

SOUTH-EAST EUROPE ENERGY BRIEF

News Analysis

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On System Separation in the Continental Europe Synchronous Area on 8 January 2021*

On 8 January 2021 at 14:05 CET the synchronous area of Continental Europe was separated into two parts due to outages of several transmission network elements in a very short time. ENTSO-E has already published initial information on the event on 8 January 2021, followed by an update with geographical view and time sequence on 15 January 2021. Since then, ENTSO-E has analysed a large portion of relevant data aiming to reconstruct the event in detail [1]. The event was also reported in IENE's Newsletter "SEE Electricity Market Analysis", No111 (Week 1: 4 – 10 January 2021) [3].

According to the most recent update published by ENTSOE on 26 January [1], the analysed sequence of events concludes that the initial event was the tripping of a 400 kV busbar coupler¹ in the substation Ernestinovo (Croatia) by overcurrent protection at 14:04:25.9. This resulted in a decoupling of the two busbars in the Ernestinovo substation, which in turn separated North-West and south-east electric power flows in this substation. As shown in Figure 1 below, North-West bound lines which remained connected to one busbar, connect Ernestinovo to Zerjavinec (Croatia) and Pecs (Hungary), while South-East bound lines which remained connected to another busbar, connect Ernestinovo to Ugljevik (Bosnia-Herzegovina) and Sremska Mitrovica (Serbia).



Figure 1 - Decoupling of two busbars in Ernestinovo

¹ A busbar is an electrical junction in a substation, which connects overhead lines, cables and transformers through electrical switches. Usually, there are several busbars in a substation, which can be connected by a busbar coupler.

The separation of flows in the Ernestinovo substation, lead to the shifting of electric power flows to neighbouring lines which were subsequently overloaded. At 14:04:48.9, the line Subotica – Novi Sad (Serbia) tripped due to overcurrent protection. This was followed by the further tripping of lines due to distance protection, as shown in Figure 2, below, leading eventually to separation of the systems into two parts at 14:05:08.6.



Figure 2 - Tripping of additional transmission network elements after the decoupling of two busbars in Ernestinovo

The route where the two parts of the Continental Europe Synchronous Area were separated is shown in Figure 3 below:

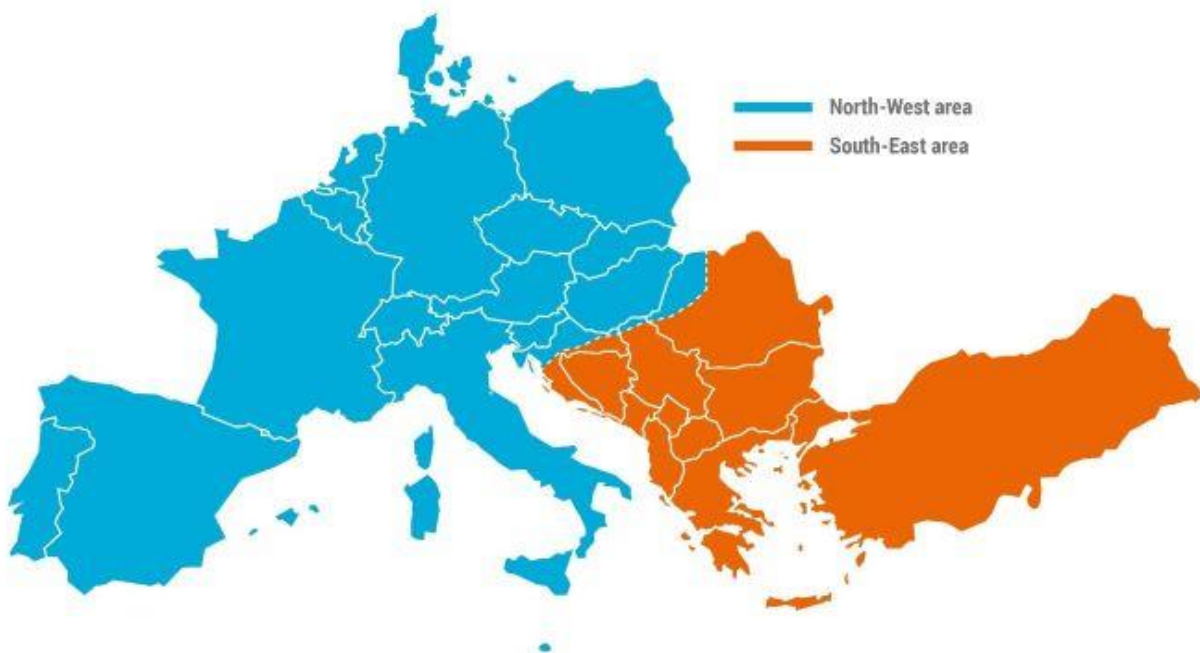


Figure 3 – Separation of Continental Europe Synchronous Area on 8 January 2021

The system separation resulted in a deficit of power (approx. -6.3 GW) in the North-West Area and a surplus of power (approx. +6.3 GW) in the South-East Area, resulting in turn in a frequency decrease in the North-West Area and a frequency increase in the South-East Area.

At approximately 14:05 CET, the frequency in the North-West Area initially decreased to a value of 49.74 Hz within a period of around 15 seconds before quickly reaching a steady state value of approximately 49.84 Hz. At the same time, the frequency in the South-East Area initially increased up to 50.6 Hz before settling at a steady state frequency between 50.2 Hz and 50.3 Hz as illustrated in Figure 4 below:

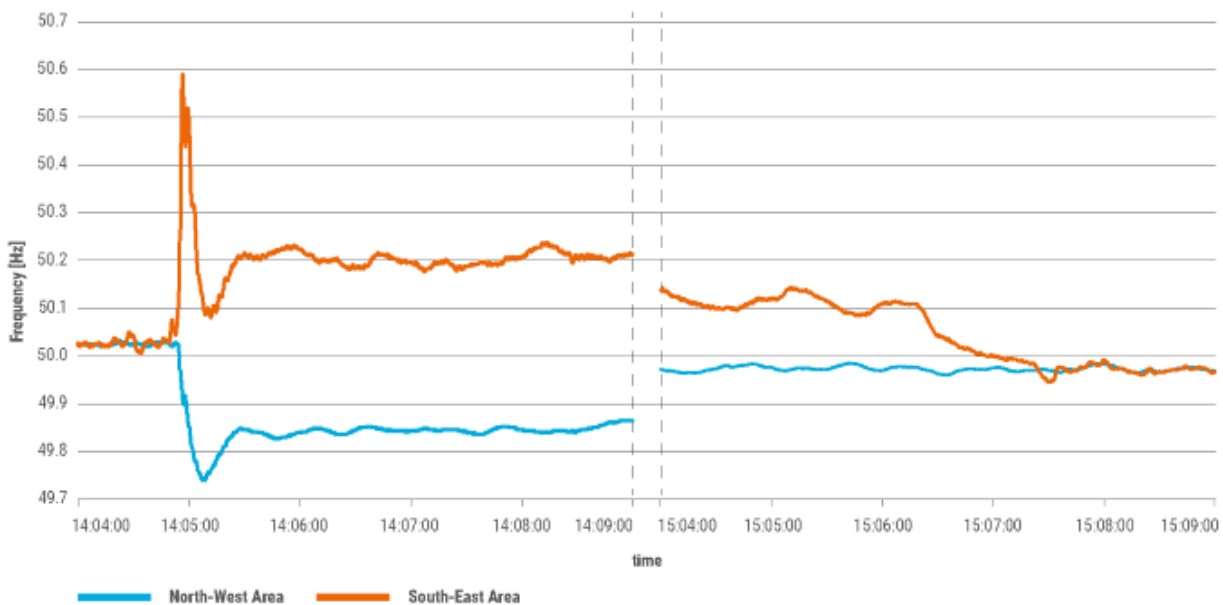


Figure 4 - Frequency in Continental Europe during the event on 8 January 2021 right after the disturbance and during resynchronisation

Due to the low frequency in the North-West Area, contracted interruptible services in France and Italy (in total around 1.7 GW) were disconnected in order to reduce the frequency deviation. These services are provided by large customers who are contracted by the respective Transmission System Operators (TSOs) to be disconnected if frequency drops under a certain threshold. In addition, 420 MW and 60 MW of supportive power were automatically activated from the Nordic and Great Britain synchronous areas respectively. These countermeasures ensured that already at 14:09 CET the frequency deviation from the nominal value of 50 Hz was reduced to around 0.1 Hz in the North-West area (Figure 4).

In order to reduce the high frequency in the South-East Area, automatic and manual countermeasures were activated, including the reduction of generation output (eg. automatic disconnection of a 975 MW generator in Turkey at 14:04:57). As a consequence, the frequency in the South-East Area returned to 50.2 Hz at 14:29 CET and remained within control limits (49.8 and 50.2 Hz) until the resynchronisation of the two separated areas took place at 15:07:31.6 CET.

The automatic response and the coordinated actions taken by the TSOs in Continental Europe ensured that the situation was quickly restored close to normal operation. The contracted

interruptible services in Italy and in France were reconnected at 14:47 CET and 14:48 CET respectively prior to the resynchronisation of the North-West and South-East areas at 15:08 CET. According to ENTSOE, despite the balancing reserves activated, customers² in the order of 70 MW in the North-West Area and in the order of 163 MW in the South-East Area were disconnected. Due to the high resilience of the interconnected network and the rapid response of European TSOs, the security of operation and electricity supply was not endangered further.

Based on the preliminary technical analyses provided by ENTSOE, a formal investigation in line with the legal framework under the Commission Regulation (EU) 2017/1485 of 2 August 2017 (System Operation Guideline) will take place, whereby National Regulatory Authorities and ACER will be invited to join with TSOs and an Expert Investigation Panel. According to with the provisions of the mentioned Commission Regulation (EU) 2017/1485 of 2 August 2017, ENTSOE will present the results of the investigation to the Electricity Coordination Group and will subsequently publish a report once the analysis has been completed. The report will describe in detail the sequence of events, the root causes and – if applicable – necessary actions which need to be taken to contribute in preventing similar events in the future. More on ENTSOE's analysis concerning the event can be found on <https://www.entsoe.eu/news/2021/01/26/system-separation-in-the-continental-europe-synchronous-area-on-8-january-2021-2nd-update/>.

The event has been characterized as significantly crucial since Continental Europe is expected to rely more and more on the cross-border transmission grid, as dispersed generation from renewables increases in line with the targets of the European Green Deal. More specifically, the midterm plan of ENTSOE for continental Europe includes 50 GW of new cross-border transmission capacity projects until 2030. ENTSOE's Ten Year Network Development Plan (TYNDP) (currently under public consultation) is available on <https://tyndp.entsoe.eu/>.

It must be further noted that the Continental Europe synchronous area, one of the largest interconnected synchronous electricity systems in the world in terms of its size and number of supplied customers, has endured system separation in the past with a much larger disturbance and impacts on customers than the recent one. The last such event, which took place on 4 November 2006, was extensively analysed and led to a number of substantial developments, like the European Awareness System (EAS) which is a platform allowing TSOs to exchange operational information in real time, enabling them to react immediately in case of unusual system condition. The TSOs are therefore well prepared in order to coordinate and manage such events and limit the consequences. This preparedness and a permanent observation of the system frequency allowed the operators to resynchronize the two separated areas in a very short period of time in the separation event of 8 January 2021.

****This special analysis was contributed by Alexandros Perellis, Senior Researcher at IENE***

² Refers to consumers that were not contracted for provision of balancing services

REFERENCES

- [1] ENTSOE, 2021, “System separation in the Continental Europe Synchronous Area on 8 January 2021 – 2nd update”, Available online at:
<https://www.entsoe.eu/news/2021/01/26/system-separation-in-the-continental-europe-synchronous-area-on-8-january-2021-2nd-update/>
- [2] ENTSOE, 2020, “TYNDP 2020 – Main Report (Version for public consultation)”, Available online at: https://eepublicdownloads.blob.core.windows.net/public-cdn-container/tyndp-documents/TYNDP2020/Forconsultation/TYNDP2020_Report_forconsultation.pdf
- [3] IENE, 2021, “SEE Electricity Market Analysis No111”

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