25% to a maximum of 46,016 €. Additionally, the programme provides operation subsidies of up to 3.1 cents €/kWh fed into the public grid. Under the Nachwachsende Rohstoffe program, a subsidy of up to 50 % (60% in the East) of investment costs for demonstration projects in the agricultural non-food sector is granted. The BMU-Programm zur Förderung von Demonstrationsvorha provides loans up to 70% of the investment costs of RES-E demonstration projects at a currency of 30 years. For the first 10 years, the interest rate is 4.9% (1998), after that it will be dependent of capital market conditions.

Other financial incentives are provided by the "ERP-Umwelt und Energiesparprogramm" which provides loans with a reduced interest rate. Loans may mount to a 50% of investment costs. In the west loans up to 75% of the investment costs can be achieved at an interest rate of 4.5% for a maximum of 0.5 M €, with a currency of 10 years. For investments in the east the interest rate is 5.0%. The 100,000-roofs solar electricity programme offers a special zerointerest loan with a repayment period of 10 years and up to 2 starting years without credit repayment (for Solar PV). Green Pricing schemes are also available.

With this new tariff structure for renewable sources, the government aims at replicating the boom of wind power during the 1990s and the beginning of the 2000th for other renewable energy technologies, and to stabilize the past growth rates for wind. To arrive at similar economics just like wind energy has already done, the REFITs (Renewable Energy Feed-in Tariffs) for solar and biomass are significantly improved, and complemented by publicly financed market introduction programs, such as the 100,000 roof-top program for solar PV, or the 200 DEM program, mainly aimed at biomass and solar hot water systems.

Heating and Cooling

German industry has committed itself to retaining, modernising and expanding the cogeneration sector. This effort is expected to prevent up to 23 million t of CO₂ emissions through 2010. Germany's new Act on maintaining, modernising and expanding heat-power cogeneration (Kraft-Wärme- Kopplungsgesetz), which came into force on 1 April 2002, will support this commitment. (source http://www.bmu.de/files/klima_nationalbericht_en.pdf)

In 2002 the Energy Conservation Ordinance was passed and functions as follows:

- Aims to reduce amount of heat, hot water and climate control used in new buildings by 25-30%
- **Unifies previous thermal insulation and heat installation ordinances**
- Buildings must have an energy profile certificate showing the amounts of energy they use and CO₂ they emit
- There are rules for existing buildings e.g. all boilers installed before 1978 must be replaced
- Higher standards for retrofitting and modernisation than the previous Thermal Insulation Ordinance

The Climate Protection Programme for Existing Buildings was launched in January 2001 to provide financial support. It is a modernization programme for buildings aimed at improving energy efficiency and reducing CO₂ emissions. Over the next few years, packages of measures involving the modernisation of heating installations, thermal insulation and the replacement of windows in more than 33 000 dwellings are to be supported by low-interest loans from KfW. The condition is to reduce CO₂ emissions by at least 40 kg per square metre of floor space in buildings which were built before 1979. (source IEA Energy Efficiency Update Germany 2003)

Transport

The federal government announced its measures to reduce CO₂ emissions in the transport sector in its Climate Protection Programme in 2000.

In 2001, the federal government drew up additional measures to reduce greenhouse gas emissions and energy consumption in the transport sector.

- As part of the Future Investment Programme, investment in the rail infrastructure in the amount of € 3.1 billion and in road construction in the amount of € 1.4 billion in the years 2001 to 2003.
- Introduction of a mileage-based highway toll for heavy trucks as of 2003. Reduced motor-vehicle tax (support for "three-litre cars" and continuation of assistance for "five-litre cars") to assist low-fuel-consumption cars.
- Agreement with automotive industry on possibilities to reduce consumption (e.g. greater use of low-friction oil and consumption gauges)
- Broadly designed information campaigns to inculcate good driving habits, with the participation of the automotive industry and car and environmental associations.
- A broadly designed traffic safety campaign, begun in February 2001, also includes information on fuel-conserving driving habits.
- Introduction of emissions-related landing fees at German airports, in co-ordination with neighbouring countries. In addition, the federal government will work toward the introduction of an EU-wide emissions-related aviation fee.
- Introduction of integrated transport and housing-settlement planning attuned to climate factors.
- .Employment of telematics and fleet management systems.
- Observation and support for the traffic-sector energy strategy of German automotive and energy companies with the goal of a broadly based introduction of alternative fuels.
- .Financial assistance from the federal government in the amount of more than € 8 billion a year for investment to improve traffic and transport in local communities (community transport financing act, regionalisation act) with an eye to the greater use of short-range public transport.

Voluntary agreements are also in place. The automobile industry committed itself to a 25% reduction in fuel consumption by new cars built and sold in Germany between 1990 and 2005. In addition, Germany supports

voluntary agreements on a European level to reduce fuel consumption and emissions of cars and trucks; for example, the ACEA agreement on CO2 reduction, in which the German car producers take part. (summarized from IEA Energy Efficiency Update Germany 2003)

Buildings

From 1999, the tax breaks that were available for the refitting of existing housing, generally to include energy efficiency, have been replaced by investment allowances in the new Länder: for modernisation and repair measures of buildings constructed before 1991 an investment allowance of 15% is granted

On 1 January 1996, the fifth amendment to *the Ordinance on the Fees for Architects and Engineers (HOAI)* came into force. This updated version of the Ordinance provides for fee-based incentives for architects and engineers to encourage efficient use of energy and the use of renewable energy sources in dwellings

In 1991, The Federal Ministry of Economics (BMWi) launched an energy saving promotion programme called *Vor-Ort-Beratung.*, as a part of national policy to reduce CO2 emissions. Goals of the programme are to improve thermal insulation and heating systems, by promoting energy certification and other energy saving measures in new and existing buildings built before 1984 in old States and 1989 in new states respectively, and to increase energy saving awareness among building owners and end users. The programme gives financial support to building owners and SME's, to procure energy audit consultancy. Several states and credit banks have additional programmes for financing investments recommended in the audits (source IEA Energy Efficiency Update Germany 2003)

Research and Development

A large scale demonstration programme for photovoltaics: the "1000 roofs programme" commenced in 1991, providing subsidies for production costs of 60% in the former GDR and 50% in western Germany. The programme has been completed and about 2100 units with total peak generation power of 5.3 MW are now installed.

"Solarthermie 2000" was launched in 1993 by the Federal Ministry for Research and Technology (BMFT, now BMBF) as part of its large-scale demonstration programme for the development of low temperature heat from active systems, especially in the former GDR.

Since autumn 1998 and following the last federal elections, responsibility for applied energy research has shifted to the Federal Ministry of Economics and Technology (BMWi). The basis for R&D on renewable energy is the 4th Programme of Energy Research and Energy Technology adopted in 1996. The main goals of this programme are:

1. Development of any technological option that may contribute to a significant and sustainable reduction of burdens to environment and climate.
2. Support the modernisation of the German economy and enhance the possibilities of German industry on world energy markets.

The programme focuses on efficient energy utilisation as well as on the development of renewable energies

			TIME							
COUNTRY	PRODUCT	FLOW	1980	1985	1990	1995	1999	2000	2001	2002
Germany	Million US\$ (2002 prices and exchange rates)	4.1 Solar Heating & Cooling	0.000	13,459	15,866	14,231	4,781	10,483	11,398	7,163
		4.2 Solar Photo-Electric	60,682	39,038	54,613	29,670	35,795	35,922	27,011	24,317
		4.3 Solar Thermal-Electric	0.000	8,705	5,704	3,345	3,438	1,341	1,533	1,037
		Total Solar	60,682	61,203	76,185	47,245	44,014	47,747	39,941	32,516
		5. Wind	29,947	16,406	13,014	19,932	20,237	14,608	16,858	14,420
		6. Ocean	1,577	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		7. Biomass	0.000	0.402	1,724	1,537	1,765	6,459	3,831	3,676

	8. Geothermal	11,821	8,437	3,328	1,911	1,634	2,236	6,896	3,959
	9.1 Large Hydro (>10 MW)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	9.2 Small Hydro (<10 MW)	0.000	0.000	0.000	0.000	0.118	0.000	0.000	0.000
	Total Hydro	0.000	0.000	0.000	0.000	0.118	0.000	0.000	0.000
	TOTAL RENEWABLE ENERGY	104,028	86,448	94,250	70,625	67,769	71,050	67,527	54,571
	TOTAL OTHER TECH./RESEARCH	7,093	3,281	1,842	5,794	6,426	10,583	12,069	11,687
	TOTAL ENERGY R&D	1,489,482	1,137,208	508,690	262,669	182,034	260,997	280,164	262,017

(Source IEA 2003: National Budget RD&D in OECD Countries – Germany 1980-2002, OECD, IEA)

Climate change

The Ecological Tax Reform is part of the Federal Government's climate-protection policy. Applicable relevant laws call for energy prices to increase, in a total of five phases, from 1999 to 2003. The basic concept calls for energy to become more expensive, through taxation, and for "work" to become less expensive. In particular, ecologically oriented trends are to be encouraged by providing incentives for energy efficiency, for use of advanced technologies and, thus, for avoidance of greenhouse-gas emissions. The Federal Government plans to review the possibility of exempting renewable energies from taxation and of enhancing the ecological precision of the Ecological Tax Reform. In order to provide a clear signal, the Federal Government has committed itself to reducing CO₂ emissions in its sphere of responsibility by 25 % by 2005 and by 30 % by 2010, with respect to their 1990 level. As part of this commitment, the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) has made a commitment to reduce its own energy-related CO₂ emissions by 30 % by 2005 (base year 1990). The BMU has been commissioned to develop a coordinated concept that government ministries can use as a guide in reaching relevant targets, under their own responsibility in each case. The concept is expected to emphasise measures involving little or no cost. One relevant example consists of "fuel-saving training" events for motorists – events in which motorists learn effective techniques, especially changes in driving habits, that can very quickly reduce fuel consumption and generate significant savings. It is being left up to the ministries themselves to select measures for achieving the main aims within their own spheres of responsibility.

By 2005, nuclear power stations now generating some 8 billion kWh/a of electricity must be replaced. Depending on what types of power stations replace these nuclear power stations – natural-gas-fired gas-and-steam power stations, hard-coal-fired stations or lignite-fired stations – an additional 3 to 7 million t of CO₂ will be generated. From 2006 to 2010, nuclear power stations now generating some 19 billion kWh/a (an additional 7 to 17 million t of CO₂) must be replaced; from 2011 to 2020, an additional 87 billion kWh/a (an additional 33 to 74 million t of CO₂) of capacity must be replaced. Considerable efficiency improvements in energy conversion – for example, through expansion of heat-power cogeneration, highly efficient gas-and-steam power stations and state-of-the-art coal-fired power stations – and in energy use (including careful use of energy in all relevant sectors), and expansion of use of renewable energies, will all play important roles in meeting this challenge. With its climate-protection programme of 18 October 2000, the Federal Government has taken the necessary decisions for making use of these options.

One important element of the Federal Government's new climate-protection programme, in the buildings and structures sector, is a multi-year campaign – being carried out via a public-private partnership – aimed at tapping potential for reducing CO₂ emissions in the residential and institutional sectors. Within the framework of the relevant public-private partnership, the BMU is working with German industry – especially with manufacturers and providers of energy-saving systems and devices for buildings and structures. The campaign is aimed especially at providing effective information and advising in all relevant areas of action.

(source http://www.bmu.de/files/klima_nationalbericht_en.pdf)

3. RE Highlights

However, institutional barriers to renewable energy development are significant, and although an attempt has been made to standardise licensing of renewable energy technologies, full co-ordination of renewable development within and between Länder (Federal States) has yet to be achieved.

One of the programs that show growing importance on the promotion of RES is the “250 MW wind”-program. This program started in 1989, the closing date is scheduled for 2006, and its main policy objective is to increase the deployment of wind power in Germany and to obtain statistically verifiable data from the practical operation of wind turbines. The continuous evaluation and publication of the results of this program support the development of wind energy technology and its integration in the German supply.

National Success Story

Germany — Photovoltaics

Many of Germany's regions actively support photovoltaics (PV) as part of their efforts to expand the use of renewable energy. Berlin, for instance, is sometimes referred to as the solar capital because of the rapid increase in PV installations. More than 9 000 m² of PV modules have been installed in Berlin, with a total generating capacity of nearly 800 kW. These include the presidential residence, the town hall, and many other ministries and public buildings. The new Innovation Centre for Environmental Technology in Berlin-Adlershof was developed by the Berlin Energy Agency, and financed through a partnership between the Energy Agency, the local energy provider BTB and the owner of the building. They jointly invested in a solution to cover the working expenses of the solar installation and to sell electricity into the energy grid. This and many of the other installations in Berlin provide excellent examples of successful PV installations, and of ecological building management.

Success factors:

• **Political: National and regional support towards the development of photovoltaics**

German energy policy is closely linked with national policies to support climate protection. Renewable energy plays an important part in this policy, and the government has actively supported financial provision towards renewables, both at national and regional levels. PV especially has benefited from support from regional governments. For example, Berlin's energy policy was established in 1994 and amongst other things seeks to increase support for the use of renewable energy and reduce CO₂ emissions by 25 % per person from 1990 levels by 2010.

• **Legislative: Premium-set tariffs combined with an obligation to purchase provide a stable, commercially favourable market to renewable electricity producers**

The Electricity Feed-In Law supports renewable electricity, including PV, by providing a guaranteed market and fixed price for the electricity produced from renewable energy sources. From 1 April 2000 the tariffs for PV are even more advantageous: they have been raised sixfold from EUR 0.08/kWh (DEM 0.16/kWh) to EUR 0.51/kWh (DEM 0.99/kWh). This rate is proving very attractive: the German government had to limit applications for receiving this new tariff in 2000 because the amount of money set aside for supporting it had already been reached.

• **Financial: Loans and grants available for photovoltaic schemes**

An important stimulus to developing PV in Germany have been the PV roofs programmes. The 1 000 PV roofs programme started in 1991 and provided subsidies for production costs of PV units of 60 % in the new Länder and 50 % in the rest of Germany. The programme was successfully completed in 1996/97. A follow-on 100 000 PV roofs programme started in 1999, which provides EUR 560 million towards supporting individuals and small and medium-sized companies to install grid-connected PV schemes. The recent increase in tariffs available to PV installations and the corresponding rapid increase in the number of installations has meant that the target date for achieving the 100 000 roofs programme has been brought forward by one year to 2003. *Germany has the highest level of photovoltaics installations in Europe, and the third highest in the world, after the United States and Japan.* The national European Recovery Programme (ERP) for Environment and Energy Savings offers long-term loans with low interest rates for investment in the use of renewable energy. The programme is administered by the federally owned Deutsche Ausgleichsbank (DtA), Bonn. Loans may amount to 50 % of investment costs, and provide favourable interest rates and loan arrangement. This programme provides grants for capital subsidies to households for PV installations.

• **Technological development: Germany has developed a successful domestic photovoltaics cells and components manufacturing industry**

High levels of federal support for research and development have helped to build a strong and competitive domestic PV industry. Almost one third of the funding support provided from the federal government towards energy research and technology is focused on renewable energy. In 1996 expenditure was approximately EUR

100 million. The majority of the funds are devoted to solar applications, particularly PV. This, combined with the expanding domestic PV market, has made Germany a location of choice for new manufacturing plants. More than half of Europe's PV manufacturing capacity is now located in Germany.

• Information, education and training: Local energy agency stimulates private and public interest in photovoltaics

At the local community level, there is high environmental awareness among German citizens, particularly of energy issues. In addition, energy agencies play an important role in stimulating the demand for PV installations. In Berlin, for example, the approach is to encourage links between private sector and public organisations to build strong local partnerships to implement PV solutions. To achieve this, the Berlin authorities supported the establishment of an energy agency, in conjunction with developing support programmes. The Berlin Energy Agency is responsible for informally coordinating active links between the Berlin Senate, Berlin businesses and energy utilities to implement new PV projects on new public and private buildings.

Regional best practice

Germany — Solar thermal

Many German municipalities have seen a rapid increase in the uptake of thermal solar installations. Examples of some successful municipalities in south-west Germany include:

- Freiburg: more than 200 domestic installations (2 500 m²) achieved by 1996;
- Friedrichshafen: nearly 5 000 m² of collectors installed to support solar-assisted small-scale district heating and hot-water systems;
- Ulm: installation of a central hot-water system for 38 homes and a district heating system (heat and hot water) for 86 residential units, in which heat from solar collectors is used together with a combined heat and power plant fired by biomass and gas.

Success factors:

• **Political: National and regional support towards increasing use of solar thermal installations**

Political support from national and regional governments is translated into practical implementation measures in the form of targets, grants, research support and other actions aimed at increasing the level of renewable energy use. Regions also see solar hot-water systems as important components in implementing Local Agenda 21 (opportunities for carrying out climate protection initiatives at the local level) in their region.

• **Financial: Federal government and private sector financial support to solar thermal installations**

A wide range of federal, regional and private sector financial support is available for solar installations.

These include:

- Federal government support: The federal government's Solarthermie 2000 demonstration programme subsidised the construction of the long-term hot-water storage and the district heating system in Friedrichshafen, contributing 53 % towards total costs.
- Regional support: In Friedrichshafen, 9 % of total costs came from regional support measures.

Energy utilities: The role of the local municipal energy company is also important. In Freiburg, for example, the company provided financial support of EUR 230/m² (part financed from EU funds). In Friedrichshafen, the owners and operators of the district heating system have responsibility for overall risk and guarantees of the system. Local people can also benefit from low interest rates provided by local or regional banks for solar installations. A number of financial institutions in Germany have supported both community- and non-community-based renewable energy projects with favourable financing packages.

• **Administration: Active support provided from municipalities for solar thermal installations**

One important factor is the role played by both the municipality and the local energy utility in encouraging the uptake of solar heating. The municipality collaborates closely with the utility in establishing and implementing energy planning and municipal energy policy and targets. *Germany is leading the way on solar thermal energy.*

In 1993: 21.0 ktoe In 1999: 75.4 ktoe Increase 1993–99: 54.4 ktoe, 260 %

• **Technological development: Quality standards provided to guarantee results from solar collectors**

GRS (Guaranteed Results from Solar collectors) is an initiative established by several municipal utilities in 1993, coordinated by municipalities. Its purpose was to ensure that the annual amount of heat supplied by a solar collector was guaranteed by the manufacturer, thus allowing for precise cost–benefit calculations and ensuring that systems met customer needs. Its application has helped to boost consumer confidence in the quality of the new types of heating systems available in Germany, and in particular those produced by German manufacturers.

• **Information, education and training: Active promotion of the benefits of solar thermal installations by municipalities, utilities and local energy agencies**

Close collaboration between municipality and utility has led to a combined effort to both disseminate and improve public relations in order to promote renewable energy uptake. Specialist advice centres have been established through local energy agencies to provide technical and practical support to local associations for solar installations, but also to support demonstration schemes.

Germany — Wind energy (to cut this or PV or biomass as too much information on national success)

Germany considerably increased the number of turbines installed during the 1990s. Many of the projects established in Germany before the mid-1990s were small to medium-sized installations, often with a high degree of participation from the local community. One example is the Halde Nierchen wind farm in the state of Nordrhein-Westphalia. This wind farm comprises nine 1-MW turbines. The wind farm was built in 1998, and all power generated from it is sold to the local public utility EBV under the Electricity Feed-In Law.

Success factors:

• Political: National and regional support towards wind energy development

Federal support for renewable energy started more than 10 years ago with the 250 MW Wind Programme. This was initiated in June 1989 as a 100 MW Wind Programme and was extended in February 1991 to 250 MW. The programme's aim was rapidly achieved, and by 1999 Germany had achieved an installed capacity of more than 4 000 MW.. Political support from government is mainly through the feed-in law, grants and research support. Many German regions or municipalities have targets for increasing their level of renewable energy utilisation, including wind energy use.

• Legislative: Premium-set tariffs combined with an obligation to purchase provide a stable, commercially favourable market for renewable electricity producers

The single most important factor for the rapid and successful implementation of wind energy in Germany is its feed-in law. From 1991–2000, the Electricity Feed-In Law provided a guaranteed market and fixed price for the electricity produced from renewable energy sources. Wind energy schemes benefited considerably during the late 1990s from the favourable tariffs available through these support measures, and the feed-in law and its successor, the Renewable Energy Sources Act (2000), continue to be the principal mechanism for achieving the rapid uptake of wind energy in Germany. Under the feed-in law, operators of the grid were obliged to purchase electricity produced from renewables within their respective supply areas, at agreed and fixed prices. For wind power the price available in 1997 was DEM 0.1715/kWh (EUR 0.088/kWh). In order not to overburden grid operators in areas where there were high rates of renewables generation with having to purchase at premium prices, a limit of 5 % renewable electricity was set from 1998 that applied within each region. Above this mark, operators of the grid were exempted from the obligations of purchase and refund. As the amount of electricity from renewable sources expanded, a number of regions exceeded the 5 % ceiling. There was also an uneven financial burden between grid operators in regions close to the 5 % ceiling and regions with low levels of renewables generation. In order to address these and a number of other issues the law was replaced by the Renewable Energy Sources Act (2000). This continues to provide a guaranteed market and fixed favourable tariffs for electricity generated from renewable sources. The 2000 Act abolished the 5 % cap and introduced a system that allows transmission grid operators to share amongst themselves the costs of compensation to renewable electricity producers.

• Fiscal: Tax exemptions are available to investment in renewable energy technologies

Private individuals can offset the costs of investment in a wind farm against tax. This makes wind farms an attractive investment option, especially for smaller investors, and can lead to a proportion of the capital costs for new wind farm developments being financed by the general public. *Germany has established itself as the world leader in wind power, with the help of a feed-in law.* In 1993: 674.0 GWh In 1999: 5 528.0 GWh Increase 1993–99: 4 854.0 GWh, 720 %

• Financial: Subsidies and low-interest loans are available to wind energy projects

Many German regions provide financial support to renewable energy schemes, including investment subsidy programmes, to implement their energy policies. Nordrhein-Westphalia, for example, actively supports renewable energy, and in 1997 alone provided some EUR 10 million to financially support environmental energy projects, including some wind energy projects. A number of German financial institutions provide low-interest loans suitable for renewable energy projects. For example, the European Recovery Programme (ERP) — Environment and Energy Savings offers long-term loans with low interest rates for investments in the use of renewable energy. The programme is administered by the federally owned Deutsche Ausgleichsbank (DtA), Bonn. Loans may amount to 50 % of investment costs, and provide favourable interest rates and loan arrangement. Loans to wind energy projects over the 1990–97 period reached DEM 3.48 billion (EUR 1.78 billion) out of the DEM 4.18 billion (EUR 2.13 billion) disbursed to renewable energy projects. The Halde Nierchen scheme received no grants but does benefit from a soft loan from the Nordrhein-Westphalia regional government under its Rationelle Energie Nutzung (Rational Use of Energy) programme.

• Administration: Planning guidance is being developed in some regions to identify areas for wind developments

Public acceptance is becoming a problem in areas with a number of wind turbines. To help to overcome local opposition to wind power developments, planning guidance is now being developed in some regions to identify areas open to or barred from wind developments. In addition, national land use directives are in preparation to

indicate how much renewable energy should be developed in each of the regions, particularly in regions (such as Nordrhein-Westphalia) where there is a high level of wind energy developments. The planning issues associated with the Nordrhein-Westphalia scheme were complex, largely because the farm is on the border of two regions and so approval from both regions was needed before the developers could go ahead, which took 3–4 years. There are no plans to strengthen coordination within and between the *Länder* of measures to promote renewable energies.

• Technological development: A strong and expanding German wind energy industry

Germany's wind energy manufacturing industry is expanding to meet the increasing demand for domestic installations, both through indigenous companies and through joint ventures, especially with Danish companies. This expansion is made possible because manufacturers are confident of a steady future market based around the continuation of the feed-in law in the Renewable Energy Sources Act.

• Information, education and training: Active involvement of locals in wind energy projects

There is generally a high level of environmental awareness amongst German citizens and an interest in wind energy as an alternative to other energy sources. Wind energy is of especial interest to farmers, who see it as an opportunity to provide an alternative income stream through land rentals or through electricity sales. Many wind farms are part-financed by local community subscriptions. In the Halde Nierchen scheme, the developer held public meetings in local communities to raise interest in the scheme. Just over 30 % of the scheme subscribers are resident in the local area. Member state/technology examples of successful penetration 43

4. Websites

Name	Description	Website
Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU)	Responsible for climate protection, environment and energy issues	www.bmu.de
/German Energy Agency (DENA)	Advises on matters of energy efficiency nationally and internationally	/www.deutsche-energie-agentur.de
BASE	a non-profit foundation and UNEP (United Nations Environment Programme) Collaborating Centre, which aims to mobilize investment in energy efficiency and renewable energy.	www.energy-base.org
Europa website	EU Commission website	http://europa.eu.int
European Commission – Directorate General for Transport and Energy		http://europa.eu.int/comm/energy/index_en.html
Managenergy	Information Services for Local and Regional Energy Actors	http://www.managenergy.net