Wind Power Development in France from January 2011 to June 2012 with some Comparisons with Germany

B. Chabot, BCCONSULT

The Context: Historical Wind Power Development and 2020 Targets in France and in Germany

Wind power development started in France mainly after the publication of the June 2001 feed-in tariffs for onshore wind. Fig. 1 summarizes this development from 2002 to the end of 2011 from reference [1], both for installed total power (in MW) at the end of years, yearly installed power (in MW/year) and for electricity production (in GWh/year). On the same figure, data from the French National Renewable Energy Plan to apply the April 2009 European directive on renewable energy [2] are plotted in dotted lines. One can see that there is a difference of 6 TWh between the historical 2011 wind energy production (11.9 TWh) and the 2012 target of 17.9 TWh published in 2010. This difference is mainly due to the decrease of yearly installed power in recent years (875 MW in 2011 versus 1190 MW in 2010 and versus the historical maximum of 1247 MW in 2009). From 2012 some new and complex regulation for wind power projects [3] may make difficult a new increase of yearly installed wind power in coming years. The 2020 French target is 25 GW, of which 6 GW offshore, with a total for 2020 electricity production of around 58 TWh (40 TWh from onshore wind and 18 TWh from offshore wind). Fig. 2 provides the same information for wind power development in Germany from references [4], [5], [6]. As this development started before France (from the first Feed-in Tariffs in 1991 and then from those defined in the German renewable energy law (EEG) passed in April 2000), wind power production was already 46.5 TWh in 2011 and the target for 2020 from the German NREAP [6] is more than 104 TWh (73.6 TWh from 35.75 GW onshore wind and 31.7 TWh from 10 GW offshore wind), around twice the French wind production targeted for 2020. There is also a difference of 6.5 TWh between the 2011 production (46.5 TWh) and the one targeted for 2012 in the German NREAP (53 TWh). This difference is in proportion smaller than in France, and it may be due for a small part to a delay for offshore wind projects (1.9 TWh anticipated for 2012 in the NREAP, but the total grid connected offshore wind turbines according to [5] was only 0.2 GW at the end of 2011), and to another part to low wind conditions in Germany from 2008 to 2011.

If the 2020 targets of the French national renewable action plan are met, with a total of 155.3 TWh (including the existing large hydropower production estimated to around 62 TWh/year), electricity from renewable energy sources would represent 27 % of the national demand for electricity. Thus, in 2020 wind power would provide 10 % of this demand and 37.3 % of electricity production from renewables. In Germany, with a total of 216.9 TWh (40 % more than in France, including the around 13 TWh/year from large existing Ger-
man hydropower plants), electricity from renewable energy sources would represent 35 % of the 2020 national demand for electricity and so, wind power would provide 16.8 % of this demand and 48 % of electricity from renewables. Thus, beyond the differences in TWh from wind power targeted for 2020, both in France and in Germany, achieving or exceeding those wind power targets is a must if the global targets for electricity and so, wind power would provide 16.8 % of this demand and 48 % of electricity from renewables. Thus, beyond the differences in TWh from wind power targeted for 2020, both in France and in Germany, achieving or exceeding those wind power targets is a must if the global targets for electricity from renewable energy sources are to be met.

**Monthly Wind Power Performance in France from January 2011 to June 2012**

Fig. 3 shows the average daily electricity production from wind power in France (only onshore at the moment) from January 2011 to June 2012. Calculation is made from raw data published on the RTE web site [7]. Those RTE data are only provisional and indicative, and potential errors resulting from using them would not be the responsibility of RTE. Final data may differ slightly from those provisional ones, and they are only for continental France, without Corsica and overseas department, that is why final monthly official wind power statistics for France, as for example in [8] or in [9] can be slightly different. The total production for 2011 was 11.278 TWh (30.9 GWh/day on average) and 6.63 TWh in the first half of 2012 (36.3 GWh/day on average).

As often in Europe, maximum wind energy production is during cold months. This is an advantage as electricity demand in France is higher during those months due to a large demand from domestic buildings electric heating, as shown in Fig. 4. Highest peak demand was 101.7 GW in February 2012 and the lowest 30.4 GW in August 2011. Wind power part of the daily demand is shown in Fig. 5. The average was 2.36 % in 2011 and 2.66 % in the first half of 2012. It is important to note that the maximum monthly average wind energy contribution to the demand was in December 2011 (3.72 %, thus 58 % more than the 2011 mean value of 2.36 %). It was also the case for the maximum daily demand coverage: 7.6 % in December 2011.

Wind power productivity defined as the ratio of daily production by installed capacity (equivalent to a potential daily average number of operation at rated power or “full load hours”) is also higher in cold months, as shown in Fig. 6: maximum value was in December 2011 (8.57 Wh/W.day) and the minimum one in August 2011 (3.38 Wh/W.day). Corresponding average daily capacity factors were 35.7 % and 14 % and 20.6 % for average 2011 value, corresponding to an average 2011 productivity of 1806 hours/year or 4.95 hours/day of operation at equivalent rated power. Average daily productivity was 8.7 % higher in the first half of 2012 at 5.38 Wh/W.day.
Fig. 5: Part of French electricity demand covered by wind power (%).

Fig. 6: Monthly average daily wind power productivity (Wh/W.day) in France.

Fig. 7: Wind power production in France in January 2012 (averaged MW on 15 minutes periods).

Fig. 8: Wind power production in France on January 22nd, 2012.

Fig. 9: Daily wind power (MW) in France in January 2012.

Fig. 10: Part of French electricity demand covered by wind power in France in January 2012 (%).

Fig. 11: Daily wind power production in France in January 2012 (GWh/day).
Examples of Hourly and Daily Wind Power Performance in France: January 2012

Fig. 7 shows wind power output in France from [7], in average MW measured during 15 minutes. Fig. 8 shows that wind power variation within a day with largest ones, as January 22nd is manageable. The maximum power decrease was around 0.5 GW/hour. As an example of detailed monthly analysis than can be made from RTE public data, Fig. 9, 10 and 11 detail daily January wind power performance in France. Fig. 9 shows the minimum, maximum and average daily power (in MW) measured by RTE in continental France within 15 minutes periods. The range was from 367 to 4636 MW, and the monthly average 1794 MW. Fig. 10 details the daily share of the French electricity demand covered by wind power during 15 minutes periods. In January 2012, the range was from 0.79 to 10.46, with an average value of 2.66 %. Fig. 11 shows the daily wind power production. The range was from 14.7 GWh/day to 103.9 GWh/day and the average value 43.06 GWh/day for the total 1.335 TWh delivered from wind power in January 2012.

Example of Comparisons of Wind Power Performance in France and Germany: January 2012

End of December 2011, there was a large difference between total installed wind power in Germany (29.075 GW) and in France (6.64 GW, 4.38 times less than in Germany). Of course, this difference is also important in terms of wind power production profiles, as shown in Fig. 12: monthly production was 9.459 TWh in Germany, 5.27 times more than the 1.794 TWh in France. Wind data for Germany are from the European Energy Exchange (EEX) web site [10], also from 15 minutes periods.

Using capacity factors measured and calculated on 15 minutes periods as in Fig. 13 gives a more interesting view of wind power productivity and wind power regimes in the two countries in January 2012. The average monthly German wind capacity factor (from a production almost completely from onshore wind installations) was 32.5 % compared to 27 % in France. This 20 % difference may result from a larger part from different wind regimes in the two countries during January 2012, and from a lesser part from differences in wind turbines ratings in the two countries in terms of specific power expressed in Watts of rated power per square meters of swept areas if this ratio is on average lower in Germany than in France.

As those capacity factors are mainly related to the average wind speeds on 15 minutes steps at hubs heights, it is very interesting to see that in this winter critical period, there were periods when those two capacity factors, and so the two wind regimes in France and in Germany, are not correlated, as from January 11 to 16. This is an obvious advantage in the future to potentially exchange wind energy between the two countries in order to compensate the relative strength and weak wind regimes at the same time in the two countries.

Conclusion

Availability of detailed and public data on wind power statistics and on real field performance is a very interesting
advantage in order to analyze and to compare wind profiles, wind production and wind productivity ratios within a country and between European countries, as shown here for France and Germany. Expanding this transparency policy and standardizing the related methodologies and detailed public results to all other European countries and to all renewable technologies for electricity production would facilitate comparisons and monitoring of progress towards the national and European Union 2020 targets of the April 2009 directive on renewable energy. Related potentially required changes in national and European related policies would also benefit from this kind of analysis.

References

Fig. 12: Wind power production in France and in Germany in January 2012.

Fig. 13: Average Wind power Capacity Factors in France and in Germany in January 2012.