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# Analysis of Polish Allocation Constraints

Comparison of historical data and NoAC simulations

Case – Q3 '25

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# Context of the analysis

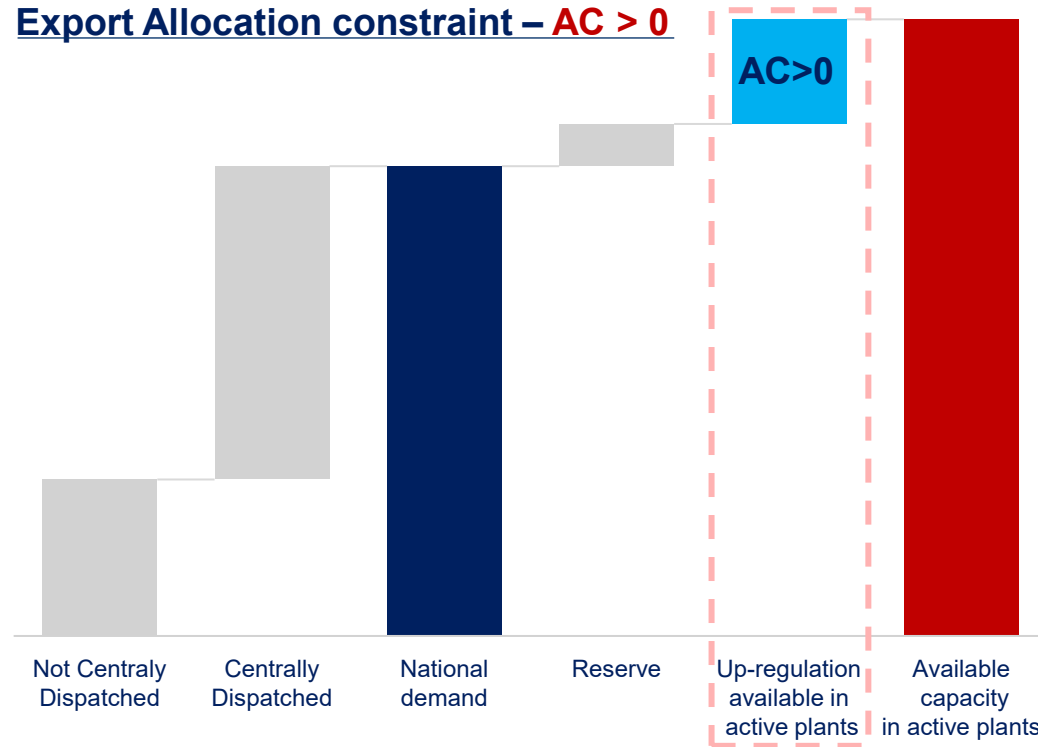
- CORE DA CCM prescribes the obligation to study the effect of Allocation Constraints on market and power system operations
  - PSE was granted the ability to apply AC for 2 years;
  - According to DA CCM for CORE CCR Article 7(3)(b)(i):
    - *in case the external constraint had a non-zero shadow price in more than 0.1% of hours in a quarter, provide to the CCC a report analyzing: (i) for each DA CC MTU when the external constraint had a non-zero shadow price the loss in economic surplus due to external constraint and the effectiveness of the allocation constraint in preventing the violation of the underlying operational security limits;*
  - 18 months after CORE DA FB is implemented, PSE and other CORE TSOs must prepare an amendment of the CORE CCM in order to extend the use of AC;
- The analysis carried out by PSE consists of two main elements:
  - **Analysis using Simulation Facility**
    - Simulating market results in absence of AC and comparing it with historical data with AC applied
    - The data covers period **from 01.07.2025 to 30.09.2025 excluding 7 days due to missing data in Simulation Facility**:
      - Days missing are 21.07.2025, 25-27.07.2025, 29.07.2025 and 1-2.08.2025
    - The only difference between historical and NoAC simulations was removal of Polish Allocation Constraints;
  - **Analysis of secure operation of the Polish power system**
    - This was done by comparing the historical reserve levels and the simulated reserve levels (in absence of AC)
    - When required reserve levels were not met, costs of necessary remedial measures were estimated (for simulated case without AC)
    - Reserve requirements used in this analysis are the least conservative ones
      - For upward reserves: it is assumed that remedial measures would be needed only if reserves fall below 1000 MW (reference incident), which is much less than the required and procured (9% of forecasted consumption as in the Polish Grid Code)
      - For downward reserves: 500 MW is assumed

# Reminder

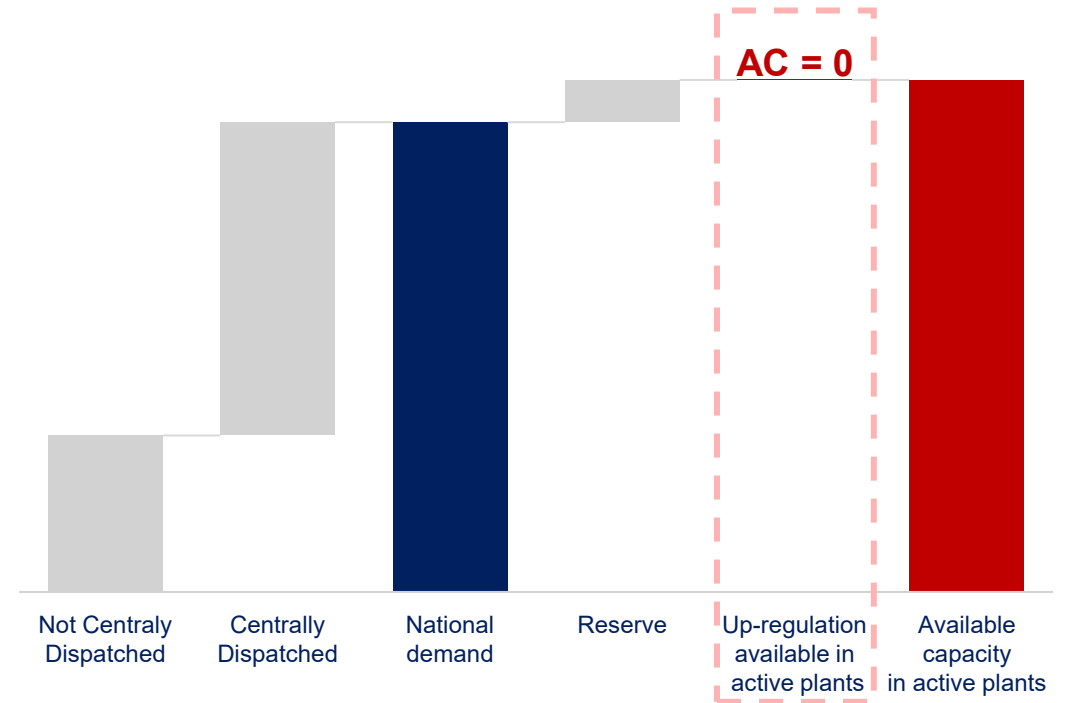
- What are Allocation Constraints, as defined in CACM?
  - Article 2.6:
    - *'allocation constraints' means the constraints to be respected during capacity allocation to maintain the transmission system within operational security limits and have not been translated into cross-zonal capacity or that are needed to increase the efficiency of capacity allocation;*
  - Article 2.7:
    - *'operational security limits' means the acceptable operating boundaries for secure grid operation such as thermal limits, voltage limits, short-circuit current limits, frequency and dynamic stability limits*
  - Article 23.3:
    - *If TSOs apply allocation constraints, they can only be determined using:*
      - *(a) constraints that are needed to maintain the transmission system within operational security limits and that cannot be transformed efficiently into maximum flows on critical network elements; or*
      - *(b) constraints intended to increase the economic surplus for single day-ahead or intraday coupling*
- Technical and legal justification of usage and the methodology for calculation of allocation constraints („external constraints”) are described in CORE DA CCM in Annex 1

## Explanation: calculation of allocation constraint - Export direction

Export Allocation constraint –  $AC > 0$



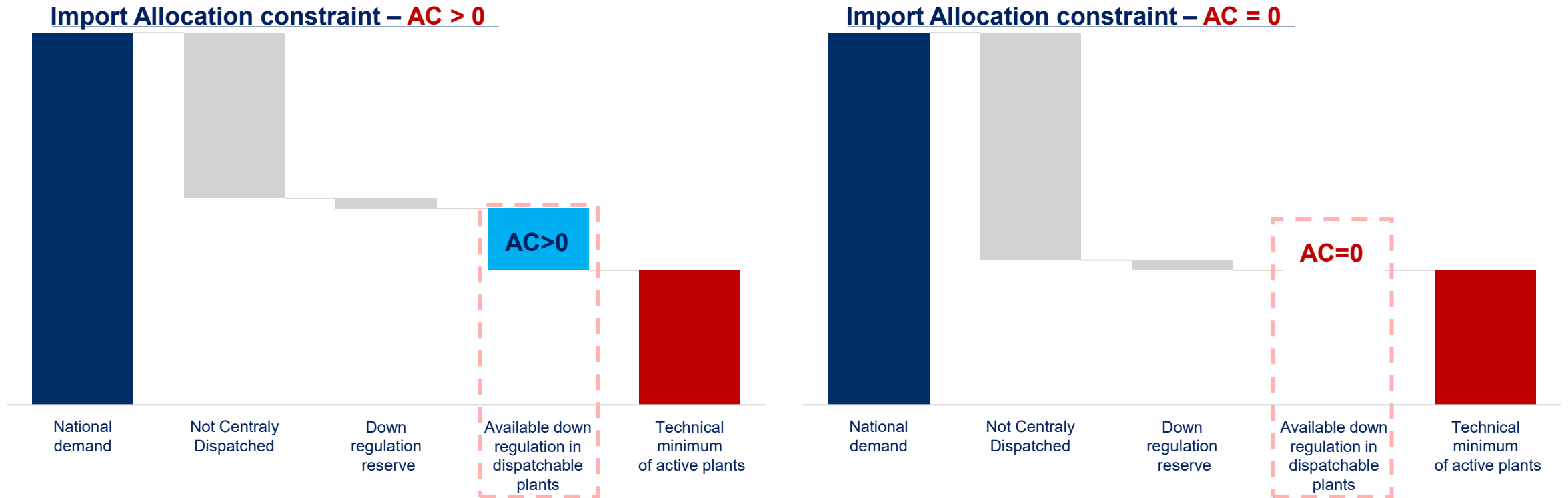
Export Allocation constraint –  $AC = 0$



Allocation constraint for export is determined by available capacity left after ensuring that national demand is supplied.

$AC = 0$  means that there was no spare generation beyond what is needed to meet the demand of Polish system.

## Explanation: calculation of allocation constraint - Import direction



**Allocation constraint for import is determined as available downward regulation after ensuring safety of the system.**

**$AC = 0$  means that power plants are operating on their technical minimum. Going below these levels is technically unfeasible due to the technical minimums of power plants and of the power system.**

# Analysis using Simulation Facility: social welfare change due to removal of AC

producer and consumer surplus [m€], Q3 '25



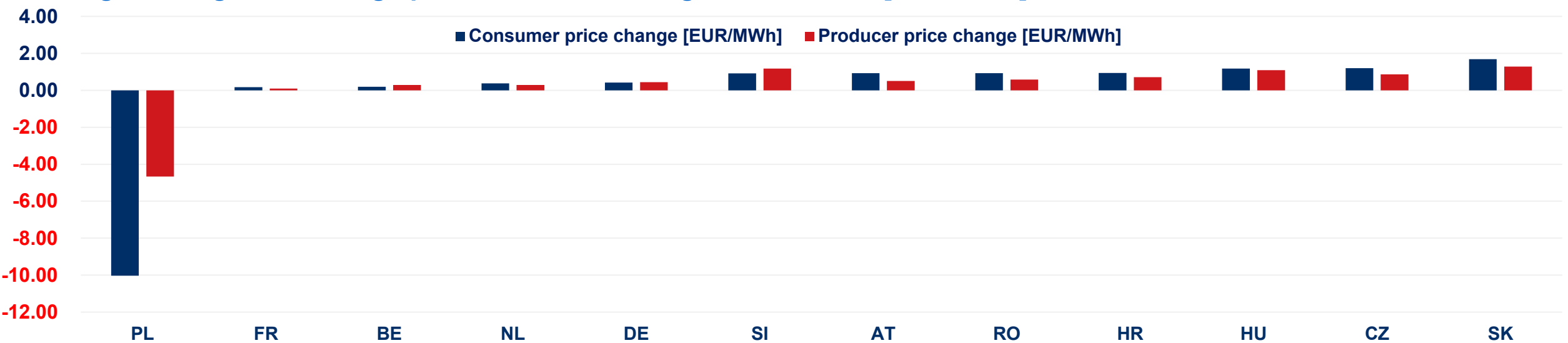
Note: Social Welfare figures need to be complemented with Value of Lost Load resulting from analysis of secure operation of the Polish power system

|                  | Country | AT        | BE        | CZ       | DE         | FR        | HR       | HU        | NL        | PL       | RO       | SI     | SK       | CORE       |
|------------------|---------|-----------|-----------|----------|------------|-----------|----------|-----------|-----------|----------|----------|--------|----------|------------|
| Producer Surplus | With AC | 1 342.83  | 816.41    | 2 618.97 | 26 346.28  | 13 412.16 | 156.22   | 1 676.30  | 3 386.15  | 283.76   | 527.90   | 42.12  | 293.52   | 50 902.62  |
|                  | NoAC    | 1 345.98  | 817.20    | 2 625.20 | 26 373.99  | 13 417.17 | 157.16   | 1 682.52  | 3 389.98  | 274.37   | 531.22   | 42.49  | 296.62   | 50 953.89  |
| Consumer Surplus | With AC | 13 158.49 | 19 654.37 | 2 891.19 | 226 571.61 | 47 648.62 | 1 557.96 | 11 180.59 | 26 580.80 | 1 477.88 | 2 273.33 | 943.36 | 1 329.58 | 355 267.80 |
|                  | NoAC    | 13 154.25 | 19 652.95 | 2 885.18 | 226 542.38 | 47 645.07 | 1 555.62 | 11 173.94 | 26 577.26 | 1 501.28 | 2 269.46 | 942.57 | 1 326.91 | 355 226.88 |
| Surplus change   | NoAC-AC | -1.08     | -0.64     | 0.23     | -1.53      | 1.45      | -1.40    | -0.43     | 0.29      | 14.02    | -0.55    | -0.42  | 0.43     | 10.36      |

Changes in Congestion Income resulting from Polish Allocation Constraints are addressed in Congestion Income redistribution process.

# Analysis of impact on the prices:

Change in weighted\* average price in CORE Bidding Zones, Q3 '25 [EUR/MWh]



|                        | Country | AT    | BE    | CZ    | DE    | FR    | HR    | HU     | NL    | PL     | RO    | SI    | SK     |
|------------------------|---------|-------|-------|-------|-------|-------|-------|--------|-------|--------|-------|-------|--------|
| Consumer average price | With AC | 81.02 | 78.45 | 86.06 | 80.05 | 40.72 | 89.13 | 99.92  | 80.88 | 114.47 | 98.51 | 86.93 | 91.42  |
|                        | NoAC    | 81.94 | 78.64 | 87.26 | 80.47 | 40.89 | 90.07 | 101.10 | 81.26 | 104.44 | 99.44 | 87.84 | 93.11  |
|                        | NoAC-AC | 0.93  | 0.20  | 1.20  | 0.42  | 0.18  | 0.94  | 1.18   | 0.38  | -10.03 | 0.93  | 0.91  | 1.69   |
| Producer average price | With AC | 89.61 | 72.62 | 92.96 | 74.32 | 45.92 | 92.44 | 81.80  | 81.60 | 86.86  | 92.59 | 91.22 | 102.86 |
|                        | NoAC    | 90.11 | 72.91 | 93.83 | 74.77 | 46.02 | 93.15 | 82.90  | 81.90 | 82.19  | 93.17 | 92.40 | 104.14 |
|                        | NoAC-AC | 0.50  | 0.29  | 0.87  | 0.44  | 0.09  | 0.71  | 1.10   | 0.29  | -4.67  | 0.58  | 1.18  | 1.28   |

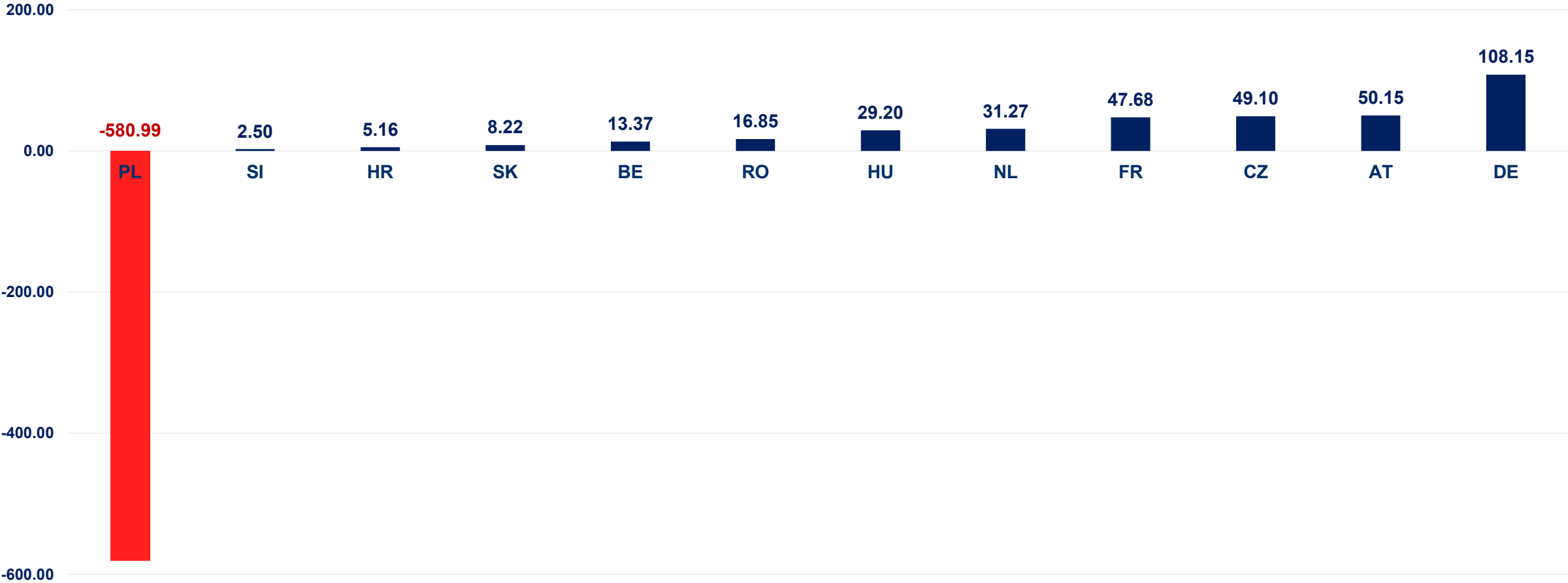
Poland is the only CORE country that would experience lower prices if Allocation Constraints weren't applied.  
In other countries, the difference is below 2 EUR/MWh.

\*Prices are weighted with volume of matched offers in bidding zones (separately for consumers and producers, as well was for AC and noAC simulations as BZ matched volume changes)

# Analysis of impact on scheduled exchanges:

Change in net exchange in CORE Bidding Zones, Q3 '25 [GWh]

<0 towards import, >0 towards export

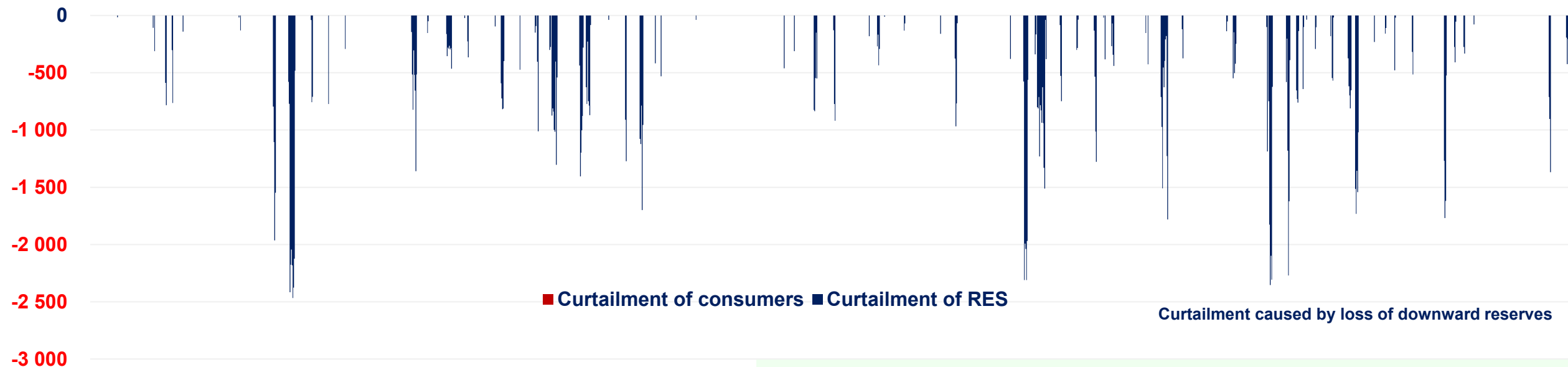


Part of the additional import in Poland is covered outside of Core CCR



# Analysis of secure operation of the Polish power system:

potential curtailment of consumers and renewable sources, hourly, Q3 '25 [MW]



Curtailed energy due to absence of AC  
(aggregated Q3 '25)



■ Curtailment of consumers ■ Curtailment of RES

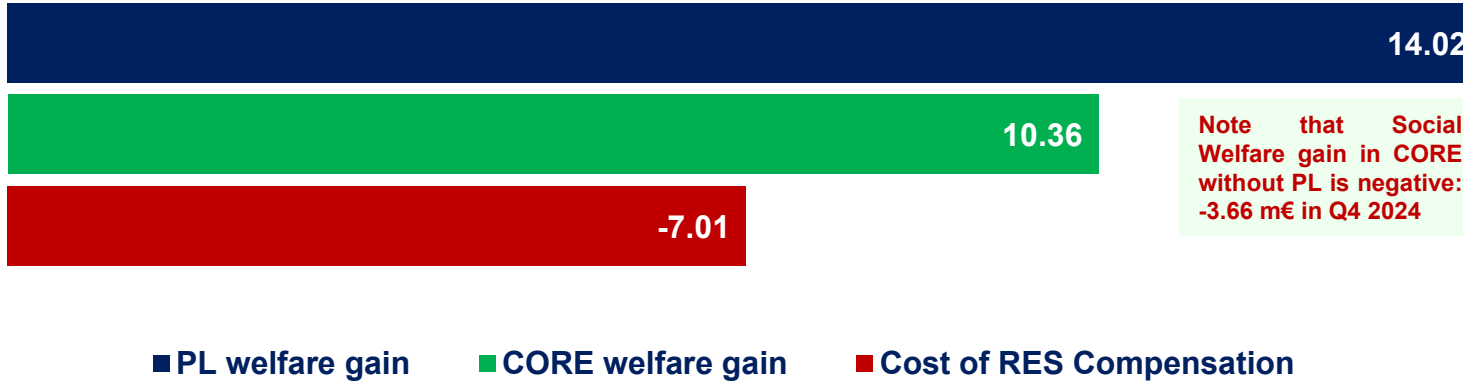
Potential curtailment of consumers and renewables is calculated by comparing simulated reserve levels after removal of AC with the required levels

In Q3 '25, **without Allocation Constraints downward reserves would be insufficient at times**. Hence, there would be a many hours when consumers or renewable energy would need to be curtailed.

**RES energy would need to be curtailed in 238 hours** due to loss of downward reserves, totaling to some with **163.3 GWh of curtailed RES** (replaced with imports).

# Social Welfare and VOLL values

Comparison of Social Welfare impact – VOLL and Surplus change [m€], Q3 '25



| Value of Lost Load [k€/MWh] |       |
|-----------------------------|-------|
| Households                  | 6.6   |
| Commerce                    | 24.7  |
| Services                    | 36.9  |
| Administration              | 18.3  |
| Industry                    | 16.2  |
| Transport                   | 17.4  |
| Average VoLL                | 17.2  |
| DSR price                   | 3.0   |
| Price of RES compensation   | 0.043 |

**Comparison of Social Welfare shall also consider costs of remedial measures for secure operation of Polish power system** (VOLL for upward reserves deficiencies and RES curtailment costs for downwards reserves)

Above VOLL calculations assume very conservative costs of load curtailment, equal to DSR costs (~3000 EUR/MWh). Actual VOLL numbers for consumers are much higher (see table above with VOLL costs determined by Polish NRA).

Costs of RES curtailment are assumed at some ~43 EUR/MWh (average compensation paid in Q3 2025)

When including the costs of remedial measures needed to ensure sufficient reserve level, these costs are much higher than any social welfare surplus gained in Poland or CORE.

# | Summary and Conclusions

- Allocation constraints do impact cross-border trading
  - In Q3 '25, **AC was the limiting factor for 30.45% of the hours**;
    - With only 0.14% accounting for Export Allocation Constraint (3 MTUs)
  - Comparing to previous reporting periods, it is the lowest impact Polish Allocation Constraints had on the SDAC market;
- Allocation constraints is the key tool for ensuring secure system operation in Poland
  - **In absence of AC, PL is unable to ensure sufficient availability of reserves** in downward direction
  - Ensuring secure operation of the Polish power system in absence of allocation constraints would **require application of remedial measures**
  - Assuming the very conservative estimation (comparing against critical reserves instead of standard levels), remedial measures would need to be applied **for 11.7% hours**. In reality, the scale would be much higher.
    - This value is for the days included in the report (missing 7 days are not included)
- Social welfare changes due to removal of allocation constraints were less significant than avoided costs of ensuring safe operation
  - Excluding Poland, **CORE would lose 3.66m€ surplus** if the AC was removed;
  - At the same time, Poland would need to incur additional costs of remedial actions to ensure secure operation of the system (RES curtailment or similar)