

## Renewable Energy Law

Case study #7 (21 October 2004)

Country: Germany

Market: electricity

### 1. Summary

In 2000, the Renewable Energy Law (EEG) replaced the previous Electricity Feed-In Law of 1991. This Electricity Feed-In Law had enabled independent power producers to feed electricity into the public grid, and mandated the utilities to reimburse them at 90% of the average kWh rates which private users had to pay.

After the deregulation of the electricity market in 1998, the law had to be modified. At the same time, other recognized defects were eliminated in the new Renewable Energy Law. The existing system of payments linked to end-user prices was replaced by rates fixed by law that have been established after scientific examinations by renowned institutes. The payments to the private electricity producers now depend on the branch of the renewable energy involved, the size of the plants, and, in the case of wind energy, the site. In August 2004 some amendments were enacted that mainly affected the rates.

So the renewable energy feed-in tariffs now vary for small hydro, landfill gas, mine gas or sewage gas from 9,67 cent/kWh for small installations below 500 kW up to 3,70 cent/kWh (0.075 €) for new large hydro installations above 50 MW. For biomass, the tariff ranges from 11,5 cent/kWh for smaller units (< 150 kW) to 8,9 cent/kWh for large installations.

The price for wind power plants is fixed at 8,7 € cents/kWh for at least five years after installation. Thereafter, the rate is reduced to a lower rate, depending on the quality of the site. At the best coastal sites, for example, the price falls to 0.055 €/kWh after the first five years of operation. This would result in an average payment of 0.063 €/kWh over 20 years. Wind turbines in mainland Germany would receive a higher payment because of the lower wind speeds there. At the reference site the wind turbine owner receives an average tariff of 0.084 € over 20 years. For offshore wind there is a reimbursement of 9,1 cents/kWh for the first 10 years of operation, 6,2 cents/kWh for the next 10 years.

The payment rates are oriented toward actual power generation costs, and are regressive for new installations by 1,5%/year, in order to promote technological developments. At the same time the distribution of the costs arising in this process have been newly regulated: They are now distributed evenly nationwide on the basis of power consumption (so that the average additional costs per kWh to the consumer, amounting to €0.42/kWh, are at an acceptable level).

The Electricity Feed-In Law was passed during a peak phase of German ecological policy, after the reactor accident of Chernobyl in the late '80s, by a conservative federal government. It was replaced by one of the first major legislative initiatives of the newly elected SPD-Green

government in 2000. The new administration was willing to set ambitious targets and to achieve them.

In the early '90s the only "green power" was large hydro. With 16 TWh, it reached a share of 4.2% of overall electricity production. During the '90s, this figure already changed significantly with the growth of wind energy (+4.4 TWh) and with increases in hydro power (+4.3 TWh), reaching 24.8 TWh by 1998. Since then, the production of "green power" has grown by another 80% to 44.3 TWh in 2002, a share of 8% of overall electricity production.

The EEG clearly recognizes the contribution of renewable energy to reducing greenhouse gas emissions and saving scarce fossil fuel reserves. Its aim is to initiate a self-sustaining market for renewable energies by compensating for the distortions in the conventional electricity market, and simultaneously creating a critical mass by means of a massive market introduction program that does not lead to any additional burden on the taxpayer. This price regulation, in combination with measures for the internalization of external costs (e.g. the Eco-Tax Reform) is designed, over the long and medium term, to ensure competitiveness with conventional energy sources. Thus, in addition to environmental and climate-policy targets, the law clearly pursues industrial-policy goals.

Renewable energies, especially in the electricity market, play a crucial role in the German government's climate protection policy. In 2000, it set the target at 12.5%, identical with the very ambitious doubling target of the EU RES directive, though at that time, the directive had not become effective. This was to be only the first step towards an energy system mainly based on renewable energies, as envisioned for mid-century.

To a lesser extent, there is resistance to particular projects which usually arises out of the fear of secondary effects, such as noise or offensive odors. It is debatable whether these effects actually appear in practice. Thus, bird-protection groups initially opposed wind-energy facilities because they feared damage to birds. These fears have proven to be largely baseless. In addition, the exhaust problem for biomass facilities is now self-regulating.

Although the EEG does not provide any subsidies, the public discussion about the so-called additional costs of renewable energies is entering into the overall public debate about cut-backs, and should therefore not to be underestimated. However, at this point, no weakening of public support for renewable energies (> 95%) has been observed. The attitude of the parliamentary opposition to the EEG, which has been amended actually, is unclear. There is a clear and publicly perceptible support on the part of the federal government and the renewable energy organizations.

With a growing share of renewable energy in the electricity market the monopolistically organized conventional competitors started to rebel against such "privileges" for renewable energies as guaranteed purchase prices and assured access to the power grids. They started legal actions on all levels (from the regional courts to the Federal High Court as well as the European High Court) challenging the legal foundations of the REL/EEG – and lost all of them. Since then some conventional energy suppliers have opened up their portfolio for green power as well; others have started to campaign against the supposedly horrendous extra costs of green power – a battle that is still going on in the public.

## 2. Description of the case

The law regulates the purchase and payment of electric power derived exclusively from hydroelectric, wind-power, solar-radiant, geothermal, dump gas, clearing gas, firedamp or biomass sources.

The development started in 1989 with an initiative by some conservative and green parliamentarians. It is expected now that by 2015, wind energy will not need the legislative support of the REL anymore, but will be competitive with conventional energy sources. This will not be true, however, for the other sources of green power.

The REL is a very well known instrument for private investors, especially in the area of wind energy and PV. It is the Ministry of the Environment that is intensively promoting the REL nationally (e.g. during the national election campaign in 2002) and internationally (e.g. at CSD 2001 New York, the Johannesburg Conference 2002, International Conference for Renewable Energies Bonn June 2004). As a highly political issue – as energy policy is in Germany – the REL is also part of partisan communications and campaigns.

Though from the beginning it was important that the laws lay within the purview of the administration – from 1990 until 2002 with the Ministry of Economics; since then with the Ministry of the Environment – there was always an active involvement of members of parliament – e.g. during the formulative phase of the original feed-in law in the late '80s / early '90s as well as in the formulation of the REL/EEG in 1999-2000. So it is not always clear who is really coordinating the policies, but there is a constant exchange.

A factor not to be underestimated is the broad public support for a more environmentally friendly energy supply. This support arises from the vivid discussions about an “energy consensus” during the '70s and '80s, and the broad rejection of atomic energy and the perceived problems of conventional energies (damage to forests and buildings, climate change). So there was a broad alliance of organizations, private enterprises and environmental groups that supported the emergence of renewable energies, though their forecast growth rate was generally underestimated.

An essential supporting factor was the opportunity to translate scientific knowledge into concrete action. Many failures in large-scale technology have confirmed that the innovations brought onto the market primarily by small and medium-sized enterprises have, due to their rapid market introduction, been steadily improved and become more economical.

Due to dependency of private power producers to continued payments of the feed-in rates, there is inherent pressure for efficiency and reliability in appliances and services. Like every other market product, new qualifications had to be acquired. But that is no obstacle to broad market introduction of sustainable energy technologies.

## 3. Results

In 2002, renewable energies totaled 44 TWh, at gross power utilization of 582 TWh, for a share of 8%. Due to poor weather conditions in 2003 (less wind and rainfall), green power production did not increase in 2003 (hydro power -4 TWh, wind energy +4 TWh), but it is expected that the feed-in will increase to almost 60 TWh, or a share of 10%, in 2004. Germany is thus on schedule with its plan to increase the share of renewable energies in electricity generation from 6.3% in 1990 to 12.5% in 2010.

The following output was installed in 2003 (comparison with 1990):

Hydroelectric: 4,620 MW (= +220 MW)

Wind power: 14,600 MW (= +14,544 MW)

Biomass: 1,100 MW (= +910 MW)

Photovoltaics: 350 MW (= +348 MW)

Technological development is a permanent issue in a steadily globalizing market. Since 1990 there has been a dramatic evolution of technologies –best observable in the growth of wind energy applications from 50kW in the early '90s to 4.5 MW today. In some parts of northern Germany, already more than 50% of power is from renewable sources, mainly wind energy. But compared with market potentials and policy goals, the penetration rate for renewables is still low.

The primary energy equivalent of renewable power generation in 2002 was 188 PJ (heat production of 200 PJ, fuel 20 PJ); with 408 PJ (2002), a doubling was achieved compared with 1990 (190 PJ), reaching a primary energy consumption share of 2.9%. The goal is an additional increase to 4.2% by 2010.

Despite the technological development since 1990, renewable energies are not competitive yet from an economical point of view and need continued assured support measures and frameworks. But new renewable energy applications have to compete with conventional power plants that received intensive subsidies for decades and were built under comfortable monopolistic market conditions.

The prices per installed kW sank by 50% for wind energy since 1990 and for photovoltaics since 1998, depending on the market stage of the particular technology. The REL puts imminent pressure on the technological development by decreasing the feed-in rates on a yearly base and technologically differentiated between 1% (biomass), 1.5% (wind energy) and 5% (photovoltaics).

In recent years, the construction of a sustainable industry, particularly in structurally disadvantaged regions, has been initiated; over 120,000 people are employed in the entire area of renewable energies, 50,000 of them in the area of biomass, 40,000 in wind energy, and almost 20,000 in the solar economy. It is expected that 25,000 additional jobs will be created by 2010. In 2002, an investment volume of € 6.0 billion was triggered. Through the use of the renewable energies, 36.4 million tons of CO<sub>2</sub> were saved in the area of electricity in 2002; 13.1 million tons in the area of heating; and 1.6 million tons in the area of fuel, for a total of 51 million tons of CO<sub>2</sub> saved.

This development is expected to be continued in a stable legislative framework.

#### 4. Evaluation: Main elements of success and problems

Since 2002, two modifications of the REL have taken place: In early 2003, the surplus cost equalization scheme was modified to lower the payments per kWh for energy-intensive industries. At the same time, every quantitative limitation for photovoltaics within REL – formerly set at 1000 MW – has been removed. As of 2004, feed-in rates have been improved and differentiated significantly for PV due to the end of the 100,000-roofs program and the threatening uncertainty for private investors due to the ongoing amendment process of the REL until the summer of 2004.

With the REL, a market for private energy producers has been induced for the first time in Germany. Thus, private investors have been able to become the driving force for a less monopolistic and more heterogenous market development. The REL initiated a process that increasingly develops the market for renewable energies. With a share of 8% of the electricity market in 2002 renewables attain only a small margin of their technical potential of estimated 80%.

#### 5. Objectives for further development

Though there is always some uncertainty during the amendment phase of the REL, the German federal government is willing to continue its very progressive policies toward renewable energies. With this reliable perspective for private business and investors, the achievement of the ambitious targets set for 2010 seems realistic. The amended REL came into effect in August 2004.

Germany is on schedule with its plan to increase the share of renewable energies in electricity generation from 6.3% in 1990 to 12.5% in 2010. In general no major changes within the system of the REL are planned with the ongoing amendment process. In detail, the goals to be achieved are higher specification and degression within the feed-in rates for the different sources of renewable energy as well as more emphasis on offshore than onshore wind power. But the amendment process is still in a too early stage to go into more detail.

#### 6. Conclusions

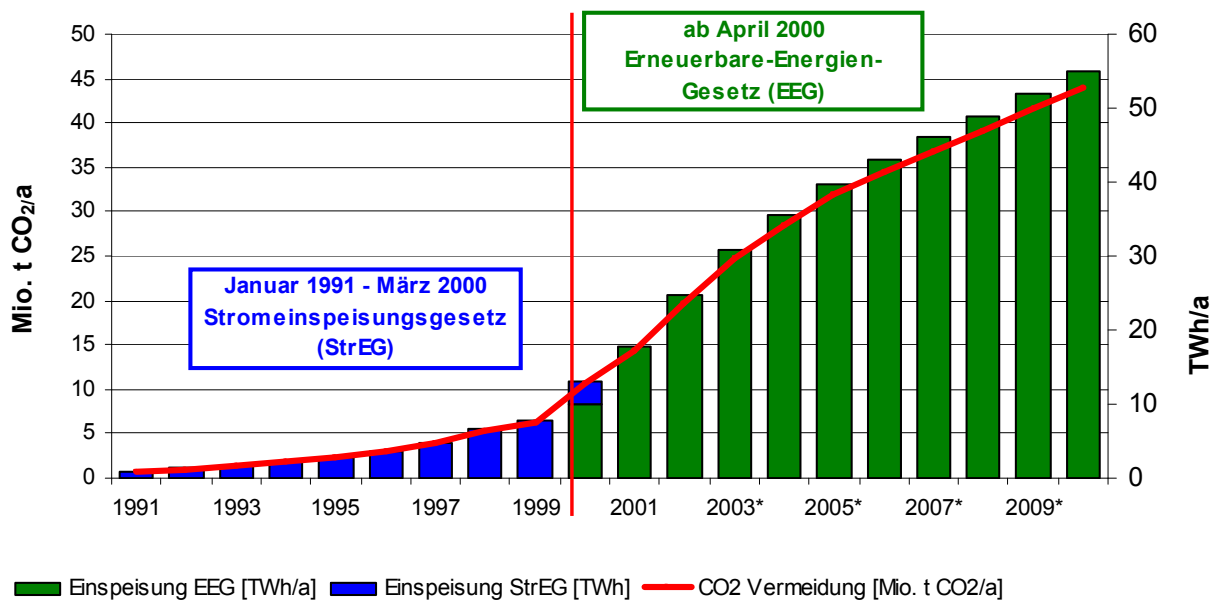
The competence and capability for electricity production is not naturally restricted to big industrial players. This is especially true for renewable energies in decentralized applications that find broad acceptance in the public. Almost half a million people in Germany are directly or indirectly involved in the production of green power, and form the core of a new consensus in energy policy.

The way to success lays in fair market conditions and attractive investment conditions.

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Quelle: VDEW, VDN, Prognose 2003 - 2010, eigene Berechnungen; \* - Projektionen

Renewable Energy Production:  
[Feed-in-Law 1991-2000](#)  
[Renewable-Energy-Law 2000-](#)

**Compensation Rates under the Renewable Energy Law of July 21st 2004,  
 for New Plants Brought into Operation during 2004, after August 1st 2004.**

For detailed tables for the development of the compensation rates, with calculation examples, see separate document.

(For larger plants, compensation is paid respectively proportionately, according to the compensation stages [§12 Sect. 2]).

Sector	Plant Output	Compensation Stipulation	Compensation Level (euro-cents)	Output Range	Life Span (Yrs.)	Remarks
Water-power	To 5 MW	§6 Section 1	9.67/kWh 6.65/kWh	Above 500 kW - 5 MW - 500 kW	30	As of 2008, certain site restrictions
	Above 5 MW - 150 MW	§6 Section 2	7.67/kWh 6.65/kWh 6.10/kWh 4.56/kWh 3.70/kWh	To 500 kW Above 500 kW - 10 MW Above 10 MW - 20 MW Above 20 MW - 50 MW Above 50 MW - 150 MW	15	Only for renovations, and only compensation for output increases
Landfill and sewage gas, firedamp	Unlimited	§7 Section 1	7.67/kWh 6.65/kWh 6.65/kWh	To 500 kW Above 500 kW - 5 MW	20	For landfill and sewage gas, the electric power credited to the output exceeding 5 MW is compensated at the market rate.
	Unlimited	§7 Section	9.67/kWh 8.65/kWh 8.65/kWh	To 500 kW Above 500 kW - 5 MW Firedamp above 5 MW	20	For the use of certain innovative technologies
Biomass <sup>1</sup>	To 20 MW	§8 Section 1 Clause 1	11.50/kWh 9.90/kWh 8.90/kWh 8.40/kWh	To 150 kW Above 150 - 500 kW Above 500 kW - 5 MW Above 5 MW - 20 MW	20	
	To 20 MW	§8 Section 1 Clause 2	3.90/kWh	To 20 MW	20	For use of Category A III and A IV old wood, for plants brought into operation after July 1 <sup>st</sup> 2006
	To 20 MW	§8 Section 2 Clause	17.50/kWh 15.90/kWh 12.90/kWh	To 150 kW Above 150 kW - 500 kW Above 500 kW - 5 MW	20	Section 2 applies only for specific fuel materials (regenerative raw materials).
	To 20 MW	§8 Section 2 Clause	17.50/kWh 15.90/kWh 11.40/kWh	To 150 kW Above 150 kW - 500 kW Above 500 kW - 5 MW	20	Section 2 Cause 2 applies to burning wood, as per Clause

<sup>1</sup> For biomass, additional combinations not represented here are possible under §8 Sections 2 - 4

	To 20 MW	§8 Section 3	13.50/kWh 11.90/kWh 10.90/kWh 10.40/kWh	To 150 kW Above 150 kW - 500 kW Above 500 kW - 5 MW Above 5 MW - 20 MW	20	Section 3 applies for power generated in so-called de-coupled operation in cogeneration facilities
	To 20 MW	§8 Section 4	13.50/kWh 11.90/kWh 10.90/kWh	To 150 kW Above 150 kW - 500 kW Above 500 kW - 5 MW	20	Section 4 applies to all power from cogeneration plants, if certain innovative technologies are used.
Geothermal	Unlimited	§9 Section 1	15.00/kWh 14.00/kWh 8.95/kWh 7.16/kWh	To 5 MW Above 5 MW - 10 MW Above 10 MW - 20 MW Above 20 MW	20	
Wind energy on land		§10 Section 1	8.7/kWh (initial comp.) 5.5/kWh (final comp.)		20	The increased compensation clause will be granted for between 5 to 20 years, depending on the reference yield of the facility.
Wind energy offshore		§10 Section 3	9.10/kWh (initial comp) 6.19/kWh (final comp.)		20	The increased initial compensation rate is paid if the facility is brought into operation before 2011; it is granted for between 12 and 20 years, depending on location.
Solar radiant energy	On or at buildings or noise barriers	§11 Section 2	57.4/kWh 54.6/kWh 54.0/kWh	To 30 kW Above 30 kW - 100 kW Above 100 kW	20	
	Façade-integrated plants	§11 Section 2 Clause 2	62.4/kWh 59.6/kWh 59.0/kWh	To 30 kW Above 30 kW - 100 kW Above 100 kW	20	
	Other plants	§11 Section 1	45.7/kWh		20	Certain site criteria must be satisfied