Svensk Vindenergi

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Flawed assumptions with respect to renewable energy in the European Commission's impact assessment

Summary

The European Commission's impact assessment for climate and energy policies until 2030 contain several flawed assumptions with respect to renewable electricity production in Sweden.

- Onshore wind power in Sweden is already cheaper than the EC estimates for 2050
- The efficiency of onshore wind power in Sweden is already higher (35 percent) than the EC estimates for 2050 (32percent)
- The real expansion of wind power in Sweden by 2015 will exceed the EC´s forecasts for 2030
- The investment cost of offshore wind power in the Baltic Sea is already lower than the investment cost predicted by the EC for 2050.
- The cost of solar power has been overestimated in comparison with other analyses
- Investment cost of nuclear power has been underestimated compared with ongoing projects in Europe
- The assumed capacity factor (90 percent) of nuclear power has been overestimated compared with the historical average in Sweden (75 percent)
- Nuclear power production in Sweden up to 2050 has been overestimated

Taken together, these flawed assumptions lead to scenarios involving a higher proportion of renewable energy sources being made to look more expensive than they really are.

Introduction

On 22 January, the EC presented its proposed energy and climate targets for 2030. The proposal was accompanied by a detailed impact assessment[1] for different targets and target levels. The impact assessment was based on a reference scenario explained in detail in the document *EU Energy, transport and GHG emission trends to 2050, Reference scenario 2013*[2]. The reference scenario makes assumptions with respect to technical development, investment cost etc. for different technologies until the year 2050. These assumptions form the basis for the various scenarios used in the EC's impact assessment.

The Swedish Wind Energy Association (SWEA) has examined the assumptions used in the reference scenario for Sweden with respect to wind power and other energy production techniques, and has concluded that they contain major errors which, when taken together, lead to a significant

[1] http://ec.europa.eu/energy/doc/2030/20140122_impact_assessment.pdf
[2] http://ec.europa.eu/energy/observatory/trends_2030/doc/trends_to_2050_update_2013.pdf

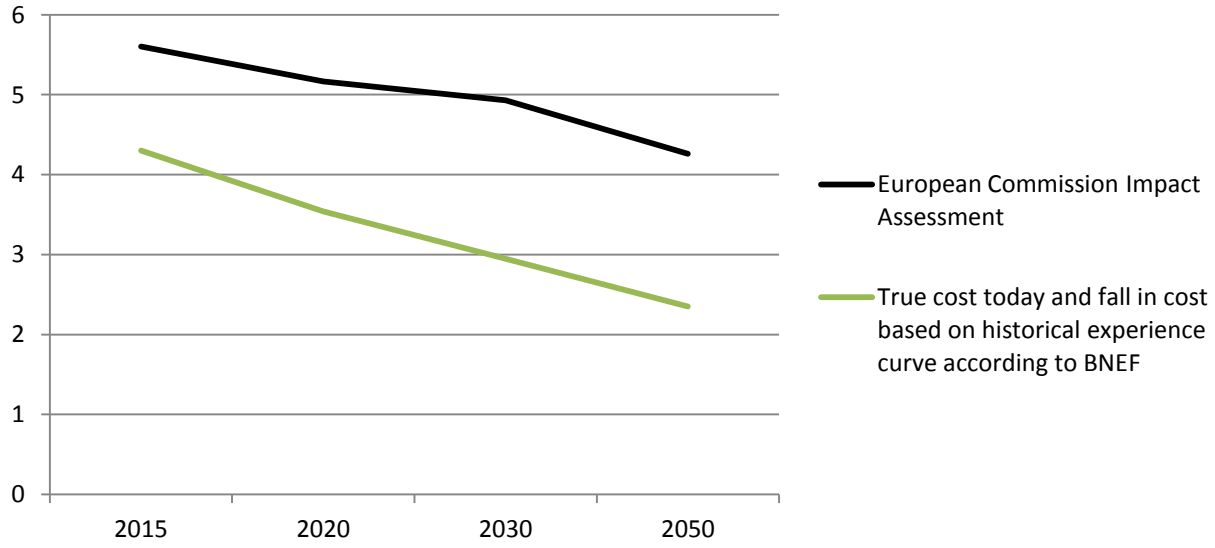
underestimate of the potential for renewable energy. The flawed assumptions results in a high renewable energy target being represented as more expensive than it actually would be.

The following is a review of the flawed assumptions for energy production in the impact assessment. The main focus is on wind power, but solar power and nuclear power have also been examined in general terms. Please note that the EC has made specific assumptions for each country. This analysis only relates to the assumptions made for Sweden.

Onshore wind power

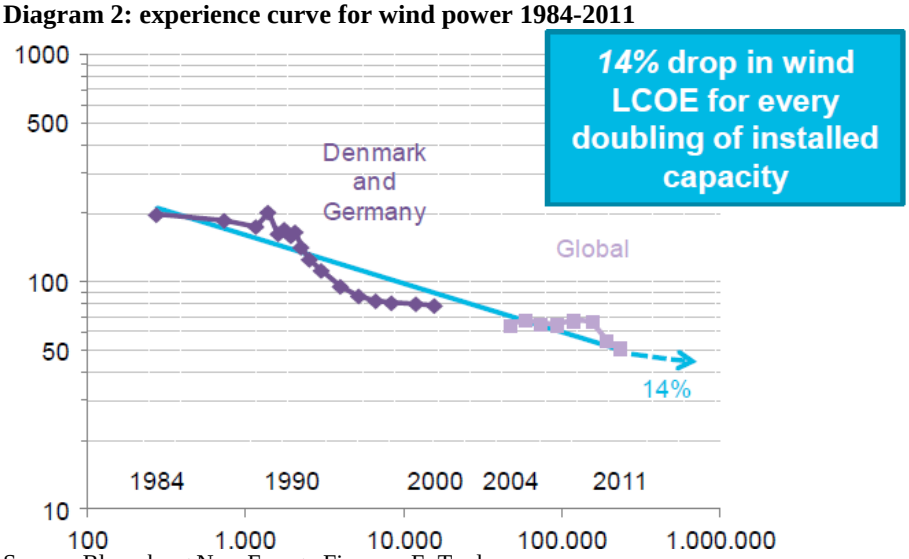
Onshore wind power is currently built in Sweden at around SEK 0,5-0,6 per kWh which corresponds to an investment cost of SEK 4,3 per annual kilowatt hour (investment/yearly production). The underlying documentation makes no mention of what investment cost per annual kWh the EC has assumed, but the information can be obtained by dividing the investment cost specified by the estimated production. Doing so shows that the EC has based its estimates on an investment cost per annual kWh of SEK 5.6 in 2015, i.e. 30 percent higher than the actual cost today. The EC also estimates that, by 2050, onshore wind power can be built at an investment cost per annual kWh of SEK 4.26, i.e. the same cost that Sweden is building wind power at in 2014. Given the assumption that the historical fall in cost of wind power (-14 percent per doubled installed capacity globally) will continue and that installations continue at the same level as in 2012-13, the EC has overestimated the cost of wind power by 67 percent in 2030, and by over 80 percent in 2050.

Diagram 1: Investment cost per annual kWh (investment/yearly production) of onshore wind power



Source: EU Energy, transport and GHG emission trends to 2050, Reference scenario 2013 (data from page 18 and 143). True cost today and assumption of fall in cost from Bloomberg New Energy Finance

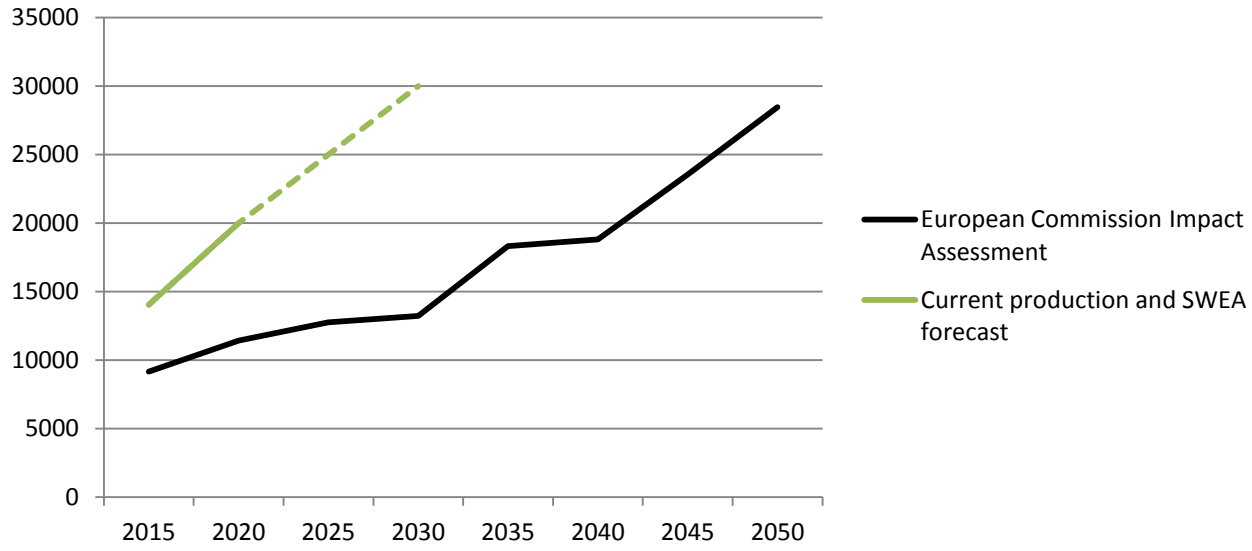
Diagram 2: experience curve for wind power 1984-2011



Source: Bloomberg New Energy Finance, ExTool

The EC estimates that, by 2020, Sweden will produce 11.4 TWh of wind power. During 2014, wind power production will already pass the 11.4 TWh mark, and SWEA expects production to have reached around 20 TWh[3] by 2020. The EC also expects wind power production to reach 13.2 TWh by 2030, a target which Sweden is certain to pass as early as 2015, i.e. 15 years before the EC's expected date.

Diagram 2: Wind power production in Sweden



Source: EU Energy, transport and GHG emission trends to 2050, Reference scenario 2013 (data from page 143). SWEA

The assumption which has the greatest impact on the EC's overestimate of the cost of wind power relates to how efficient a wind turbine is at producing electricity. The underlying document does not specify the capacity factor the EC has used in its calculations, but dividing production by nameplate capacity indicates that the EC has estimated that wind power, between now and 2030, will deliver around 2,500 full load hours, equivalent to a 29 percent capacity factor. The EC estimates that efficiency will increase to 2,700 full load hours by 2050, equivalent to a capacity factor of 32 percent. The onshore wind turbines currently under construction in Sweden deliver, on average, 3,100 full load

[3] Given correct technical adjustments at control station 2015 and the current plans for the green certificate system.

hours, equivalent to a capacity factor of 35 percent. Wind power is, consequently, more efficient today than the EC expects it to be by 2050.

Offshore wind power

The potential of offshore wind power has also been significantly underestimated. The EC estimates investment cost at €4,500/kW in 2015. There are currently examples of offshore wind power in Sweden which have been built at a cost of €2,770/MW[4], i.e. almost 40 percent cheaper than the EC estimate. The EC also estimates that, by 2030, investment cost will be €3,507/kW and, by 2050, €2,829/MW. Consequently, the EC believes that, by 2050, offshore wind power will be more expensive than the actual cost of wind power construction in Sweden in 2013.The main explanation for this is probably the fact that the reference scenario has completely ignored the "inland sea technology" relevant to the Baltic Sea and the Kattegat, and has only used North Sea technology in its estimates.

Since offshore wind power is not included in the reference scenario for Sweden, it is impossible to work out what assumptions the EC has made with respect to the investment cost per annual kWh, but given that offshore wind power will see the same fall in cost as onshore wind power (-14 percent per doubled installed capacity globally), any assumption which completely ignores offshore wind power until 2050 is unreasonable. There is also reason to believe that the potential fall in cost of offshore wind power may be even greater since, at present, the technology involved is less mature than that of onshore wind power.

Other types of power

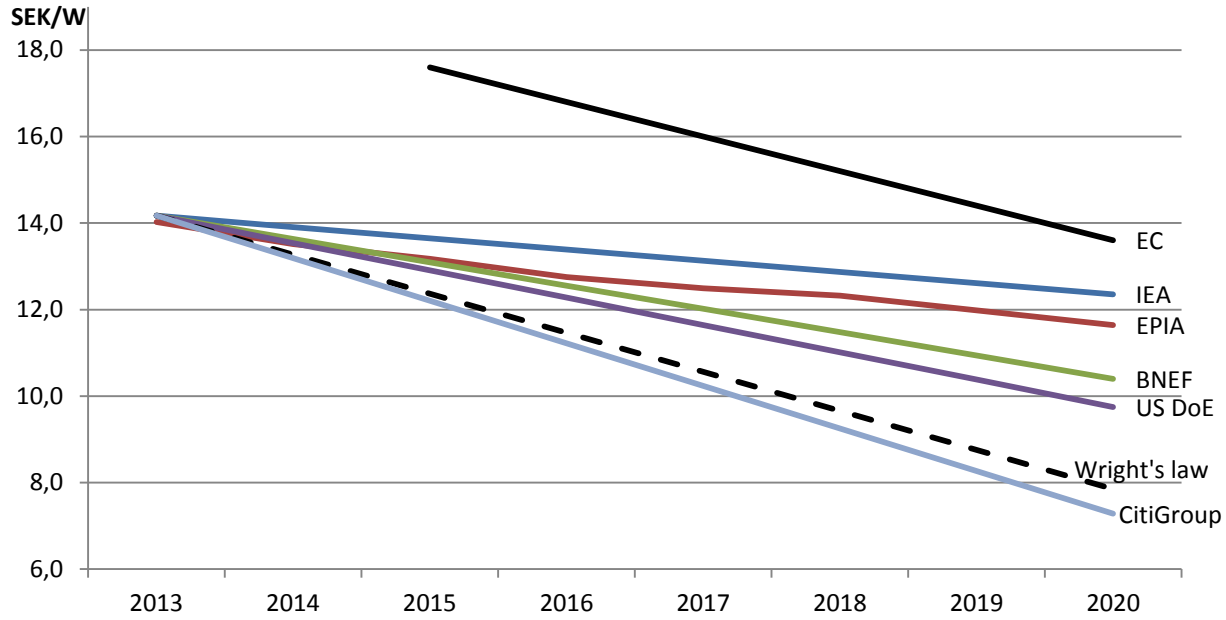
Solar power

With respect to the cost of solar power, the EC estimates that large-scale solar power (which is cheaper than small-scale solar power) will cost €1,508/kW by 2020. This cost is significantly higher than the cost of small-scale solar power estimated by most of the major analysis institutes.

The "Wright's law" curve in diagram 3 below shows the price trend in accordance with the principle that the price falls by 20 percent when the installed capacity doubles. Historically, solar power has benefitted from a fall in cost of 19.6 percent each time installed capacity doubles.

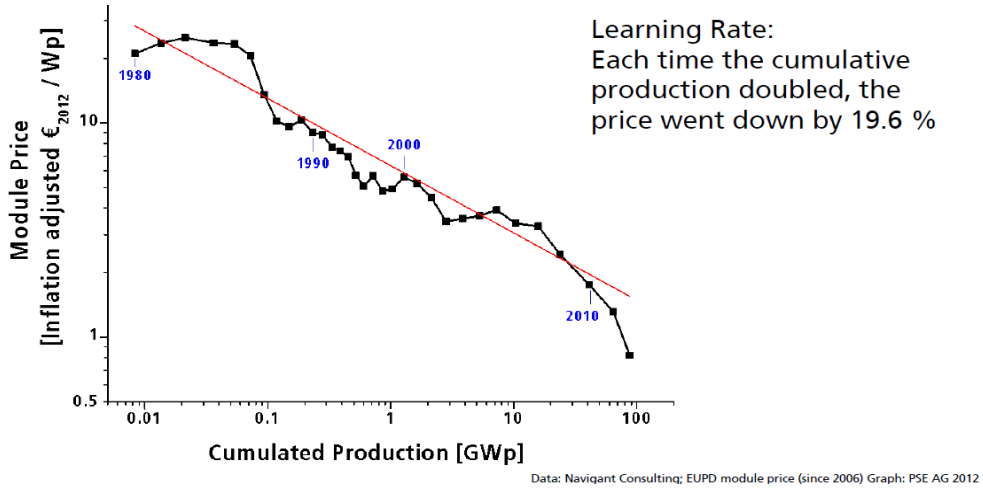
[4] Is also in line with the estimates presented to the Nordic Council of Ministers, http://www.nordicenergy.org/wp-content/uploads/2013/09/THEMA-report-2013-12-Offshore-wind-farms-as-joint-projects_final-report.pdf

Diagram 3: Investment cost SEK/W – small-scale solar power



Source: EU Energy, transport and GHG emission trends to 2050, Reference scenario 2013 (data from page 18). Summary by SWEA. Other data from individual institutes. Currency exchange rate SEK 9/€.

Diagram 4: Experience curve for solar cells 1980-2012



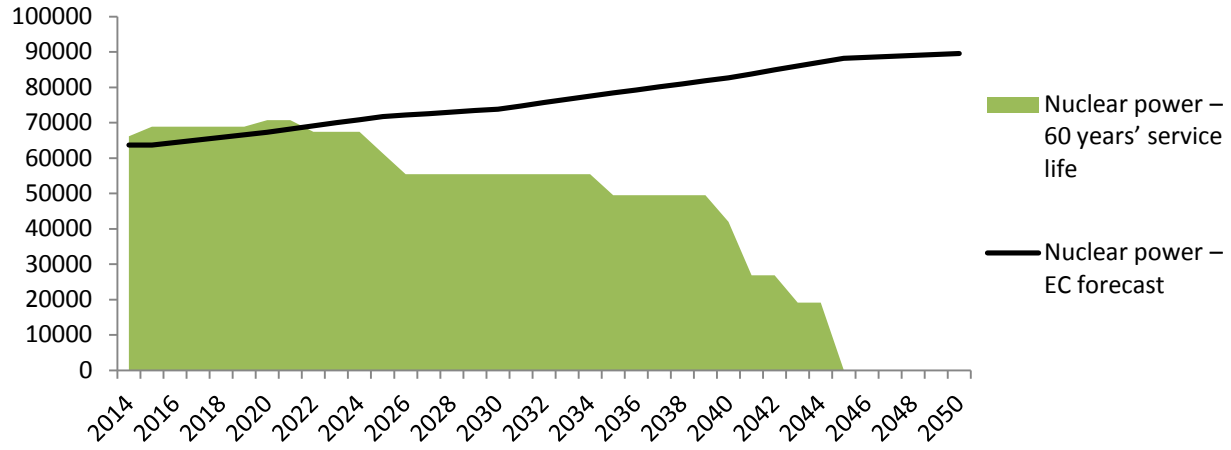
Nuclear power

The EC estimates that, by 2030, nuclear power in Sweden will be producing 74 TWh, with the figure rising to 90 TWh by 2050, despite the fact that over this period, existing nuclear power facilities will be phased out. With an operating period of 60 years, the last of the current nuclear powers plants will be decommissioned in 2045. Even if investments are made in new nuclear power plants, it is debatable whether there will be such a dramatic increase by 2050.

The nuclear power companies have also announced that it will be at least 10 years[5] before a decision is made about new investments, which means that the earliest any new nuclear power can be brought on-line is around 2030.

[5] *"But much work is still to be done and we won't be making a decision on any investment for at least ten years"* Torbjörn Wahlborg in an article in Dagens Industri 29 January 2014

Diagram 5: Nuclear power production in Sweden, GWh

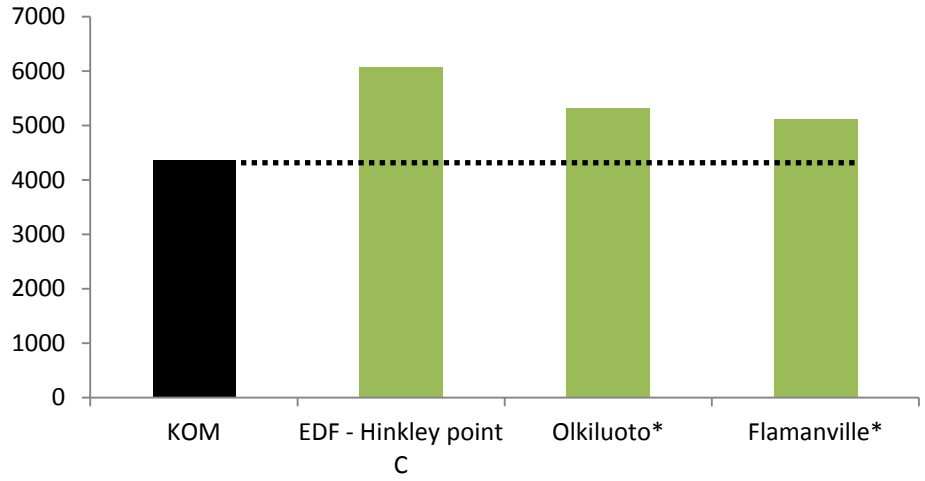


Source: EU Energy, transport and GHG emission trends to 2050, Reference scenario 2013 (data from page 143). Production from current nuclear power compiled by SWEA.

The EC estimates that nuclear power in Sweden, despite ageing reactors, will have a capacity factor of more than 90 percent from the 2020s. According to the IAEA, historically it has struggled to reach 75 percent[6].

Finally, the EC appears to underestimate the cost of investing in new nuclear power. The EC estimates investment cost at €4,350/kW by 2020, and expects it to fall to €3,949/kW by 2050. It is extremely difficult to find reliable data for investment cost in nuclear power, but the few projects in progress in Europe show a significantly higher cost than those quoted by the EC. See diagram 6.

Diagram 6: Investment cost, nuclear power €/kW year 2020



Source: EU Energy, transport and GHG emission trends to 2050, Reference scenario 2013 (data from page 18). EDF. Compiled by Svensk Vindenergi. Currency exchange rate SEK 9/€.
*Both Olkiluoto and Flamanville are currently under construction. The cost is an estimate from the supplier EDF in December 2012[7][8].

Conclusions

There are significant inaccuracies in the assumptions made by the EC with respect to technology and cost trends for power production in Sweden, especially for wind power. On the basis of the impact assessment, it is impossible to ascertain how much these flawed assumptions have affected the

[6] IAEA-PRIS http://www.iaea.org/PRIS/CountryStatistics/CountryDetails.aspx?current=SE
[7] http://www.hs.fi/paivanlehti/talous/Areva+Olkiluoto-3+maksaa+85+miljardia/a1355374947866
[8] http://www.reuters.the EC/article/2012/12/03/us-edf-nuclear-flamanville-idUSBRE8B214620121203

outcome of the scenarios with a higher proportion of renewable energy, but it is obvious that the flawed assumptions put renewable energy at a disadvantage. Disadvantageous assumptions with respect to renewable energy result in higher systems costs, higher electricity prices and reduced growth (see, for example, page 122 of the impact assessment, table 35, which shows an increase in electricity prices in Sweden of 18 percent with a renewable energy target of 35 percent). This is particularly significant since it is assumed that onshore wind power will be the type of power which will expand most until 2030.

On the basis of this report, Sweden ought to take account of these flawed assumptions when the position on the 2030 framework is drawn up. Ideally, the errors should also be pointed out during the preparation of policies in partnership with other member countries, since there are indications that Sweden is not the only country affected by the flawed assumptions with respect to renewable energy

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