

Feed-in Tariffs for Wind Energy

Case study #25 (27 October 2004)

Country: Portugal

Market: electricity

1. Summary

Despite the deployment of wind energy in some European countries in the mid 1980s, the production of wind electricity in Portugal remained small and essentially unchanged until the mid 1990s. Several factors contributed to this situation: the state of the art back then, didn't allow a wider application of technology to the often limited wind resource in Portugal (between 3 and 5 m/s in most of the low altitude sites and up to 8-9 m/s in some of the best hill top sites); the legal and financial frameworks were not yet tailored to the specifics of wind energy; there were no driving forces in place to set the market in motion.

With the technology maturing and developing, and with national and international policies encouraging an increased use of renewable energy, a more suitable legal and financial framework for wind energy was put in place. Meanwhile, after an initial period of scepticism as to the environmental impact of wind farms, the public acceptance of wind energy was significantly increased, following several studies and the dissemination of information by key experts and authorities. Besides improvements in regulation and the ease of access to power production of independent power producers, the cost of renewable electricity was reduced, thus creating a more attractive framework for market growth. The revision of the feed-in tariff, first established in 1988, played a key role in this market growth. Its different stages of development showed a clear recognition by authorities of the potential contribution of wind energy to the Portuguese energy policy: increased use of national indigenous resources, improved security of supply and reduction of GHG emissions. The current target for wind energy is 3750 MWe by 2010, as part of an overall objective to reach 9680 MWe of installed capacity from renewable sources.

The results of this and other initiatives, such as the direct and regulated access to the public electric system (Decree Law 312/2001 of 10 December), the subsidy scheme under the PRIME (former POE) Programme and the more agile environmental permitting procedures (Joint Ministerial Dispatch n. 51/2004 of 31 January), will ultimately help to address Portugal's international commitment under the UNFCCC (Kyoto Protocol) and to reach the national target of 39% electricity consumption from renewable sources by the year 2010, stated in Directive 2001/77/EC.

2. Description of the case

This initiative takes the form of a feed-in tariff. It was first established by Decree-Law 189/88, which set up the rules applicable to the production of electricity from RES. At that time, tariffs

were undifferentiated for different renewable energy sources. In 1995, D.L. 186/95 and D.L. 313/95 introduced an autonomous regime for renewable electricity production, as part of the National Electrical System. Later, D.L. 168/99 introduced a complete change in the feed-in tariffs (increasing the price paid for renewable electricity), reorganised the regulatory process and changed the access mechanisms to grid connection. An environmental package associated with avoiding CO₂ emissions was then included in the new formula to determine the price paid to producers. This environmental package was determined based on 370 kg CO₂/MWh and 7.5 EUR/kg CO₂, thus resulting in about 28 EUR/MWh. There was then a general increase in the tariff (from less than 55 EUR/MWh to a maximum of 75 EUR/MWh), common to all RE technologies. In 2001, D.L. 339-C/2001 performed a further adjustment in the formulation that determines the feed-in tariff by introducing a coefficient Z that affects the environmental package differently according to the renewable energy technology. The sequence of changes introduced to the feed-in tariff is depicted in Figure 1.

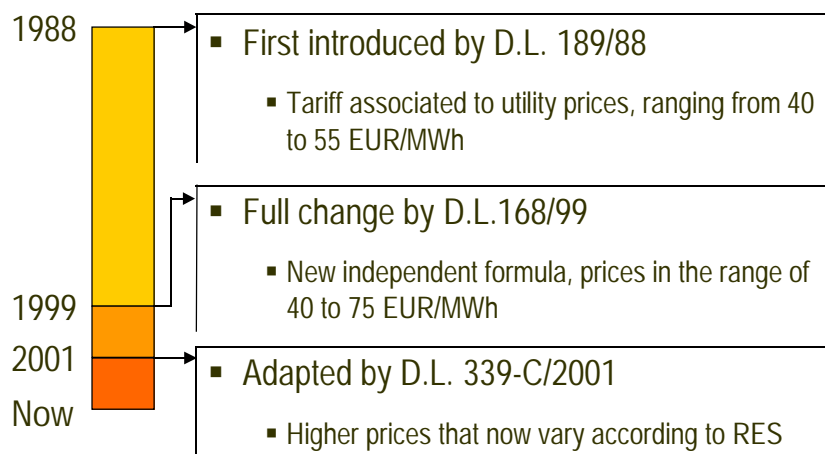


Figure 1 – Evolution of the feed-in tariff in Portugal

The current formula that determines the monthly payment to independent power producers using renewable resources is detailed in Figure 2.

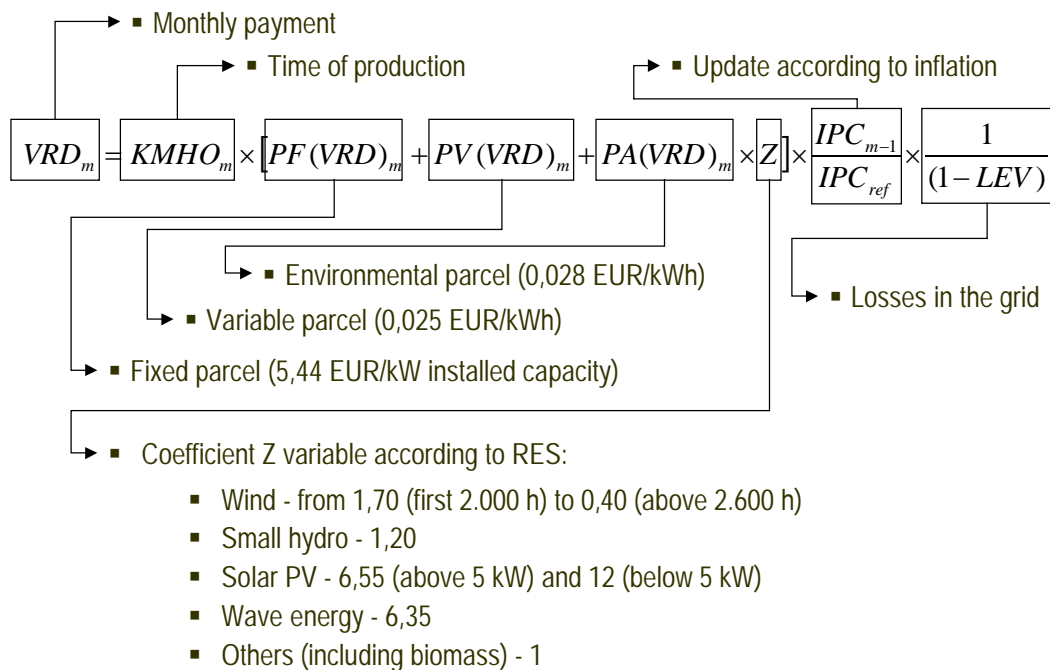


Figure 2 – Formula used to determine the monthly payment to renewable electricity producers (feed-in tariff).

In the case of wind energy, the coefficient Z introduced by D.L. 339-C/2001 varies from 1.70 for the first 2000 hours per year of electricity production to 0.65 for production above 2600 hours per year. This option rewards sites with limited wind resources, broadening the number of economically feasible projects.

Table I – Price range for the feed-in tariff according to the type of technology

RES	Specification	Coef. Z	Feed-in tariff (EUR/MWh)	
			Minimum	Maximum
Wind	Below 2000 h	1,70	52	100
	2000 to 2200 h	1,30	44	85
	2200 to 2400 h	0,95	38	72
	2400 to 2600 h	0,65	32	60
	Above 2600 h	0,40	26	52
Solar PV	> 5 kWp	6,35	150	285
	< 5 kWp	12,00	255	465
Small hydro		1,20	42	82
Wave energy		6,35	145	280
Other		1,00	40	75

An important aspect of the feed-in tariff is the fact that the formula presented in Figure 2 remains valid for 12 years, after which it is changed for the rest of the time of the IPP (independent power producer) licence. This change affects the environmental package, firstly by reducing it four-fold and, secondly, by removing the mechanism for linking it to inflation. Despite this reduction after 12 years, the fact that the monthly payment remains predictable provides safety for investors.

The feed-in tariff has been complemented by D.L. 312/2001, which establishes a clearer regime for the transfer to the public electricity system of the electricity supplied by IPPs (including renewable sources). Also, more recently, the Joint Ministerial Dispatch n. 51/2004 of 31 January 2004 was published to address the environmental permission process, making it faster and less bureaucratic, and aiming to reduce the time spent at this planning stage to a maximum of six months.

3. Results

Wind energy (on land) has been the renewable energy market segment of most interest during the last five years in Portugal (see Figure 3). A significant number of wind farms were built and several projects are now at different planning stages. From 19 MW in 1997, the installed capacity had increased to nearly 200 MW by the end of 2002. In that year, the production of wind electricity amounted to 0.24 TWh.

The reduced figure for power commissioned in 2003 was due to unusual circumstances and growth is expected to resume in the following years. A clear indication of this expected growth is the amount of applications for grid connection points already submitted, which account for 3250 MW of the 3750 MW target. More than 100 of these projects were already licensed and this can mean an additional 1100 MW coming online in the coming years. In addition to these evidences, in May 2004, 20 new projects were granted funds by the PRIME Programme, leading towards a further 244.5 MW of power. This is a total investment of 273.4 MEUR in forthcoming years, supported by 43.2 MEUR from the government.

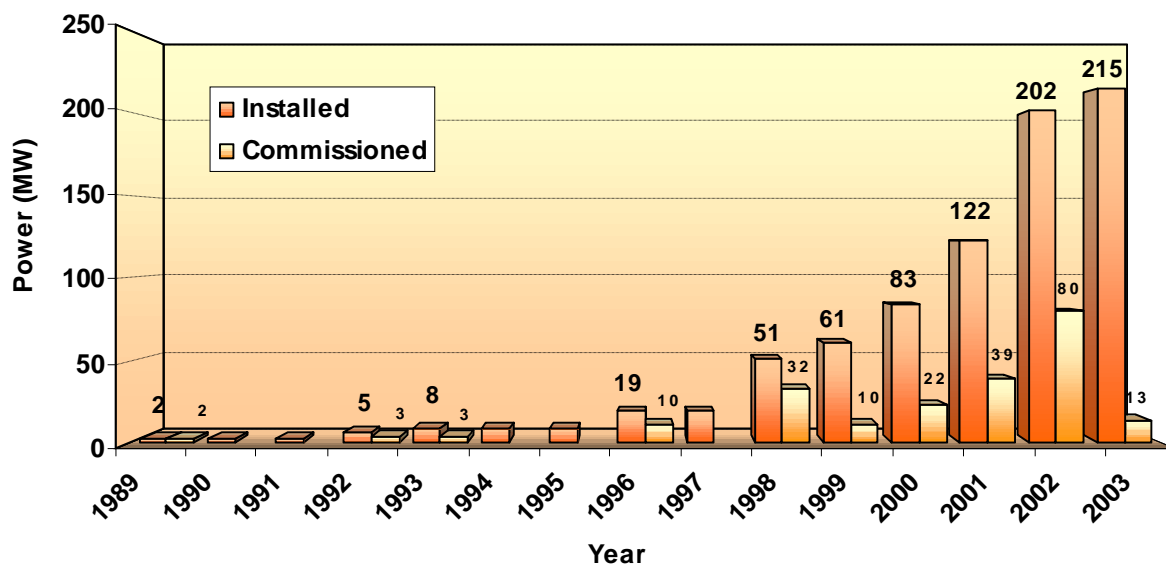


Figure 3 – Installed capacity for wind energy in Portugal from 1989 to 2003

The feed-in tariff was the main cause for the current interest in wind energy. This new market dynamic had several positive consequences, such as the creation of new jobs (not yet quantified) and that national industry can take part in the manufacturing of the wind generators, thus avoiding dependence on foreign manufactures and suppliers.

The total costs for putting the feed-in tariff into practice as a policy initiative may be estimated at 3800 million EUR capital cost to install 3750 MW of wind power by 2010, plus around 185 000 EUR year⁻¹ MW⁻¹ in payments by the public grid utility for the feed-in tariff. The total primary energy savings can be estimated at 31.1 PJ per year, based on a generation of 2.3 GWh year⁻¹ MW⁻¹ ("Forum - Renewable Energy in Portugal", ADENE/INETI, 2002; 1 GWh = 0.0036 PJ). The energy generated represents a displacement of 2600 ktonne CO₂ year⁻¹ (83.6 ktonne CO₂ PJ⁻¹).

4. Evaluation: Main elements of success and problems

Several actors played important roles in the success of wind energy in Portugal. Firstly, there are the actual promoters of the projects, who are a vital driving force for the sector. Despite the market being open to all players, the existing promoters now tend to comprise a small but active group of private investors with ambitious plans for further development of wind energy. Secondly, the financial institutions see wind projects as very attractive and are keen on making available the necessary funds for promoters to put their projects in practice. There is a special private fund – the NovEnergia2010 – created by several investors together with financial institutions, dedicated to investment and support of renewable energy projects with emphasis on wind. Thirdly, the municipalities, because D.L. 339-C-2001 defined that 2.5% of the price paid to wind farms for the electricity supplied to the grid must revert to the Municipality where the farm is located, were strongly stimulated to bring wind energy into their territory and also to be an active partner in an increasing number of wind projects. In some cases, this partnership was put into practice by the participation of the Municipality in companies created to own and explore the wind farms. The revenues are incorporated into the yearly budget of the Municipality and so are used for the welfare of local people.

Other success factors to be noted are:

1. The positive discrimination of wind energy in the formula that determines the feed-in tariff, particularly in those sites where the resource is less strongly available
2. The tariff being guaranteed for 12 years and, after that, there is only a reduction in the environmental premium
3. Wind energy emerging as a mature and reliable technology
4. The availability of a largely unexplored resource

This scheme was not subject to any particular promotion action, other than its presentation by national authorities and experts at renewable energy events.

The main bottleneck so far has been the limited capacity of the public grid, particularly in those regions where wind resources are available, which caused the Director General for Energy to suspend any calls for applications for further grid connection points, taking into account the limited grid capacity still available. The focus is now on putting to practice those projects that have been granted a grid connection, leaving the remaining 500 MW to be attributed at a later

stage. The market will continue to develop as the capacity of the grid is improved and technical restrictions are removed. To address this problem, a grid reinforcement plan was drawn up by the grid utility and is now being put into practice, including about 70 projects for new and upgraded grid infrastructures, a total investment of 110 MEUR by 2010, to cope with the additional capacity coming from renewable sources.

Another important barrier to the deployment of wind energy in Portugal has been the Environmental Impact Assessment (EIA) process that most wind projects must undergo. In general, wind farms with more than 20 towers or located less than 2 km away from another wind farm, as well as any project located in a sensitive area, must be submitted for an EIA. Despite being clearly regulated according to European directives, the EIA and – in particular the subsequent pronouncement by several environmental authorities – was, in practice, imposing severe restrictions on the fast development of wind projects. To overcome this situation, the Ministry of the Environment issued additional legislation in 2001 (Dispatches 11091/2001 and 12006/2001) and more recently in 2004 (Joint Ministerial Dispatch 51/2004) to facilitate and speed up the permitting process. These diplomas recognised the national interest of wind energy projects and introduced special but careful considerations for the specific case of wind farms to be sited in environmentally protected sensitive areas. This new framework should allow projects to have the necessary decisions regarding environmental issues in just six months.

5. Objectives for further development

Targets for wind energy have already been set at 3750 MW by the Council of Ministers Resolution 93/2003, providing an important contribution to reach the national target of 39% electricity consumption from renewable sources by the year 2010, as assumed under Directive 2001/77/EC. Although it has not been specified if this target is to be reached also using off-shore wind generation, it is generally admitted that only on-shore plants will be in place by 2010.

The feed-in tariff is an on-going policy instrument and is prepared for easy updating and change within the existing framework. Furthermore, other instruments that further aid the development of wind energy in Portugal can complement it. That is already the case of the PRIME programme (the former POE), that provides direct capital incentives for investment or support to interest payments in wind projects, and the NovEnergia 2010 fund that is used by national promoters of RE projects to help finance their projects.

6. Conclusions

The revised feed-in tariff had a strong and noticeable impact in the wind energy market in Portugal. Installed wind capacity has grown exponentially since 1999. Most RE initiatives have been covered by the feed-in tariff legislation, but wind has been the source that is most commonly utilised. Some details of the formula for the tariff and in the associated legislation were very important for the success of this instrument for wind energy and – as existing barriers are lifted – the market is expected to continue to grow at a very high rate.

The main attractions of the feed-in tariff are the positive discrimination of less windy sites and the price being guaranteed for 12 years. These bring wind energy into the category of financially safe projects, thus raising the interest of many investors. Additionally, the fact that municipalities now benefit directly from the income generated by those projects developed in their region was a major incentive for project development. This could be a promising option for other countries to increase the acceptance of wind projects by local authorities and to make good use of unused land.

However, it is crucial to have an adequate framework for the practical development of wind projects. As part of this, the planning and permission procedures must be carefully established. Aspects such as the capacity of the grid, the bureaucracy of the environmental process and the involvement of local agents are all important factors for success. Some of the experience gained with the Portuguese model on these aspects, and possible ways to overcome them, may be of interest to other member states.

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