BEE

Bundesverband Erneuerbare Energie e.V.

Supporting Renewable Electricity in the Market – Which are the best support schemes for RES electricity applied in Europe?

Ladies and Gentlemen,

2. As an example I will illustrate what has been achieved in the German wind energy market.
Up to 1990, renewable energy's share of the power supply comprised only 2.7%, almost all of which stemmed from hydropower. Today the proportion of renewables has reached about 8 % and is increasing by approximately 1% annually.
There are currently 130,000 jobs in the RES sector, 46,000 of which are related to the wind power industry, in total a €9 billion business.
This increase is due mainly to wind power, followed by biomass, hydropower and photovoltaics.

3. Within a period of 13 years, wind energy grew from nearly nothing to almost 5% of total power generation. Hence, wind's contribution to electricity generation increased faster than nuclear energy when it was first introduced to the market in the 1960's

That's an indication of some of wind energy's special advantages: it requires little planning time, makes hardly any demands on a country's infrastructure and the process of wind turbine production can tap the cost and time advantages of assembly line production. Wind energy is ideal for developing countries with their rapidly growing power demand.
Thus it will be possible to increase the share of wind-generated electricity in Germany from 5% today to 15% by 2020 – using the same number of machines and not including offshore wind power potential.
They have to pay fixed tariffs for this power.

4
2 Photos: a) Size comparison small machine – big machine
b) picture of wind farm

5 (Technical development of wind turbines)

Development 1990 – 2003:			current typical size:	
Capacity:		250 kW	> 4,5 MW	2 MW
Rotor diameter:		30 m	> 112 m	80 m
Hub height:		40 m	> 120 m	100 m
Annual output:	(kWh)	400,000	> 12 mil.	4.5 mil.
Design:		stall	> pitch control ,variable speed , growing number of gearless	

Consequence of technical development: To increase wind's share of electricity from 5% today to about 15% (onshore) by 2020, the number of machines (12,000) does not need to be raised. Offshore wind power can supply a further 15%. The production costs of wind-generated electricity have been reduced by more than 60%.

6 (Benefits)

RES will be the biggest factor in attaining the national Kyoto climate targets by 2010. (----%)

There are currently 130,000 jobs in the RES sector, 40,000 of which are related to wind power, a €9 billion industry.

Development of a new industry with technologically sophisticated products that are ideally suited for export.

Renewable energy expansion is taking place in thousands of new companies which safeguard high growth and vitality, contribute to more widespread public acceptance of RES locally and are an inherent part of democratic society – as opposed to the generally autocratic centralized structures of the old energy economy.

7 (Ingredients of success)
Policy frameworks have been an overriding factor of success.
For example subsidy programmes from state budgetary funds for the first phase of market introduction, such as the 100,000 PV roofs program.
Steady and continuous growth since 1990 was fostered primarily by the German Feed-In Law (*Stromeinspeisungsgesetz*) and then the Renewable Energy Sources Act (EEG) which went into force in 2000.

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Central points of the EEG's mechanisms are:
The utilities are obligated to connect renewables power plants to their networks and take in the electricity from these plants.
They have to pay fixed tariffs for this power.

9 (Quantity equalization and distribution of electricity

9.1 Local grid operators sell their power to their transmission grid operators.
9.2 The transmission grid operators allocate the amounts of power among themselves so that each of them has the same proportion (percentage-wise) based on their network's power sales.
9.3 The transmission grid operators sell the electricity to power retailers, who in turn deliver it in the same proportion as part of their total mix (i.e. together with power from conventional power stations) to customers.
9.4 The power retailers add the incremental costs for electricity from the EEG on their invoices to customers. Currently that's about 0.3 euro cents/kWh.
This scheme means that all consumers participate evenly in the intake and financing of renewably sourced electricity and that there are no regional imbalances. It is key that consumers carry the costs of production and no state funds go toward financing (i.e. no subsidies).

10.
There are four types of price differentiation that make the EEG a cost-efficient tool. I define cost efficiency in this context as the minimum price per kilowatt-hour that is required to provide enough incentive to invest in a particular renewable energy project. The four types of differentiation are:

1. Differentiating between the various technologies creates the foundation for parallel development, for example with PV, which is still rather costly but has huge potential for becoming cost-effective.
2. Differentiating between plant sizes enables a high degree of tapping potential at low cost. (Example: biomass)
3. The remuneration rates for new plants decrease yearly to accelerate the pace of technological progress, which translates into sinking costs for consumers. The descending tariffs have stimulated enormous advances in wind turbine technology.
4. A very specific topic in the EEG is the differentiation between the profitability of wind energy sites using the Reference Revenue Model. I will explain this in more detail later.

11./12 Costs

13. A comparison of various promotion schemes in Europe reveals that the countries which have been most successful in promoting renewables are those with legally fixed price schemes in place. It's very noteworthy that in stark contrast to economic theory, quota models have led to higher prices on average than fixed price regulations.
Upon closer look, however, this phenomenon makes perfect sense: There are a multitude of uncertainties during the phase of market introduction. If there is the additional fear of strongly

fluctuating market prices for the product electricity, then financing projects is either altogether impossible or it is only possible in conjunction with high risk premiums. That would exclude many of the smaller, more cost-effective players from the market

14. The following conclusions can be drawn:
Stable and reliable economic parameters are important and provide planning security.
Stop-and-go conditions are poison for successful market introduction.
Promotion measures from the state budget that are constantly subject to change are not very convincing.
Solid legal groundwork of financing drawn from the market and based on energy consumption provides a reliable framework for new projects and new players in the market.

The instruments of promotion should be transparent and free of red tape for all market participants.

A decentralized industry structure involving many companies is a good foundation for tapping potential cost-effectively.
The economic involvement of many players creates a positive attitude toward renewable energy sources which impacts the political arena accordingly.

15. The Reference Revenue Model - the differentiation between the profitability of wind energy sites

(production cost dep. on site quality)
On a nation-wide level, you often find that the quality of wind sites covers a very wide spectrum. In other words, average wind speeds can be very different from site to site. That in turn means that the costs of producing wind-generated electricity can vary greatly, depending on the site. If you want to tap a certain amount of the nation's total wind energy potential, then you have to look at all the sites you intend to use. Of these, you must pick out the "worst" site and ensure that the remuneration you pay per kWh is enough to cover the production costs at this site. In simple fixed-price models or regular quota systems with no price differentiation, this would be the benchmark remuneration rate for all sites. But in a scheme that allows for price differentiation, this benchmark rate can still be used to ensure that low quality sites are profitable and better sites can be paid a lower remuneration rate. This cuts costs considerably.
But if you want to adapt the remuneration to the site profitability you must gather reliable information about the wind speed conditions at each site. As you can imagine, expert projections vary to a great degree, which is not viable.
On the other hand, precise wind speed measurements take years.
The trick of the Reference Revenue Model in the EEG is to use the installed wind turbine itself as a measuring device.
In the end you have ensured that the low quality sites are profitable, high quality sites aren't being paid too much. And most importantly, you have tapped the total intended potential fairly and economically.

16. – 18. (Reference Revenue Model)
During a measuring period of five years, the EEG tariff for wind energy is kept at a uniform level of 8.9 cents/kWh for all sites. After this time, the wind site is evaluated by comparing the actual output of each turbine with the reference yield of this particular type of turbine at a defined average wind site – a so-called reference site. The reference yield is calculated by applying the power curve of that type of turbine to the wind speed conditions at the defined reference site. The higher the actual yield is above the reference level, the sooner the tariff will be reduced to 5.9 cents/kWh in the subsequent years. Extension of the higher initial tariff can vary from zero years at very profitable sites to 15 years at sites which produce half the output compared to the best sites.
Altogether, different extension times lead to different remuneration rates in the average over a 20-year period.

The features of the model are as follows:

1) The amount of aid needed to make a wind turbine investment profitable can be adjusted to different wind resources without any bureaucratic intervention. Therefore the volume of aid is altogether less than with schemes that promote all sites uniformly.

2) Since the calculation of reference yield of turbines is based on power curves according to obligatory legal standards, it is easier to evaluate the efficiency of different types of turbines. The use of reference yields provides transparency in determining tariffs and facilitates comparisons of different wind turbine designs and manufacturers, thus stimulating competition.

3) The reference yield model is neutral to different technologies. Determining the feed-in tariff does not depend on nominal power or rotor diameter. It rewards all improvements to wind turbines' profitability without favouring particular technical characteristics.

4) The comparability of typical reference yields permits banks and investors to easily evaluate the prospective financial performance of any wind power project.

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