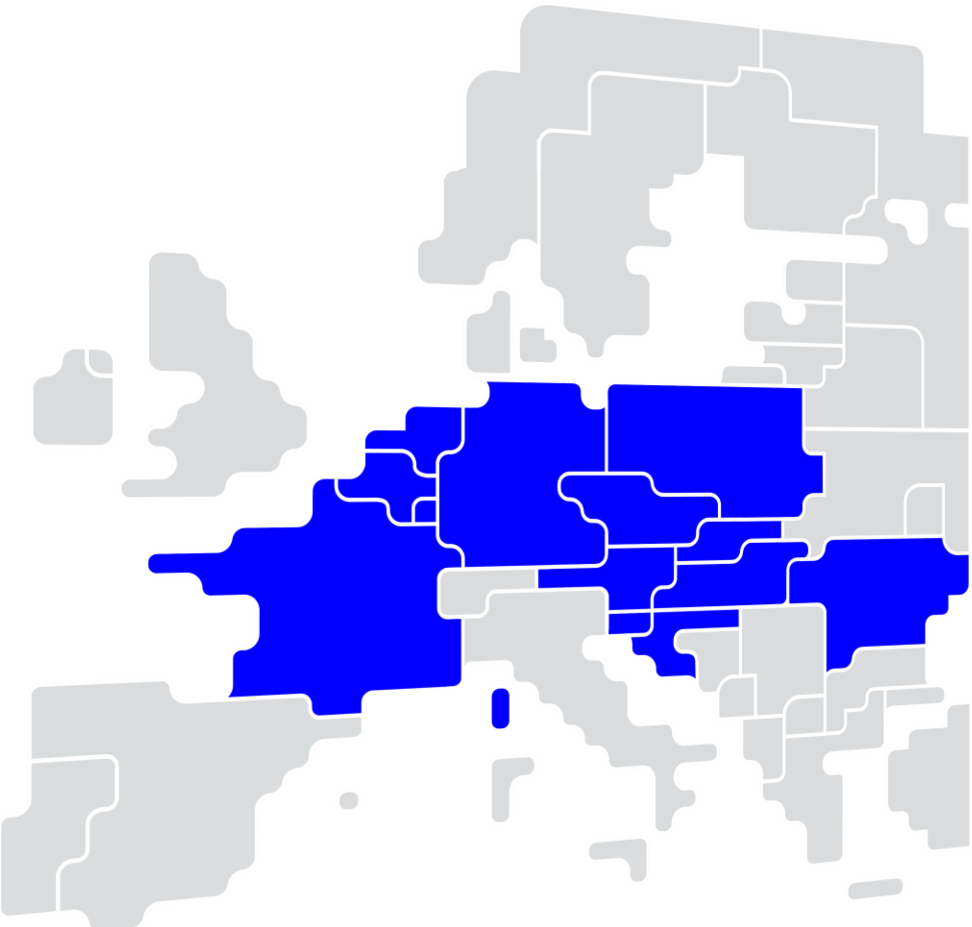
CORE

Accompanying Document on the Results of AHC SPAICC-like Run #4



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1. DOCUMENT HISTORY AND STATUS

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2. INTRODUCTION

This document provides an overview of the Core TSOs’ results and observations from the so-called SPAICC-like Run #4, conducted as part of the testing concept for the go-live of Advanced Hybrid Coupling (AHC) in the Core Capacity Calculation Region (CCR). This is the final SPAICC-like run before AHC go-live.

The Core TSOs are preparing to implement AHC for nine non-Core borders, with all TSOs required to have their local tools ready by the end of Q1 2025. This specific milestone has been reached.

While the AHC implementation in SDAC was initially targeted for mid-2025, the actual go-live depends on both SDAC scheduling and the performance of EUPHEMIA, especially considering the complexity arising from the additional virtual hubs required for Core AHC. Moreover, AHC must only be implemented after a deliberate gap following the go-live of 15-minute MTU. As of now, the Core TSOs expect the AHC go-live to occur before mid-2026, contingent on EUPHEMIA’s performance and any mitigation measures needed. AHC go-live will be communicated to external stakeholders at least three months in advance.

Given the tight implementation timeline, a special testing concept was developed in close coordination with Market Participants, National Regulatory Authorities (NRAs), and ACER. This approach aims to avoid a six-month external parallel run and instead supports a more agile deployment. The strategy includes offline batch testing and a one-month external parallel run shortly before go-live.

This series of tests is referred to as SPAICC-like runs, based on the established SPAICC (Standard Procedure for Assessing the Impact of Changes in Core) methodology, typically used for assessing grid changes due to expansion projects. In total, four SPAICC-like runs were planned. Runs #1 through #3 have already been executed and published, each helping to identify and address specific challenges. Run #4, the final one, has now also been completed.

For SPAICC-like run #4, all Core TSOs applied their local validation tools, ensuring significantly improved consistency and robustness in the results. Critical technical issues identified in previous runs were successfully resolved:

- The error in the External Constraint (EC) setup for the RO–BG border (which had previously allowed unrealistic import levels) has been corrected.

- The vertex computation approach, which previously generated unbalanced vertices for certain Business Days, has also been fixed.

Despite those improvements, some limitations remain but do not impact the representativeness of the results.

- The Net Position Forecast (NPF) still relies on a prototype version of the AHC NPF tool.

- Not all TSOs executed their minMACZT reductions in line with the derogation provisions of Regulation (EU) 2019/943 Article 16(9).

When interpreting the SPAIC-likr run results and comparing them with historical capacity calculation figures, it should generally be borne in mind that calculation tools and methods have changed or been further developed in the meantime and that numerical inaccuracies can also lead to differences.

SPAICC-like Run #4 marks an important milestone in the AHC implementation process. With all TSOs applying validation tools and previous technical issues resolved, the quality and representativeness of the results has notably improved. While some minor challenges remain, Core TSOs are actively working on mitigation measures to ensure a smooth and reliable AHC go-live in the projected timeframe. A general description of AHC including a list of the affected borders can be found in Chapter 3.

3. AHC AND THE FUTURE CORE AHC BORDERS

The term hybrid coupling refers to the integrated use of Flow-Based (FB) and Available Transmission Capacity (ATC) constraints within a single capacity allocation mechanism. There are two concepts of hybrid coupling: The Standard Hybrid Coupling (SHC) and the Advanced Hybrid Coupling. The key distinction between SHC and AHC lies in how power exchanges over interconnectors between bidding zones (BZs) within the Core CCR and those outside the Core CCR - both part of the Single Day-Ahead Coupling (SDAC) – are mapped into flows on Core CNECs. Today, only SHC is in use in the Core CCR.

In SHC, access to scarce CNEC capacity is ensured by ex-ante defining capacity on Core CNECs before the Core capacity calculation. Thus, SHC is based on forecasted exchanges on the relevant interconnectors and includes a security margin to account for deviations from the forecast. This means that, in the event of an incorrect forecast, either

- (a) grid security is jeopardized because too much capacity is released, or
- (b) an efficient market outcome is not achieved because capacity remains unused

Conversely, in AHC, exchanges over the respective interconnectors compete for CNEC capacity alongside all other cross-zonal power exchanges within the Core CCR during market coupling in SDAC. By enabling such non-discriminatory competition for limited CNEC capacity, AHC is expected to both enhance socio-economic welfare while simultaneously improving operational grid security.

Core TSOs will introduce AHC for the following bidding-zone borders:

- DE-DK1 (AC border)
- DE-DK2 (Kontek + KF CGS)
- DE-SE4 (Baltic Cable)
- DE-NO2 (NordLink)
- NL-DK1 (COBRACable)
- NL-NO2 (NorNed)
- PL-LT (LitPol, AC border after synchronisation of the Baltic states)
- PL-SE4 (SwePol)
- RO-BG (AC border)

A Cost Benefit Analysis ('CBA') regarding the introduction of AHC is not foreseen, as the obligation to introduce AHC resulting from the CCM is independent of economic viability and, given the conceptual differences between SHC and AHC, improvements in terms of computational accuracy of the capacities are obvious.

Core TSOs have detailed the method for AHC in the Second amendment of the Day-Ahead Capacity Calculation Methodology of the Core Capacity Calculation Region, specifying the framework for the technical AHC implementation:

- In the AHC, the CNECs of the Core Day-ahead capacity calculation region shall not only limit the net positions of Core bidding zones due to exchanges on bidding zone borders of the Core CCR but also the exchanges on bidding zone borders between the Core CCR and adjacent CCRs.

- For each AHC border, the Core TSOs shall introduce at least one virtual hub and the PTDFs of the virtual hubs shall be included in the flow-based parameters, meaning that the dimension of the Core flow-based domain is increased by adding more hubs (“columns”)

- Cross-zonal network elements pursuant to Article 5 of the Core DA CCM shall additionally include those on AHC borders and the maximum zone-to-zone PTDF of a CNEC shall additionally consider the PTDFs of the virtual hubs, meaning that the dimension of the Core flow-based domain is increased by adding more CNECs (“rows”)

- Core TSOs may impose a limit to the net position of the virtual hubs for AHC borders if it is based on the NTC computation of a neighbouring CCR.

4. EVALUTATION OF SPAICC-LIKE RUN #4 RESULTS

In the following paragraph, Core TSOs present their interpretation of the results of SPAICC-like run #4.

4.1. Differences in min/max NP due to AHC

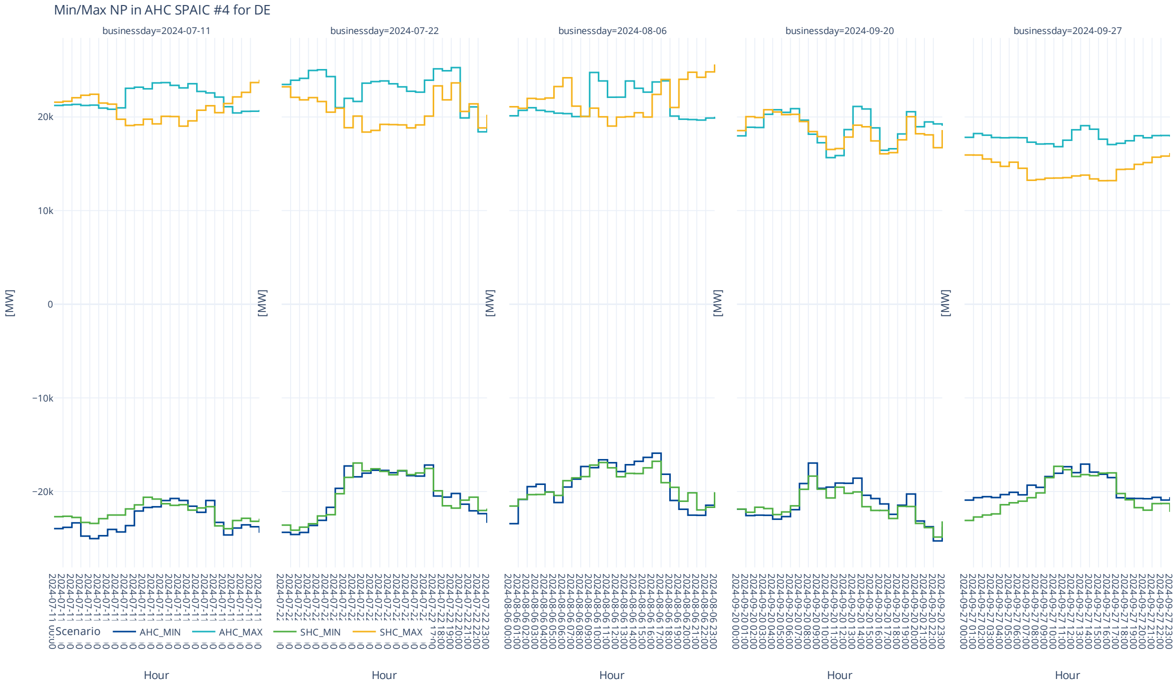
The results in this chapter focus on the differences in minimum and maximum Net Positions (NP) for hubs with AHC borders. In the case of the AHC scenario, the minimum and maximum NP values correspond to a "Core incl. AHC" NP, which is directly derived from the Cross-Zonal Capacity (CZC) domain as calculated in the Flow-Based Capacity Calculation (FB CC) process. For the non-AHC scenario, the minimum and maximum NP values are calculated differently. They are obtained by summing the Core Min/Max NPs, which are derived directly from the CZC domain of the FB CC process, and the Available Transfer Capacities (ATCs) for AHC borders. These ATCs are sourced from the ENTSO-E transparency platform[1]. For those timestamps in which there was not ATC for a certain border on the ETP, a flat value fallback based on the EC was used.

[1] Offered Day-ahead Transfer Capacity Implicit [11.1]

To better show the difference in context the values are plotted below as a line plot for before and after AHC, instead of direct delta plots. Both these types of plots as well as delta plots for all zones are available in the plots.zip attached to this report.

Due to the large number of business-days all plots are split to keep them readable. As before we show here the 4 zones which have AHC hubs attached to it.

4.1.1 DE/LU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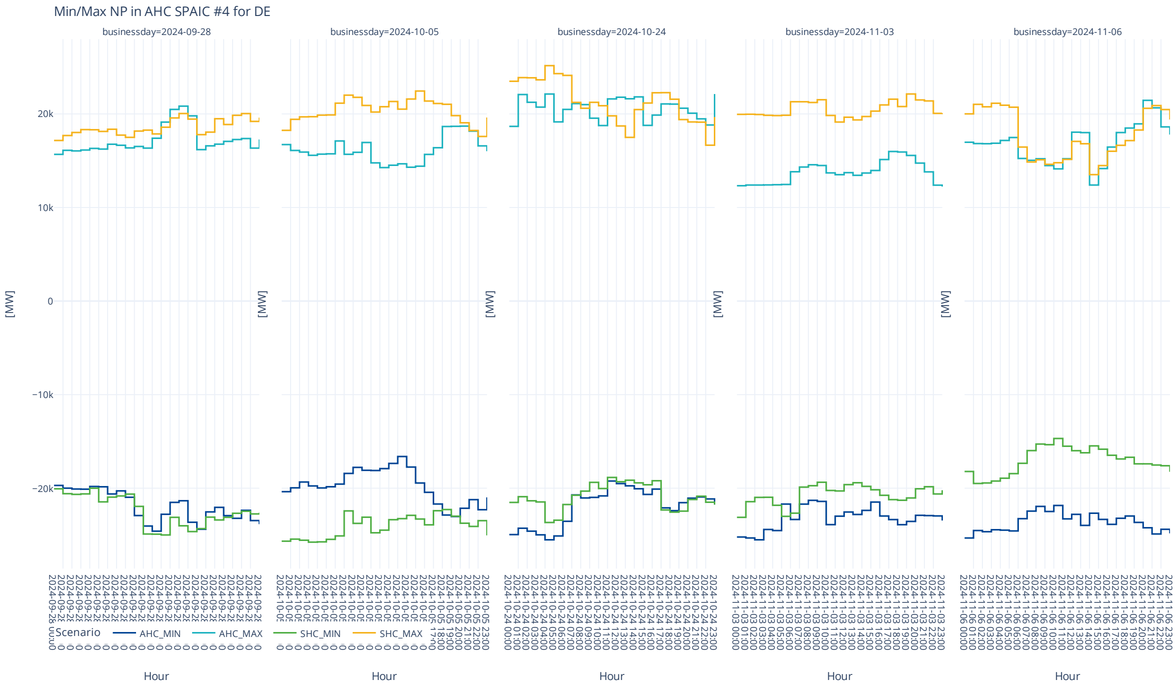
AHC_MAX
SHC_MIN
SHC_MAX
Hour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Scenario
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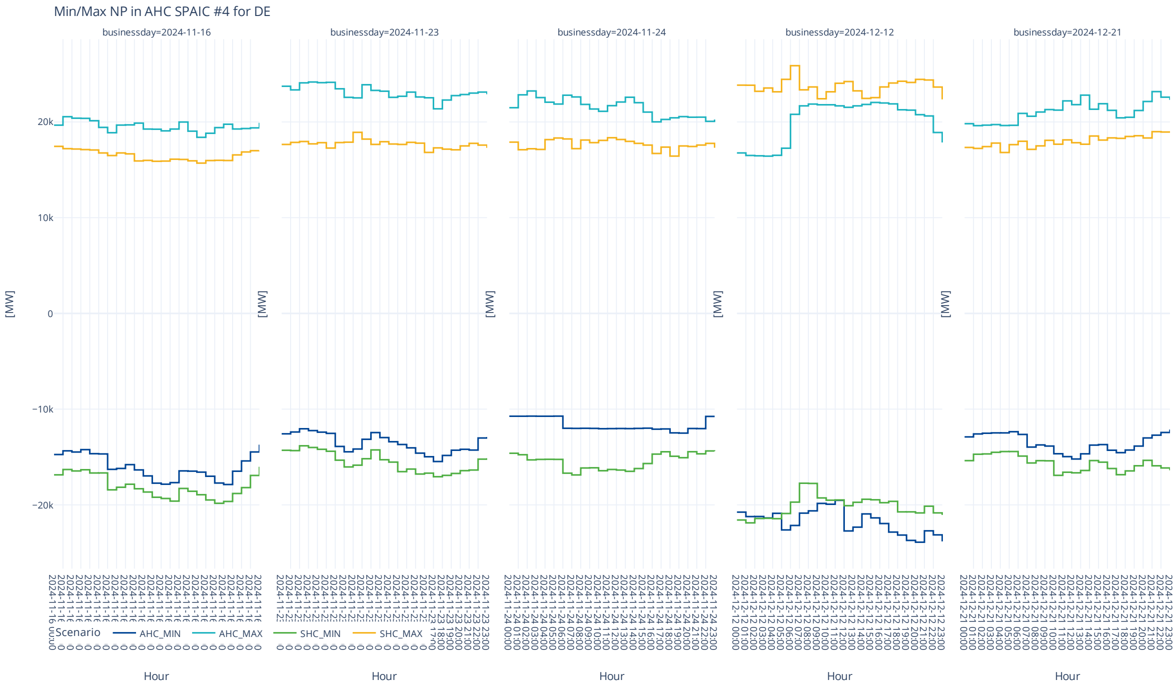
AHC_MAX
SHC_MIN
SHC_MAX
Hour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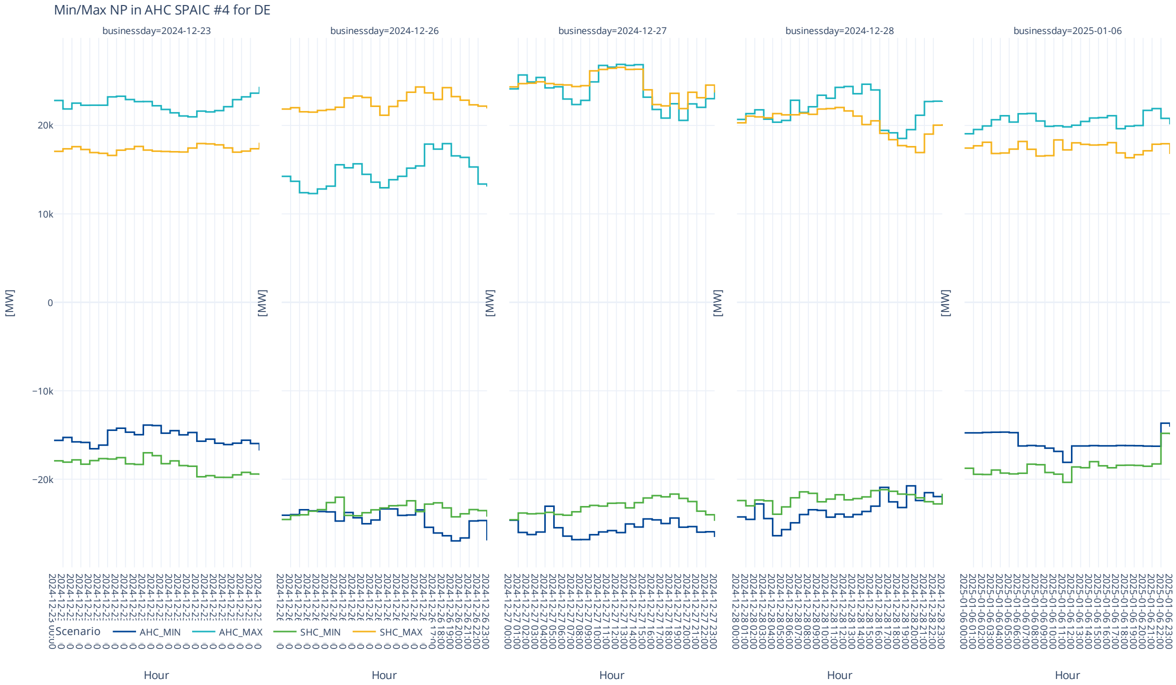
AHC_MAX
SHC_MIN
SHC_MAX
Hour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−20k
Scenario
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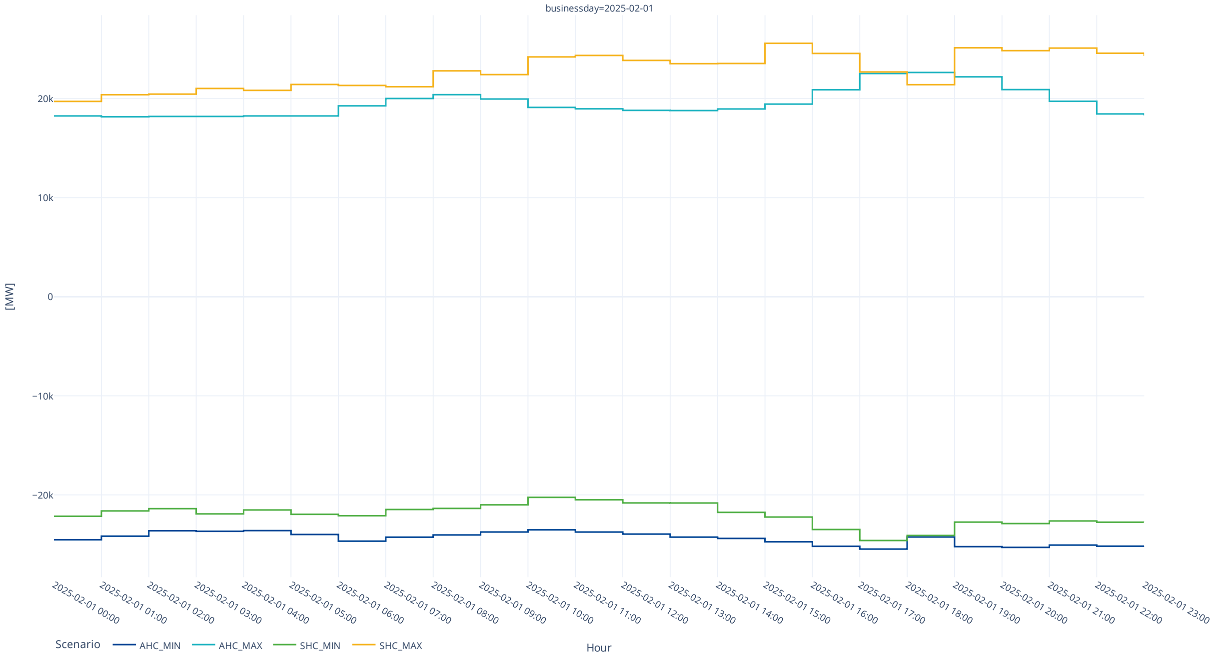
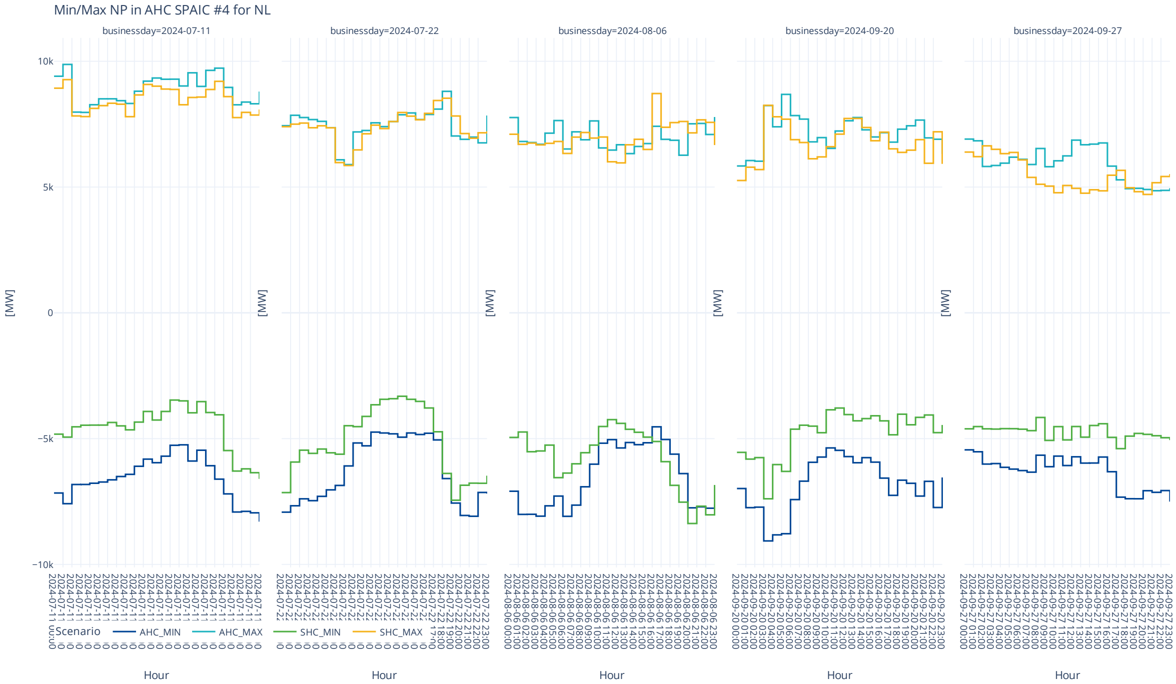
AHC_MAX
SHC_MIN
SHC_MAX
Hour

Min/Max NP in AHC SPAIC #4 for DE



4.1.2 NL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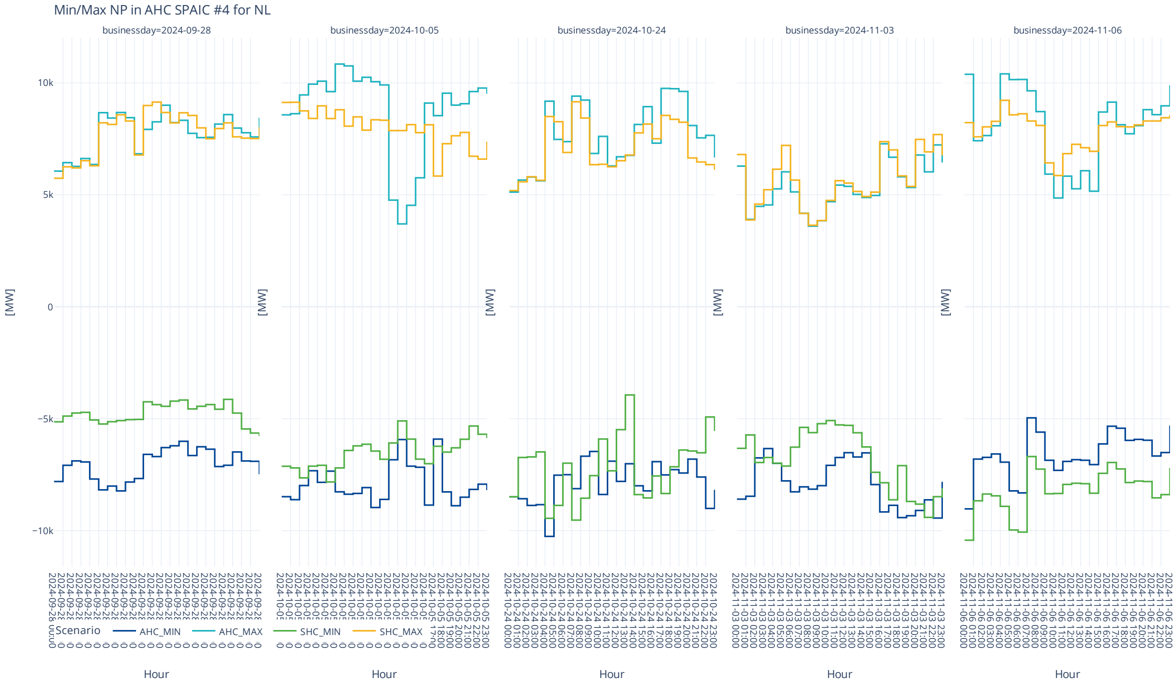
SHC_MIN
SHC_MAX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AHC_MAX
SHC_MIN
SHC_MAX

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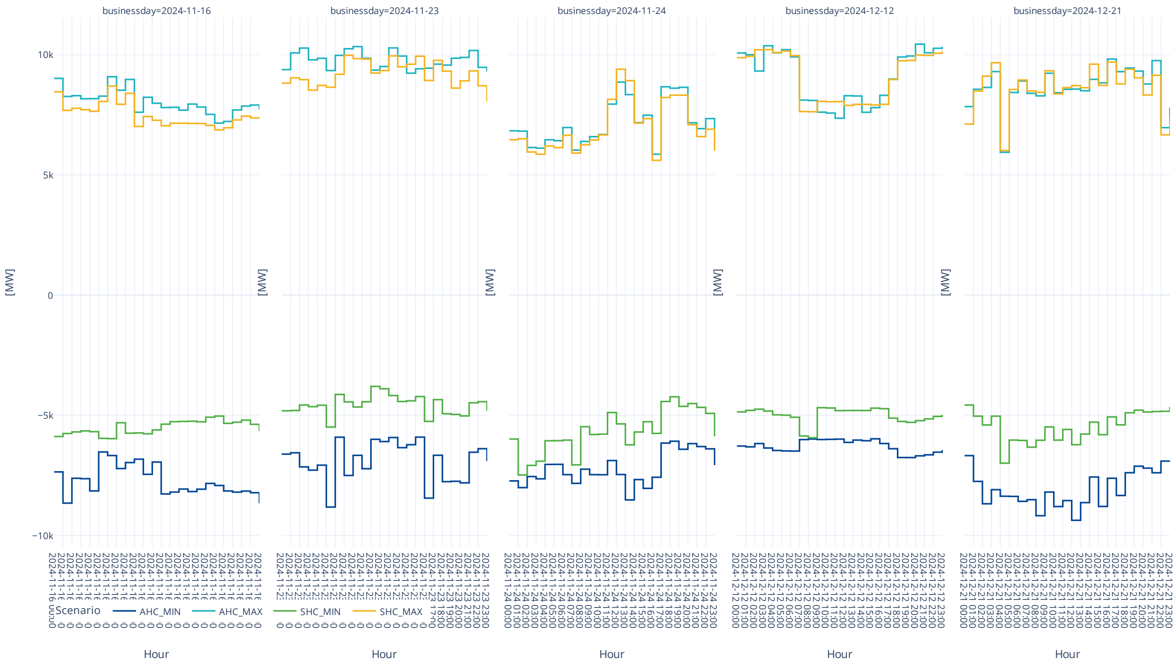
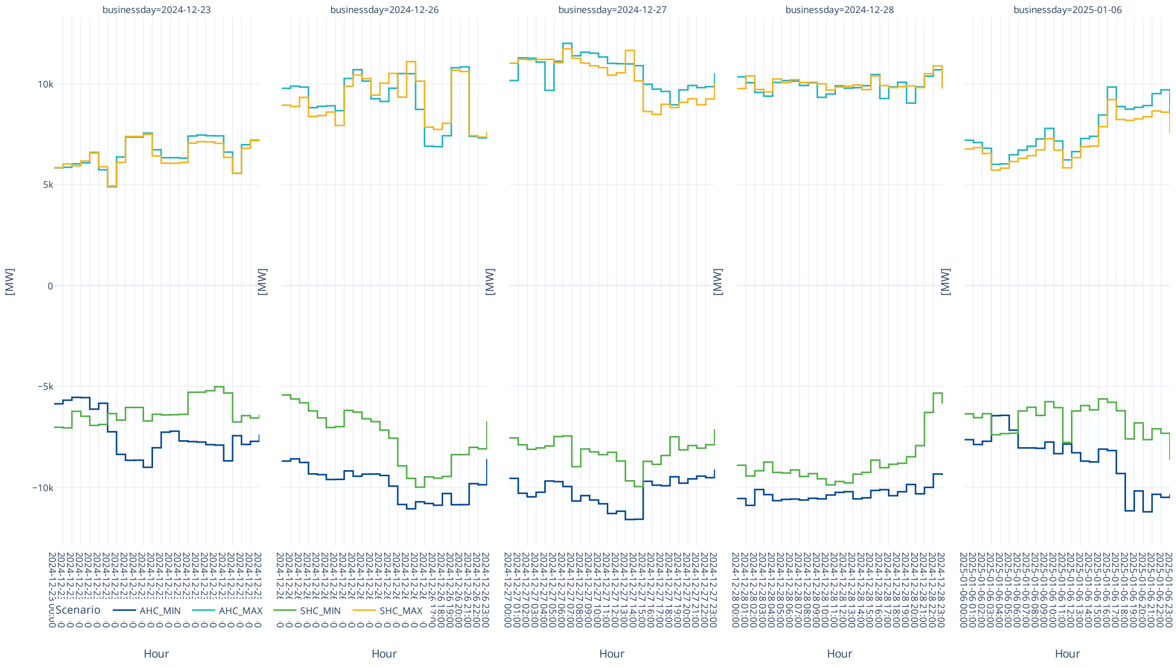
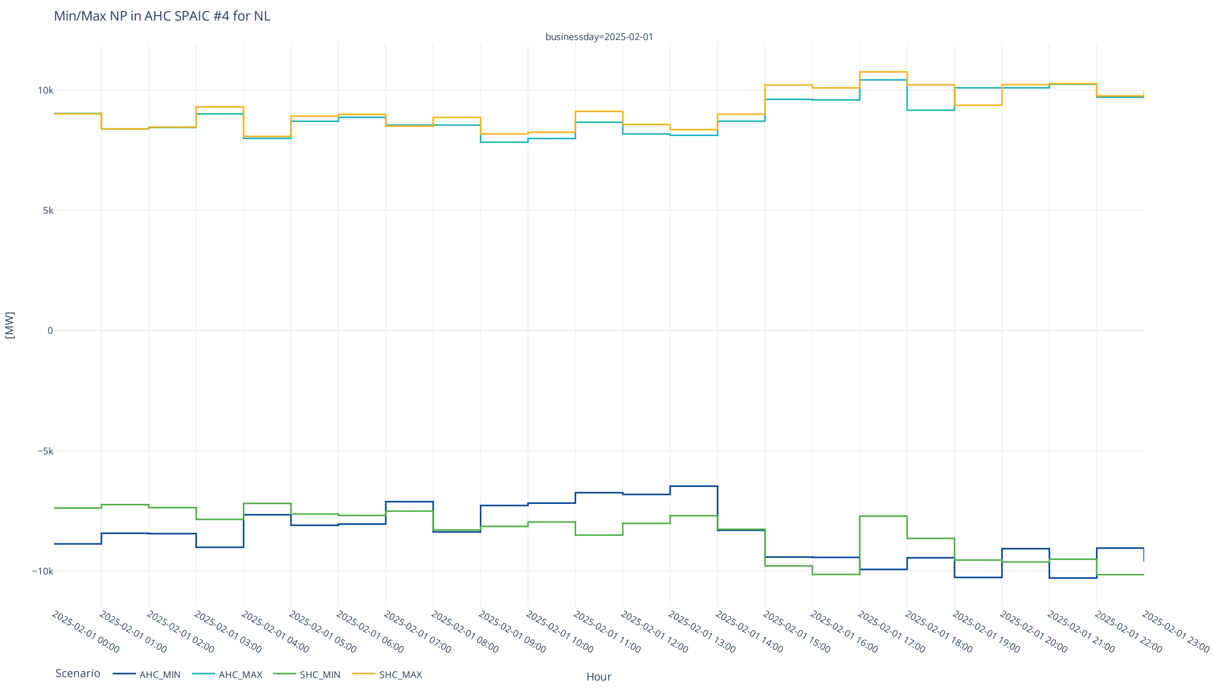


Min/Max NP in AHC SPAIC #4 for NL





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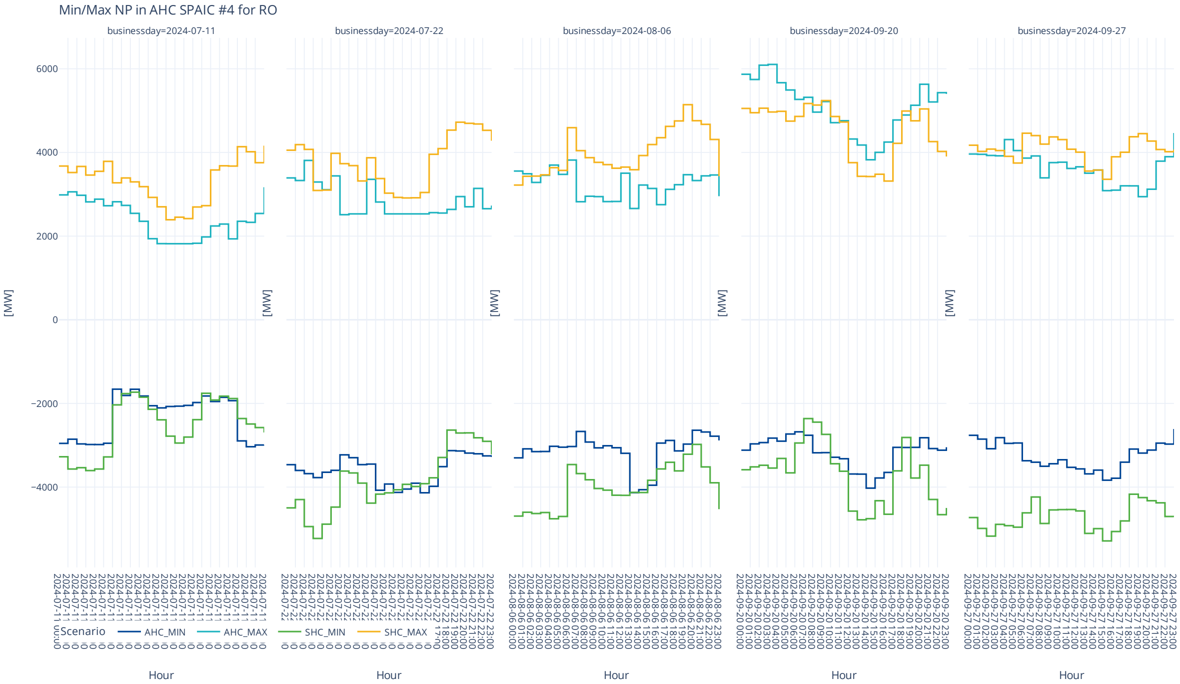
2025-02-01 19:00
2025-02-01 20:00
2025-02-01 21:00
2025-02-01 22:00
2025-02-01 23:00
Hour
Scenario
AHC_MIN
AHC_MAX
SHC_MIN
SHC_MAX

4.1.3 RO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Hour
Scenario
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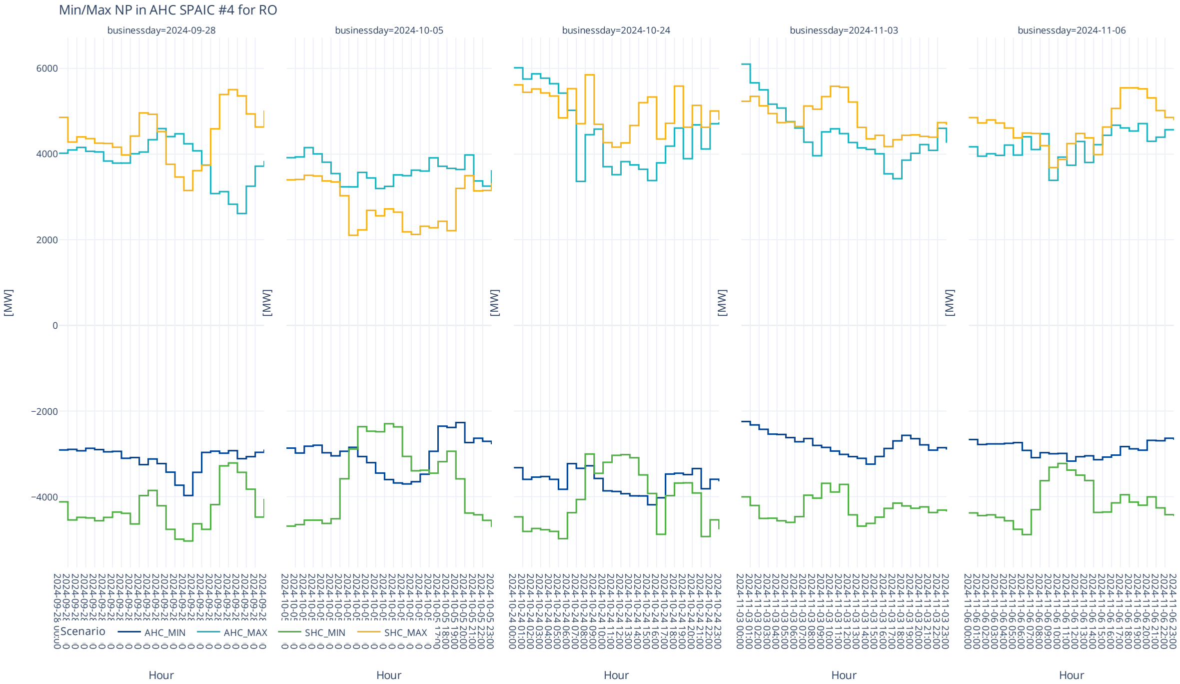
AHC_MAX
SHC_MIN
SHC_MAX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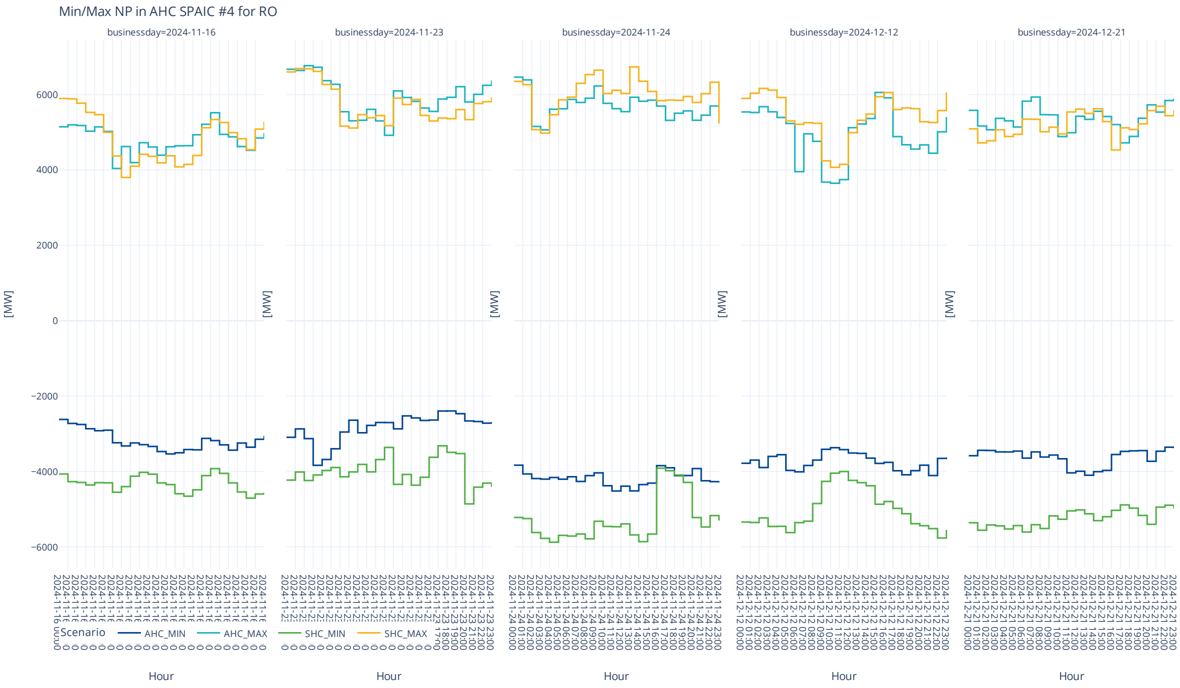
Hour
Scenario
AHC_MIN
AHC_MAX
SHC_MIN
SHC_MAX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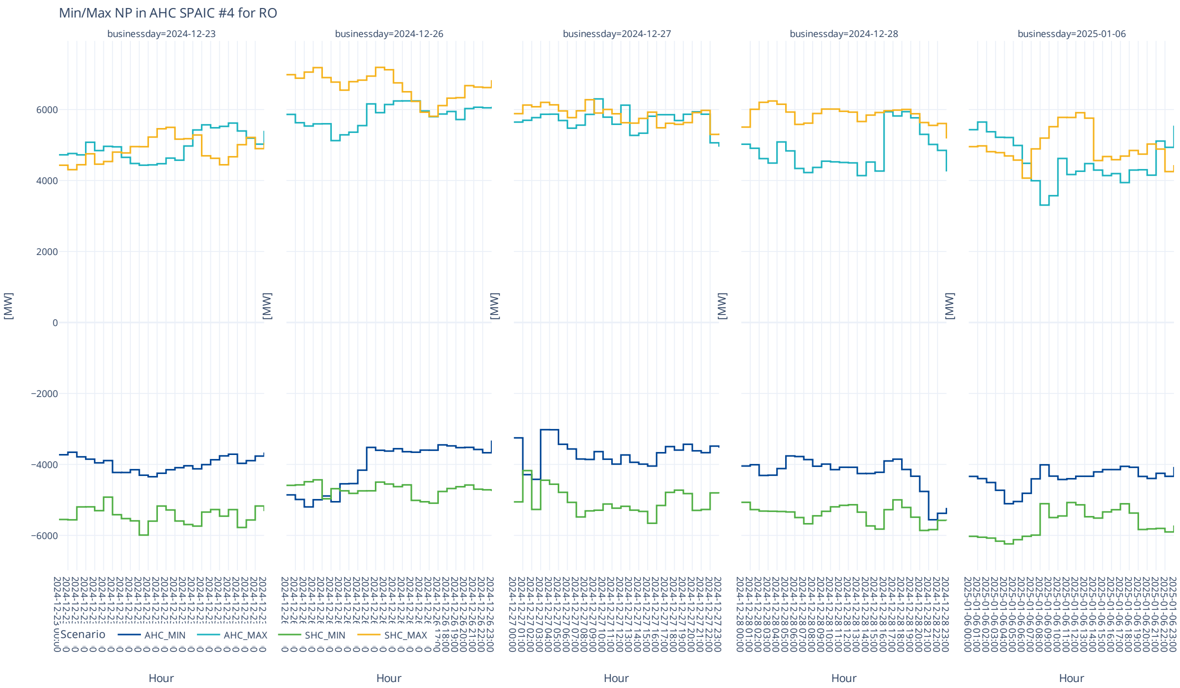
Scenario
AHC_MIN
AHC_MAX
SHC_MIN
SHC_MAX
Hour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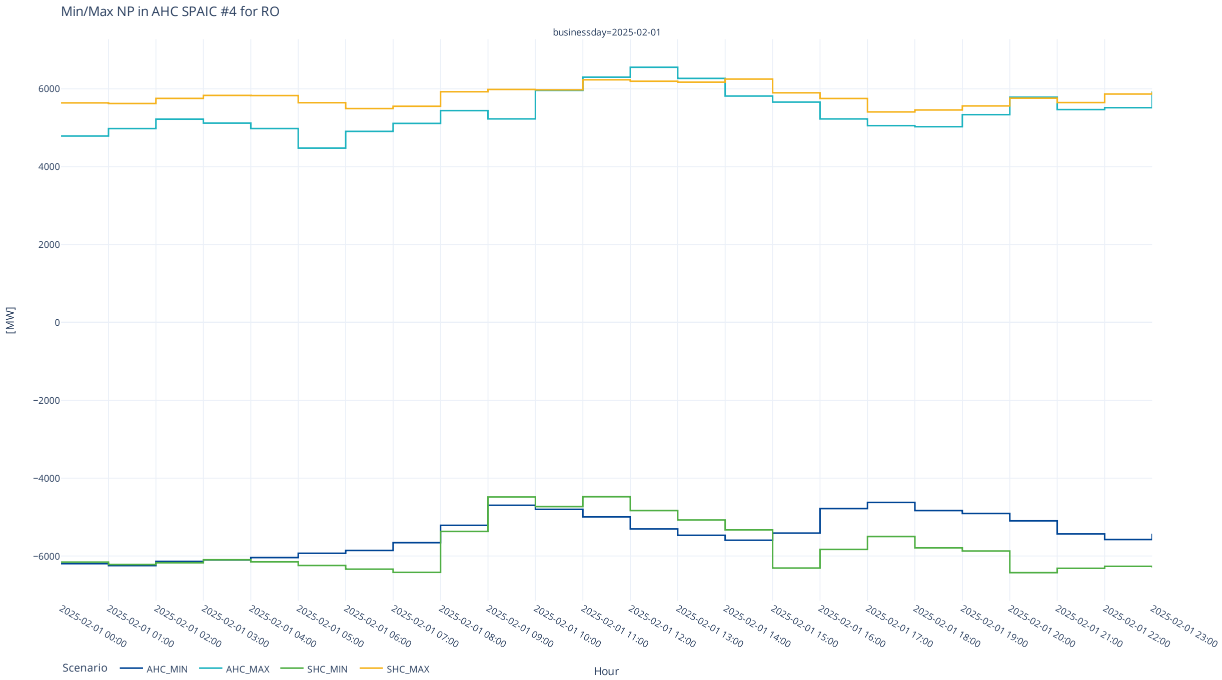
AHC_MAX
SHC_MIN
SHC_MAX
Hour



Classification of the results for the RO/BG border

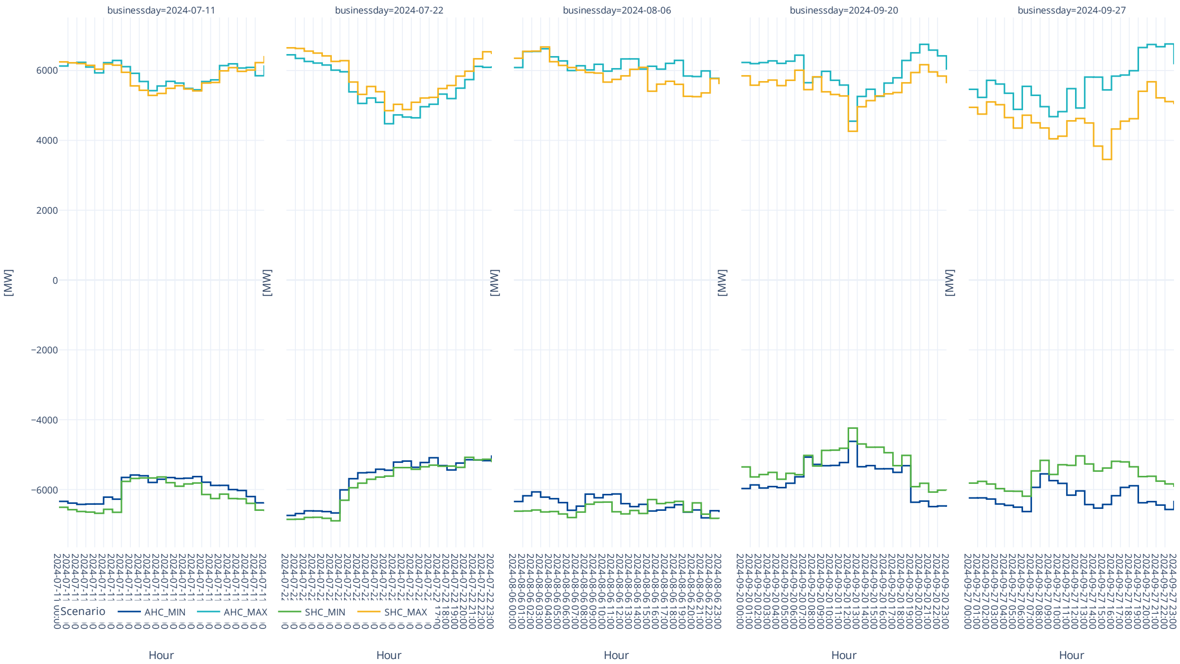
In the AHC SPAICC-like run #4, LTA inclusion was applied for both the AHC and Core borders. Nevertheless, the plots above show that the available capacities on the RO/BG border are lower in the AHC case compared to the SHC case. The reduced minimum and maximum net-position figures in the AHC scenario can be explained by the higher level of operational grid security.

In the current non-coordinated SHC approach, capacity can be released by both CCRs (SEE and Core), depending on reciprocal forecasts of flows caused by other CCRs. However, if forecast errors occur – for example, when exchanges on the RO/BG border are forecasted too low – the resulting f_uaf is underestimated or incorrectly computed. This leads to an overestimation of available capacities, which can endanger operational grid security and impact neighboring TSOs, as those imports will take "routes" via, e.g., Serbia and Croatia.

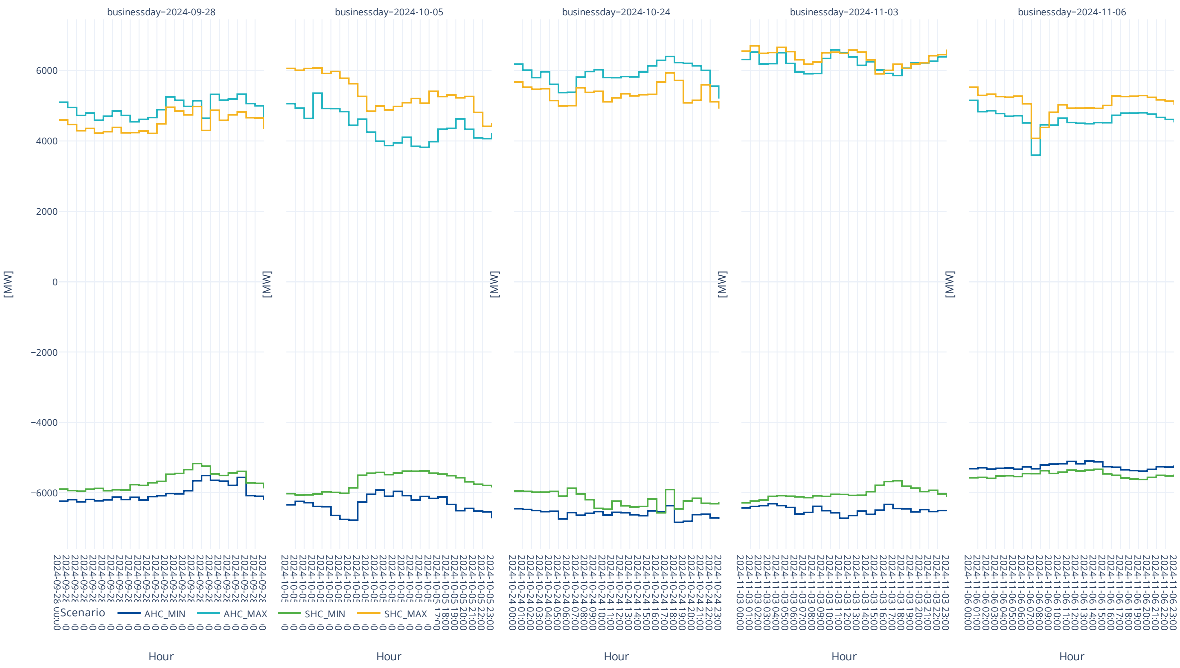
While this issue is not an inherent shortcoming of the AHC method – since AHC merely makes these flows "visible" – Core TSOs consider this enhanced visibility a significant gain in operational grid security. Todays' situation in SHC may be associated with operational risks taken in real – time, overloads on the lines and in extreme cases, power outages.

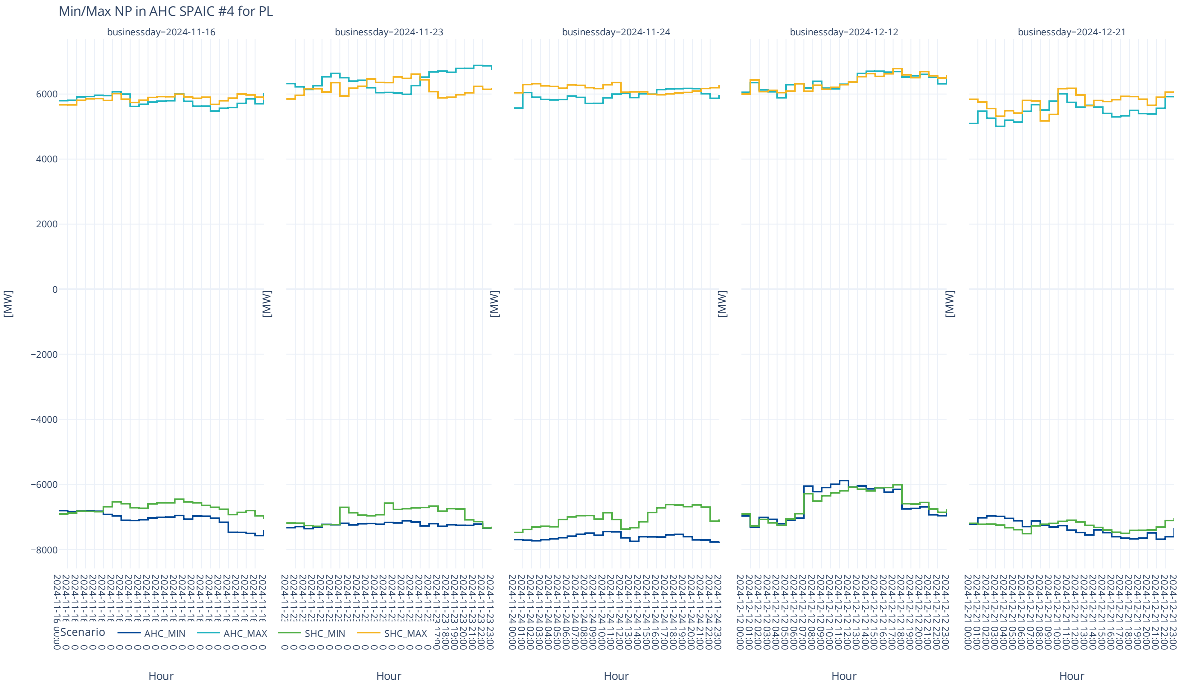
4.1.4 PL

Min/Max NP in AHC SPAIC #4 for PL



Min/Max NP in AHC SPAIC #4 for PL

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Scenario
AHC_MIN
AHC_MAX
SHC_MIN
SHC_MAX
Hour


Min/Max NP in AHC SPAIC #4 for PL
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Scenario
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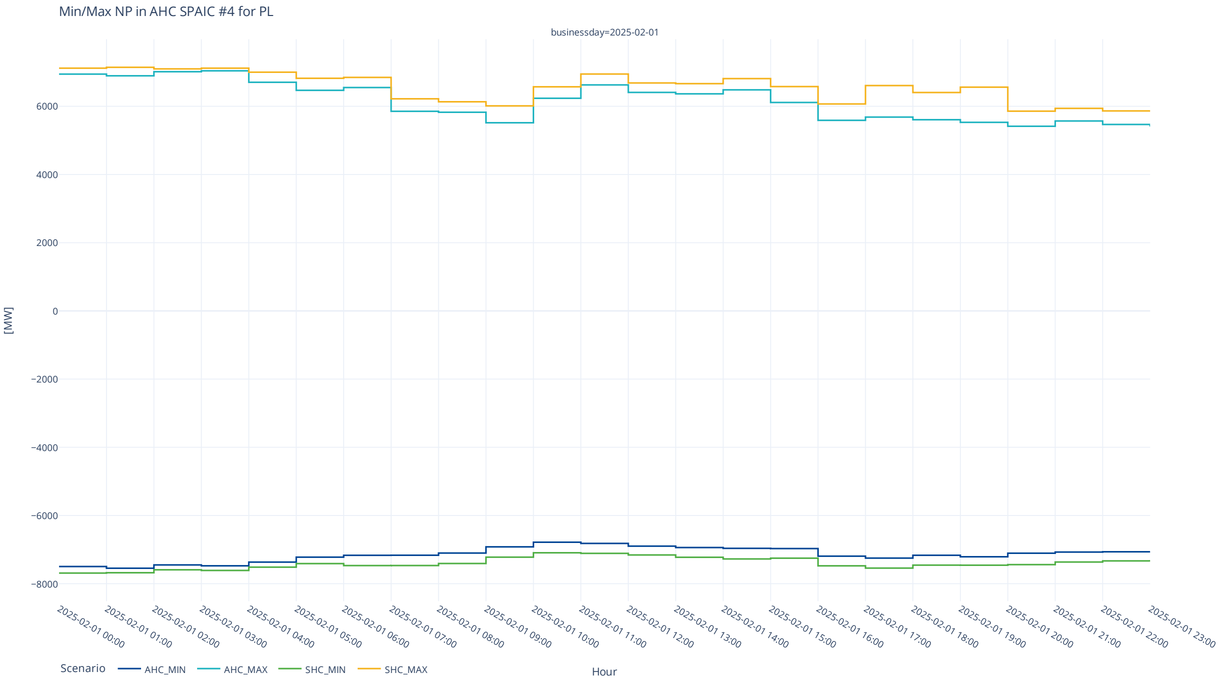
AHC_MAX
SHC_MIN
SHC_MAX
Hour



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2025-02-01 18:00
2025-02-01 19:00
2025-02-01 20:00
2025-02-01 21:00
2025-02-01 22:00
2025-02-01 23:00
Hour
Scenario
AHC_MIN
AHC_MAX
SHC_MIN
SHC_MAX

4.2. Differences in unscheduled allocated flow due to AHC

Unscheduled allocated flows (F_{uaf}) are flows resulting from forecasted market exchanges with other CCRs (e.g. Hansa or Italy North) or third countries (e.g. Switzerland or Serbia). Those flows stem from a lack of coordination and inefficient capacity calculation and allocation but could also be the result of a scheduling methodology, which does not follow the physical flows resulting from capacity allocation. Hence, they are influenced by the introduction of AHC.

Figure 4-1 below shows the F_{uaf} for two CNEs (in base case) close to future Core AHC bidding zone borders for 11 July 2024, taken from SPAICC-like run #3 as no significant changes in the conclusions could be observed by taking data from SPAICC-like run #4.

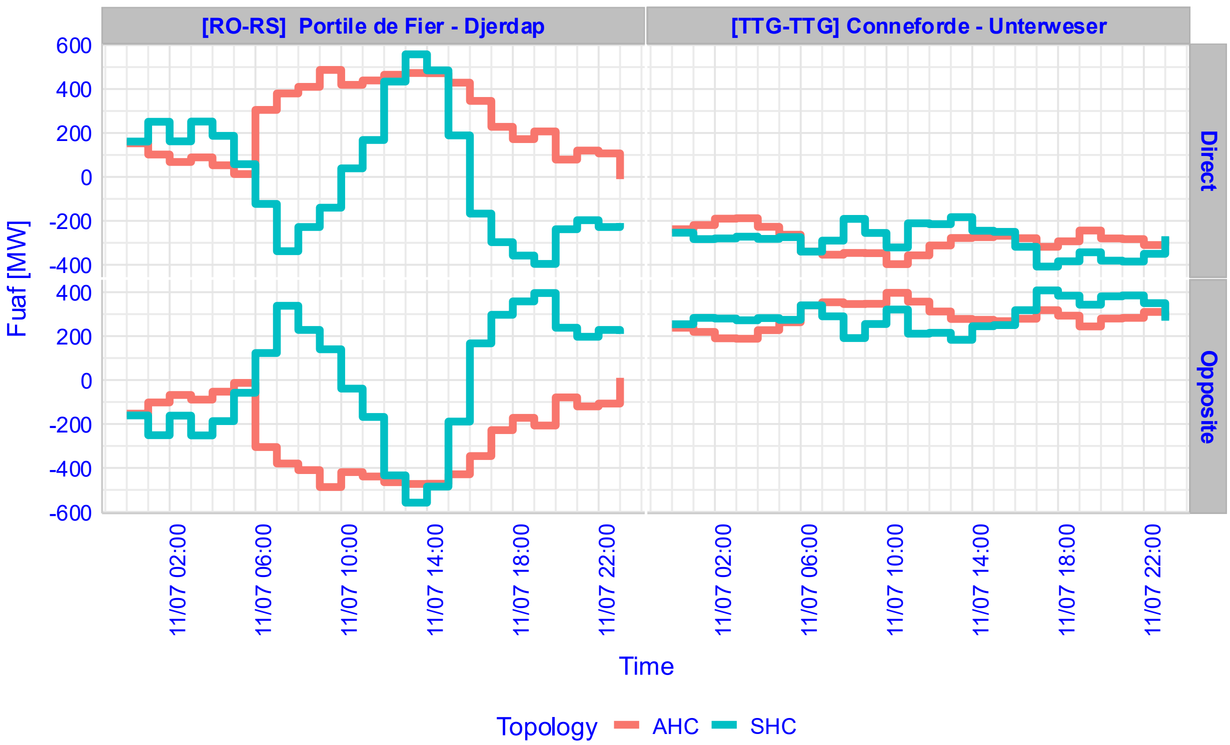

Figure 4-1: Example of F_{uaf} on two CNEs and difference between SHC and AHC

The first CNE '***Portile de Fier - Djerdap***', is located on the Romanian-Serbian bidding zone border and showed a zone-to-zone PTDF > 15% on the exchanges between Romania and Bulgaria for that day. In a similar fashion, the Tennet Germany CNE '***Conneforde - Unterweser'*** showed a zone-to-zone PTDF > 15% on the exchanges between Germany and Denmark 1 for that day. For both CNEs, the changes in F_{uaf} over time between SHC and AHC are apparent. These changes can result in both higher and lower F_{uaf}. For comparison and to illustrate the 'mirroring' effect on F_{uaf}, both the direct and opposite direction of both CNEs are shown.

5. EXPLANATION OF DATA PROVIDED WITH THIS DOCUMENT

Core TSOs provide two zip-files per BD. One contains the final domain results, as it would normally be published on the JAO publication tool. The other one contains the plots as shown in the previous section for all hubs in html format. When interpreting the results, the limitations listed in chapter 2 shall be taken into account.

6. NEXT STEPS

Preparations for AHC go live in SDAC are still in progress. For the time being, no specific go-live date for Core AHC has been set by the relevant market coupling and SDAC groups. Whilst Core TSOs are technically ready to go live with AHC, a three-month preparation phase will be needed to prepare for a go live after a date has been confirmed. Currently and in case no performance issues are identified during the SDAC performance tests, which are conducted in parallel to the SPAICC-like runs, a go live of AHC is expected in the first half of 2026. Core TSOs will issue a public statement, once the go live date has been agreed upon and preparation begin at least 3 months before a go live.