IEAGHG Information Paper; 2014-IP13: Record electricity generation from renewables in Germany

Fraunhofer ISE recently released electricity generation data for Germany for the first half of 2014, including the share from renewables.

In the first half of 2014 renewable energy, i.e. wind, solar, biomass and hydro, contributed about 31% to Germany's electricity generation. This was mainly possible due to favourable weather conditions, i.e. an abundance of wind and sunshine compared to the average year, but the growing production from renewables, especially wind and solar, played an important role as well.

Figure 1 shows the contribution of all fuel types to German electricity production during the first six months of 2014. Compared to 2013, non-hydro renewables increased from 24% to 27% of the total electricity production. In particular, solar increased by 28%, wind by 19% and biomass by 7%. In contrast, the electricity production from hydro power decreased by 7%. For the first time ever, the share of renewables was higher than the share of brown coal, for which electricity production declined by 4% compared to 2013. However, the contribution of brown and hard coal, which decreased by 11%, to the electricity mix are still above the average of the last 10 years. Overall, gas fired power plants experienced the largest decline, producing about 25% less than in 2013.

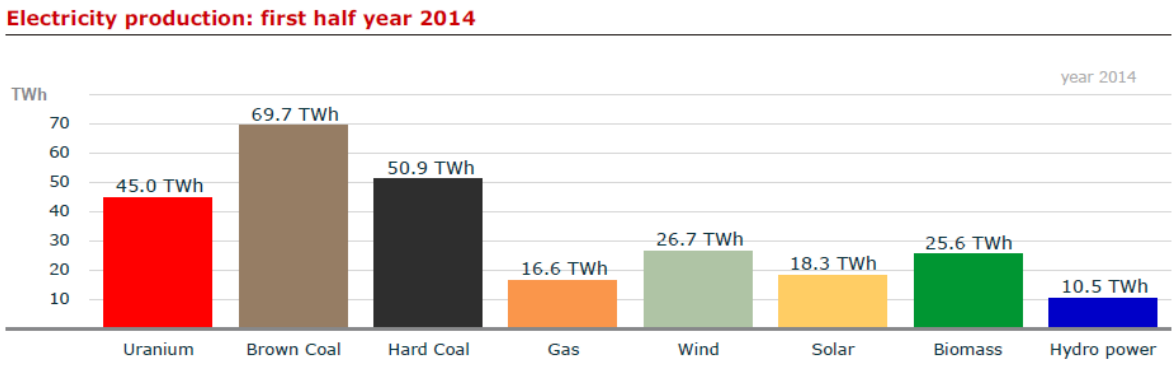

Figure 1 Electricity production in Germany for the first half of 2014 (Fraunhofer ISE, 2014)

In May, renewables could temporarily account for 75% of the power demand. Solar power achieved another record in June, when it generated about 50% of the overall electricity demand. Favourable weather conditions in combination with a low demand due to a public holiday were the main reason for this. Notwithstanding, despite the high electricity production by renewables, there is no major reduction in conventional generation, in particular from coal. This lead to an export surplus of approximately 18 TWh in the first half of 2014 (see Figure 2).

If the trend continues until the end of the year, then Germany will achieve a record here as well, most likely outperforming the huge export surplus of 2012 and 2013. The main importers of German electricity are The Netherlands (with transit to Belgium and UK), Austria, Switzerland (with transit to Italy) and Poland. So it looks as if the exports are keeping electricity generation from coal fired plants high, which would be otherwise offset by renewables. However, it is still an open debate whether the switch to renewables or the exports are the main reason for a missing, significant reduction in coal fired power generation[1]. An important question for future investigation is how to consistently buffer the unreliable outputs of wind and solar without increasing coal-based back-up power.

[1] Greg Morris wrote an insightful blog about this issue:
http://www.renewablesinternational.net/german-coal-power-for-export/150/537/76783/

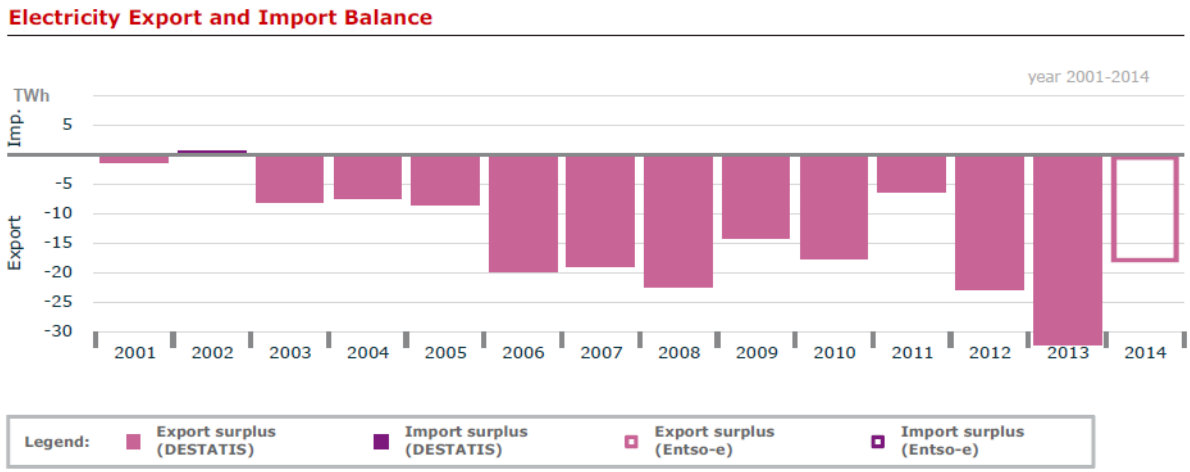

Figure 2 German electricity import and export balance since 2001 (Fraunhofer ISE, 2014)

The electricity production data of Fraunhofer ISE is available either as an extensive slide pack[2] or via an online tool[3] on their website. Both contain energy data and power curves on an annual, monthly, weekly and even daily basis, which is updated regularly. Fraunhofer's online tool also includes spot prices.

Furthermore, the German Association of Energy and Water Industries (BDEW) published a short paper on the price situation[4]. The high exports are mainly due to the low prices at the German electricity market, compared to e.g. The Netherlands, France, Switzerland (ca. 5-8 €/MWh less in 2012). Three reasons for the low prices are the low marginal cost of conventional electricity generation from nuclear and coal, renewables entering the market at zero marginal cost and low CO_2 prices lessening the competitive disadvantage of brown coal.

What the export situation means in term of CO_2 emissions is another issue that needs consideration. Figure 3 shows the CO_2 emissions from electricity production in Germany since 2003, with a break-down into emissions related to domestic production and to electricity exports. Both are on the rise again compared to the situation during the 2009 economic crisis but in 2013 the domestic emissions decreased for the first time after the crisis, with the growing renewables clearly contributing. Emissions from exported electricity, however, reached an all-time high since 2003, so might be an area of concern in the future if the trend continues.

[2] http://www.ise.fraunhofer.de/en/renewable-energy-data?set_language=en
[3] https://www.energy-charts.de/index.htm
[4] https://bdew.de/internet.nsf/id/20140114-pi-mueller-grundlegende-reform-des-eeg-ist-eine-kernaufgabe-der-neuen-bundesregierung-2014/$file/BDEW%20Hintergrundinformationen%20Stromaustausch%20mit%20dem%20Ausland.pdf

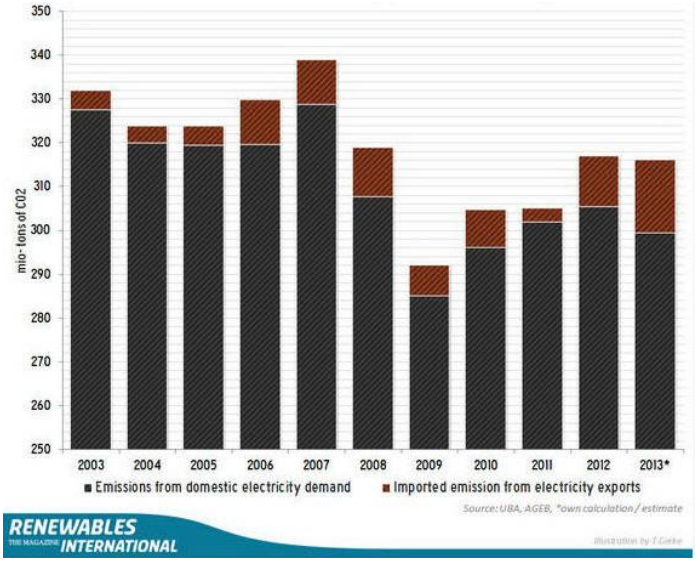

Figure 3 CO_2 emissions from electricity production in Germany[5]

Besides these surrounding issues, it seems that Germany's *Energiewende* (energy transition) is well on track to achieve its target of 80% renewable energy generation in 2050 and it demonstrates that the integration of high shares of renewables into the grid is doable and feasible. It will be interesting to watch Germany in its role as an early mover here and to see if and how it will work out. Another interesting topic is the impact that the nuclear phase-out until 2021 will have on the energy mix of the future. Apart from further expanding renewables, maximising energy efficiency and restructuring the energy sector, in my opinion development of cost-effective, long-term storage technologies for electricity will be essential to prevent a shift to more coal-generated electricity or a shift of nuclear power plants to other EU countries.

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[5] http://www.renewablesinternational.net/did-co2-emissions-from-german-power-sector-drop-in-2013/150/537/75866/