

Market resilience analysis

Introduction

Market resilience, or market depth, indicates the price sensitivity due to an increase in offer or demand on the market. The results of this analysis provide both an indication of the robustness of the markets as well as additional information for estimating the impact on market clearing prices when a PRB would have been accepted. Only using the published aggregated curves would omit the effect of the block order selection as well as the changes in cross-border flows. The resilience analysis performed for the Belpex BE and APX NL areas are using a re-run of the price calculation in order to include these two effects.

Methodology and scope

The resilience analysis requests manual operations and is therefore performed periodically (e.g. on a monthly basis). For all hours of a delivery day, an additional volume of offer or demand is added to the historical order book as a price taking order, after which a re-run of the algorithm calculates new prices. The offset volumes currently used are 50, 250 and 500 MW for both supply and demand, resulting in each hour having 6 prices per bidding zone, on top of the reference price.

Starting with the extension of the CWE market coupling to North-West Europe in February 2014, the reference price was also published, in addition to the historical clearing price. The added supply or demand volume was then the only variable when re-computing market results.

Since the launch of the NWE day-ahead market coupling (followed by the MRC market coupling), APX has not been in a position to use all of the order books for the purpose of calculating and publishing resilience analysis. The geographical scope of the network topology for resilience analysis includes the bidding areas operated by APX, Belpex and EPEX SPOT (i.e. CWE+APX UK). To generate more accurate results, virtual areas have been added to this scope with price taking orders representing the historical import and export with the hubs not operated by APX, Belpex and EPEX SPOT (outside CWE+APX UK). The network topology used is represented in Figure 1.

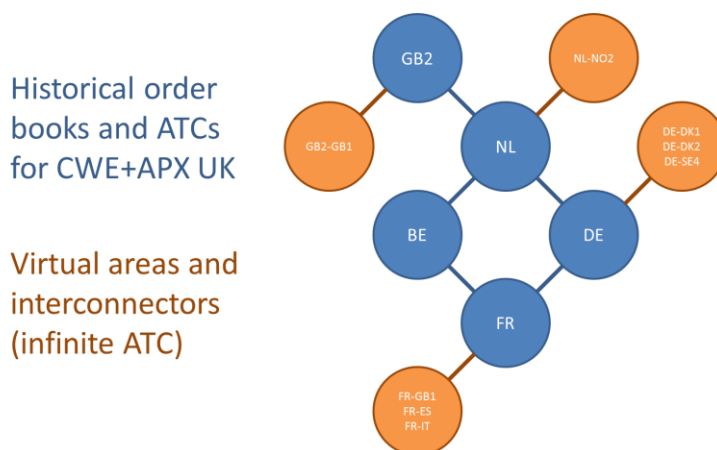


Figure 1: Topology for resilience analysis

As the input data for the resilience analysis is different from the input for the real performance of market coupling (not all order books are used for the resilience analysis), the algorithm is solving a different problem. Combined with calculations being cut-off by a set calculation time limit, the different runs of the algorithm can end up with varying block order selections. This consequently has an effect on the market clearing price results, therefore possibly leading to a difference between the historical clearing price and the reference price.

An example of the resilience analysis is shown in Table 1 (Belpex DAM market is represented). As described above, the price as published can be found in the column “Historical”, whereas the initial re-run of the algorithm with the new topology but with no additional volumes is provided in the column “Reference”. Although it is to be expected that historical and reference prices would be nearly identical, some differences may appear as illustrated for hours 3 and 4 in the example below.

Date	Hour	Historical	Supply 500 MW	Supply 250 MW	Supply 50 MW	Reference	Demand 50 MW	Demand 250 MW	Demand 500 MW
31/12/2014	1	43.55	34.97	39.94	42.84	43.55	44.94	48.86	48.49
31/12/2014	2	41.25	34.97	39.02	41.00	41.25	41.77	43.62	43.55
31/12/2014	3	38.99	34.97	37.99	39.02	39.02	39.02	41.00	39.02
31/12/2014	4	34.94	34.07	34.99	35.07	35.02	35.03	35.14	34.97
...

Table 1: Example of resilience analysis results

Non-intuitive (hourly) results

It should be noted that some results may be seen as non-intuitive at first glance. An hour is considered to have intuitive results if the clearing price decreases when adding price taking supply, or the clearing price increases when adding price taking demand. For comparison, an example of intuitive results is shown below in Figure 2.

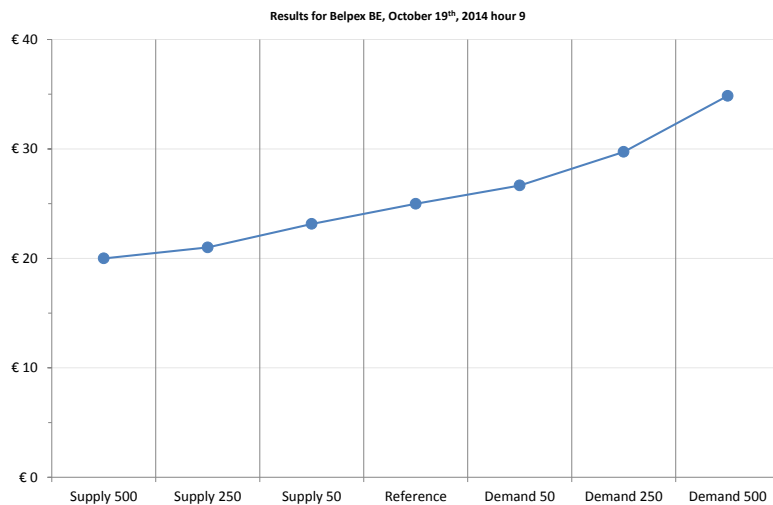


Figure 2: Hour with intuitive results

Two examples of non-intuitive results can be found below (see Figure 3 and Figure 4). Non-intuitive hourly prices are the result of differences in accepted block orders:

- Additional price taking supply/demand causes larger block orders to become rejected in the offset scenario
- Additional price taking supply/demand causes larger block orders on the other side of the order book to become accepted in the offset scenario

Some numerical examples based on the results for the Belpex DAM resilience analysis are presented below to illustrate this. The same principles and explanation apply to similar occurrences on the APX NL DAM.

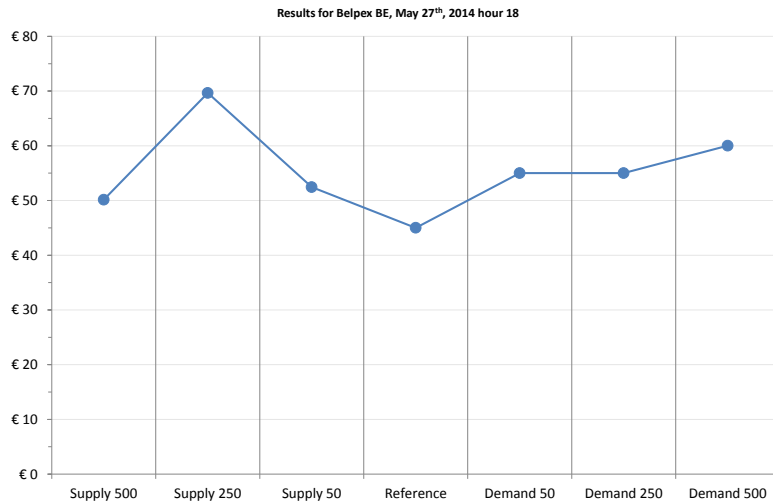


Figure 3: Hour with non-intuitive results (1)

The result from the reference scenario contains an accepted supply block order with a submitted quantity of 400 MW for this particular period. In the scenario where 250 MW price taking supply is added to the order book, this block order can no longer be accepted. The (price taking) 250 MW generates more welfare, however the all-or-nothing constraint causes the larger block order to no longer be accepted (accepting it would result in a market price below what is necessary to make the block order “in the money”).

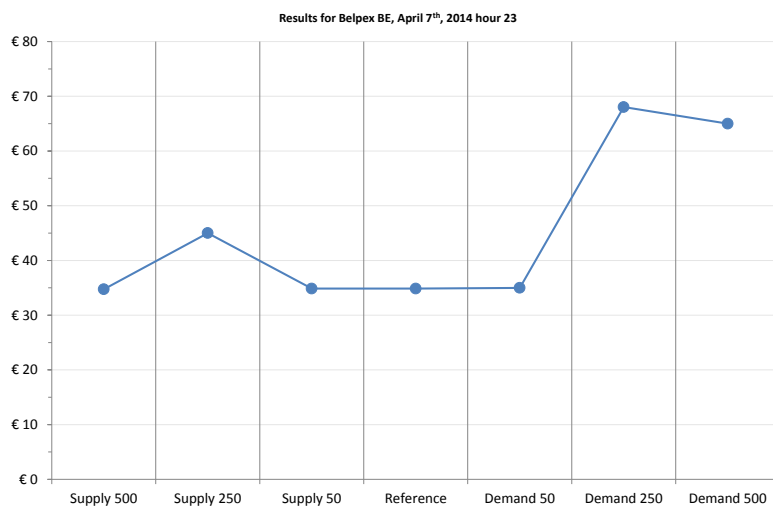


Figure 4: Hour with non-intuitive results (2)

Focusing on the scenario with 250 MW additional price taking supply, due to this extra supply being available in the market a block order of 345 MW (demand) can now be accepted whereas this was not possible in the reference scenario.

As these two examples demonstrate, the hourly prices for the scenarios illustrated in the resilience analysis may seem non-intuitive while being in fact absolutely correct when considering the impact of block orders on the price formation.

An overview of the results presented as the monthly average prices for the quantity offsets, as described in the methodology section, is shown in both Figure 5 and Table 2. This includes the market clearing prices for the additional scenarios for 2013 and 2014.

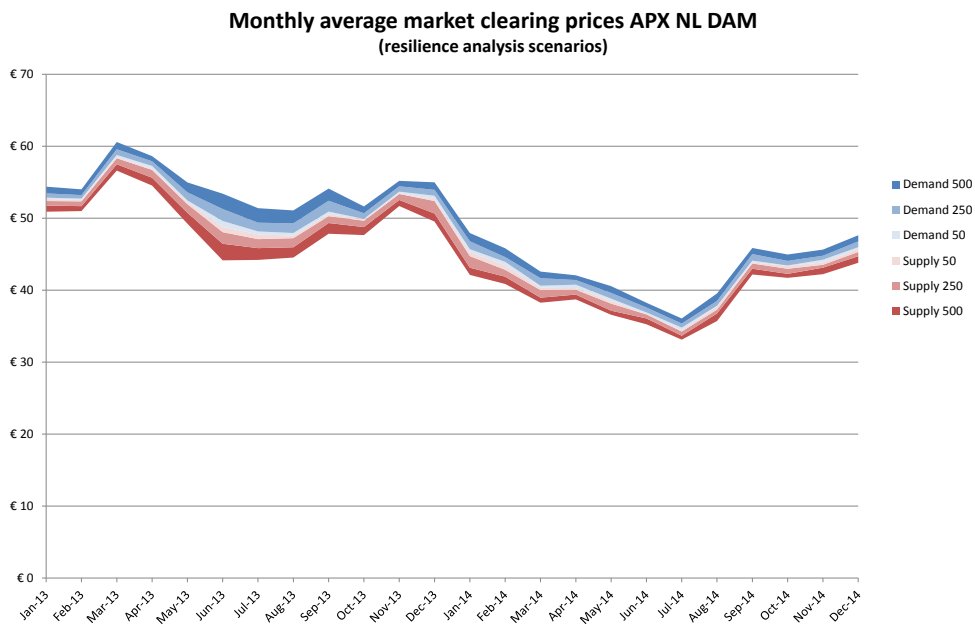


Figure 5: APX NL DAM market resilience

2013	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Supply 500	50.90	51.00	56.62	54.54	49.24	44.15	44.21	44.53	47.84	47.66	51.70	49.53
Supply 250	51.76	51.68	57.50	55.63	50.75	46.45	45.84	45.96	49.33	48.77	52.53	50.65
Supply 50	52.39	52.34	58.33	56.71	51.95	48.07	47.09	47.23	50.29	49.65	53.37	52.39
Reference	52.67	52.54	58.52	56.87	52.23	48.80	47.76	47.58	50.57	49.83	53.50	52.65
Demand 50	52.86	52.72	58.79	57.26	52.47	49.61	48.16	47.95	50.92	49.91	53.69	53.12
Demand 250	53.45	53.21	59.59	57.91	53.60	51.28	49.38	49.29	52.43	50.69	54.44	53.95
Demand 500	54.38	54.01	60.59	58.63	54.98	53.41	51.40	51.08	54.12	51.64	55.19	54.99

2014	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Supply 500	42.12	40.87	38.26	38.72	36.58	35.26	33.12	35.71	42.18	41.72	42.22	43.81
Supply 250	43.12	41.87	38.96	39.39	37.15	36.07	33.67	36.77	42.98	42.27	43.13	44.71
Supply 50	44.74	42.83	40.02	40.07	38.13	36.64	34.25	37.30	43.71	42.98	43.53	45.32
Reference	45.28	43.44	40.35	40.29	38.54	36.67	34.44	37.76	43.85	43.40	43.85	45.77
Demand 50	45.70	43.94	40.62	40.76	38.82	36.91	34.80	37.84	44.11	43.43	44.24	45.98
Demand 250	46.79	44.60	41.67	41.41	39.63	37.60	35.36	38.50	45.01	44.07	44.79	46.78
Demand 500	47.94	45.82	42.58	42.07	40.56	38.25	36.07	39.55	45.86	44.96	45.64	47.63

Table 2: Monthly average APX NL DAM market clearing prices (resilience scenarios)