IMPACT OF DISTRIBUTED GENERATION ON LOSSES, DRAW OFF COSTS FROM TRANSMISSION NETWORK, AND INVESTMENTS OF THE FRENCH DNO ERDF

Our paper studies the long-term impact, in year 2020, of the development of Dispersed Generation on three expenditures of the French DNO ERDF:

- Losses purchasing,
- Draw off invoice paid to the transmission network operator RTE,
- Investments costs in the primary substations.

We choose a relatively high scenario of regional development of DG. Wind farms and combined heat and power (CHP) units are expected to represent the most important DG installed capacity in 2020. Wind farms would reach 16 GW of onshore plants connected on dedicated feeders. They are modelled by a representative sample of 70 curves on a 9-year historic. Combined heat and power would reach 3.7 GW, connected on existing feeders. CHP usually works from November to March. We simulate also the other technologies of DG which are already installed: hydraulic, biogas, biomass etc..., representing 2.8 GW.

Our forecasts of installed power are allocated by drawing lots among all the primary substations, respecting geographical and technical representative criteria.

To estimate the impact on losses, we build a sample of 100 networks, each of them being described by the HV/MV substation and the MV network. Consumption and DG are represented with 6 power values selected in random order from load curves, so that peak and off-peak hours and seasonality are considered. Losses are then calculated using a network calculation program.

We find that in 2020, DG would make losses to increase of about 0.9 TWh, knowing that annual losses of ERDF in 2008 have been about 20 TWh. That is mainly due to the connection of wind farms to dedicated feeders: around 18 000 km of connection lines will be installed.

To estimate draw off costs, we simulate, for each of about 2200 substations:

- 10 profiles of wind generation
- of which we deduce 10 possible draw off curves in 2020
- then we apply the present tariff of network.

Due to DG in 2020, the draw off invoice of ERDF would be reduced of 300 M€, but that gain may be threatened by a possible future evolution of transmission tariffs.

To estimate the impact on the investments, for each of about 2200 substations, we correct the 10 draw off load curves to the minimal temperature of reference, which is for instance -7° in Paris. By comparing peak values with and without DG, we see if DG allows to postpone investments.

The mean time of investment postponing is 4.45 years. You will see on the chart the number of substations in function of the number of years of investment postponing.
We have estimated the gain on the net present value on investments in the period 2020-2060 at around 100 M€. Around 1/3 of that gain is due to wind farms.

In conclusion, results show that DG, in the scenario expected for 2020, increases significantly the distribution network losses, mainly because of the connection of wind farms to dedicated feeders. On the other hand, it contributes to decrease the draw off costs, but the question stays whether the transmission tariff will increase in compensation. DG also contributes to delay the need of reinforcements in primary substations.