Response to Elia public consultation regarding the adequacy and flexibility needs of the Belgian power system for the period 2024-2034

by Sebastian Gonzato (all opinions and suggestions are my own)

I would be delighted to further discuss the points that I raise below with Elia. You may contact me at sebastian.gonzato@kuleuven.be

Operation of Energy Limited Resources (ELR) during scarcity

In brief

The methodology concerning the Unit Commitment and Economic Dispatch in ANTARES should state explicitly the operation of ELR during scarcity events. I believe that, for consistency with the reliability standard calculation, this operation should be severity minimising or LOLE maximising.

Elaborated

I'm basing the following remarks on my working paper entitled "The effect of short term storage operation on resource adequacy" and my more preliminary working paper "On the economic justification for the Loss of Load Expectation in the presence of Energy Limited Resources". I should emphasise that neither has been accepted for publication yet.

The premise of what follows is that the operation of ELR, such as short term storage (e.g. batteries), is undefined under a cost minimisation framework during scarcity events. This is illustrated in the figure below, taken from the first of my working papers mentioned above. All of the strategies presented below lead to the same (E)ENS and therefore the same cost, hence why the operation is not uniquely defined if operational costs are being minimised as is the case when using ANTARES.

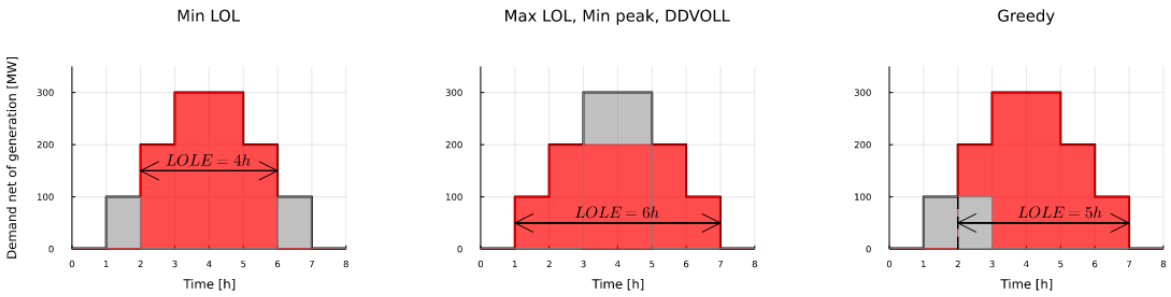

Figure 1: Three different storage operational strategies which give three different Loss of Load Expectation (LOLE) values* despite the EENS (red shaded area) being the same. Black line is the load net of generation before storage is dispatched and grey area is the energy not served avoided by storage. Titles above plots are the names of the strategies investigated in this paper (see Section 3.2) which coincide with the illustrated behaviour.

*This is actually the Loss of Load Duration, though this is equal to the LOLE if there is only one scarcity event per year.

In the same paper, for a base case I found that I could get between 2 and 6 hours of LOLE depending on the assumed storage operation, as shown in the figure below.

I am not suggesting that this range would also occur in Elia's adequacy and flexibility studies. I am however suggesting that **Elia explicitly mention the type of operation of ELR that is imposed** in the methodology.

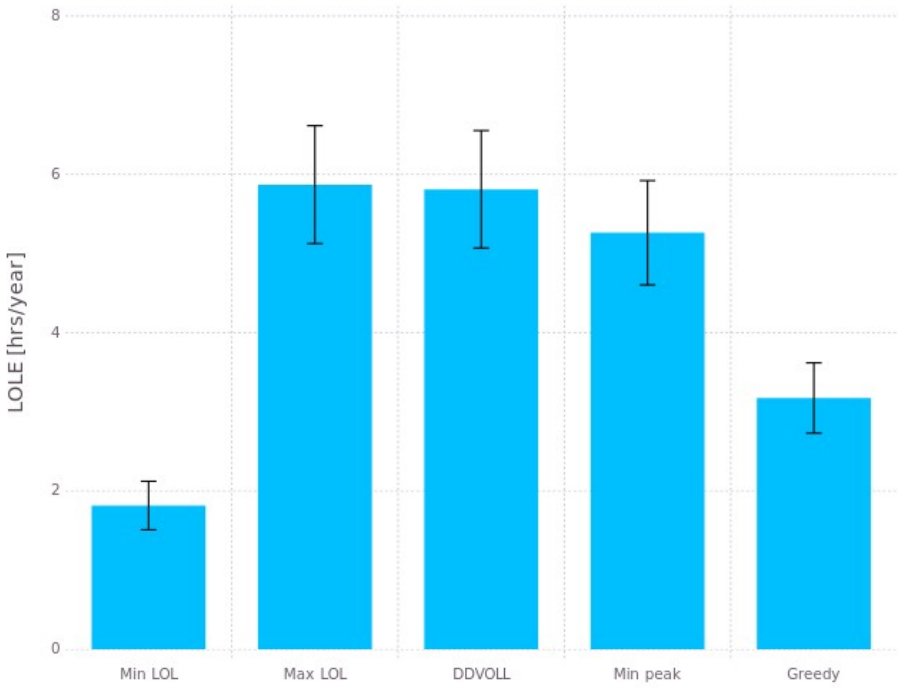

Figure 7: Effect of storage operation on LOLE (95% confidence intervals). EENS is the same for all storage operations considered (see Appendix 8.2).

As to which operation should be used, I suggest the “Max LOL” or severity minimising operation (DDVOLL in the figure above). This is because that I believe **this operation is consistent with the reliability standard calculation**. I elaborate this reasoning in my second working paper. It is a lengthy topic, so I will not elaborate on it further here.

Economic viability assessments

In brief

I would be interested to see more detail in the methodology regarding the EVA algorithm as well as results of an EVA loop.

Elaboration

Elia's approach to EVAs is particular in that it doesn't fit the mould of any particular class of model that one may find in the literature, i.e. it's not a capacity expansion planning, equilibrium, agent based or system dynamics model. I would say it most closely resembles the flow-chart philosophy of agent based models without explicitly representing agents (see e.g. Figure 2 of this paper).

For this reason I believe that a high degree of transparency regarding the EVAs would be beneficial to Elia and other stakeholders. While I do not have much experience with this sort of modeling, I presume that convergence is sensitive to user defined parameters. Elia states this explicitly:

In order to ensure the convergence of the results, only a limited amount of candidates is moved from 'in-the-market' to 'out-of-the-market' status at each iteration.

My specific requests on this subject:

- I would like to know more about **how the number of candidates is limited** (see quote above).
- I would be interested to see the **results of an EVA loop**, including but not limited to the evolution of candidate resources, the installed capacities, the distribution revenues of generators, in Elia's next A&F study.
    - Ideally this would be done for several EVA loops so as to show the nature of the convergence that could occur. For example, Elia states that "oscillations" occur for some EVA loops.
- Checking the **agreement between the EVA and the adequacy assessment** e.g. in terms of LOLE would be interesting.
    - This was an issue raised by ACER for the last ERAA.
    - As I understood Elia's methodology, when an EVA loop is finished the full set of MC years is used to validate the convergence. If this is the case then agreement should not be an issue, though this should be confirmed.

I do not suggest this merely to create more work for those at Elia, but on the basis of results from Elia's last A&F study which piqued my interest. In it, I see that there is a difference of 0.9 GW in non-viable GAP when comparing the EU-BASE and EU-SAFE scenarios for 2032 (Figure 5-32 and 5-36). This implies that nuclear unavailability increases profitability of other units in the EVA, ultimately decreasing the non-viable GAP. Elia comes to the same conclusion (see comments under Section 5.2.3). This is an interesting result, and I wonder whether some of this change in non-viable GAP is actually due to practical issues regarding convergence.

Other considerations

- Elia may be interested in improved Monte Carlo sampling methods to decrease computation time. See this paper from Simon Tindermans of TU Delft.
- For the EVAs, what features are used to perform the k means clustering? Why the choice of k means (which will produce different results for every run) and not e.g. hierarchical clustering?
- Does Elia aggregate technologies and solve a (relaxed) clustered unit commitment model? This was the impression I got from the methodology description of the last A&F study, but in the methodology given in this public consultation (“Unit Commitment and Economic Dispatch”) I got the impression that individual units were modeled.