Winter Outlook 2022-2023

Summer 2022 Review

Country comments

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ENTSO-E Mission Statement

Who we are

ENTSO-E, the European Network of Transmission System Operators for Electricity, is the **association for the cooperation of the European transmission system operators (TSOs)**. The 42 member TSOs, representing 35 countries, are responsible for the **secure and coordinated operation** of Europe's electricity system, the largest interconnected electrical grid in the world. In addition to its core, historical role in technical cooperation, ENTSO-E is also the common voice of TSOs.

ENTSO-E **brings together the unique expertise of TSOs for the benefit of European citizens** by keeping the lights on, enabling the energy transition, and promoting the completion and optimal functioning of the internal electricity market, including via the fulfilment of the mandates given to ENTSO-E based on EU legislation.

Our mission

ENTSO-E and its members, as the European TSO community, fulfil a common mission: Ensuring the **security of the inter-connected power system in all time frames at pan-European level** and the **optimal functioning and development of the European interconnected electricity markets**, while enabling the integration of electricity generated from renewable energy sources and of emerging technologies.

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Introduction

This document includes individual country reviews on the security of supply situation in their system during the last season, as well as comments on the expected adequacy situation or specific operational conditions during the coming season. It aims to present specific national insights provided by TSOs on a voluntary basis. These insights reflect only the positions of the concerned TSOs who have submitted their comments and should not be considered as ENTSO-E's statement.

The aim of the retrospective reviews is to present the most important events that occurred during previous season and to compare them to the previous Seasonal Outlook study results. Important or unusual events or conditions in the power system and the remedial actions taken by the TSOs are also mentioned.

Comments on the expected adequacy situation and any additional information are presented to provide more background information about the local power systems, which might not always be represented in pan-European adequacy models.

Countries did not provide comments or reviews if there was no relevant information to be reported.

Albania

Winter Outlook 2022-2023

No adequacy issues are expected for the Winter 2022-2023.

Summer Review 2022

No adequacy issues were recorded during the past season.

Austria

Winter Outlook 2022-2023

This year's Winter Outlook Report - published in times of tense geopolitical situations - does not show any adequacy concern for Austria, neither in the reference scenario nor in the individual sensitivities.

On top of the European seasonal assessment performed by ENTSO-E, Austrian Power Grid AG (APG) carried out a stress test for this winter period, in which three different combinations of scenarios were analysed. The first combined scenario (assuming unconstrained gas availability in Europe) does not show adequacy risks for Austria. However, in case of drastic reductions of gas availability in Europe affecting all Member States, Austria may face scarcity situations and insufficient availability of resources to ensure a secure domestic supply of electricity.

APG is preparing for a National Resource Adequacy Assessment (NRAA), which will in the future be carried out on top of the European Resource Adequacy Assessment (ERAA) and Seasonal Outlooks (SO). The scope of such an NRAA is to investigate additional scenarios with possible implications on Austria's security of supply.

Austria is well prepared for the coming winter: grid reserves in an amount of ca. 3 GW are contracted and thus available. On top the maintenance windows of power-plants were re-optimized to allow for maximum availability. Furthermore, the storage levels of gas fuel storages and reservoirs of pump storage hydro plants are at very good filling level.

Regarding the published CGV values, APG appreciates the effort that has been taken in order to perform a first assessment on the European perimeter in this direction. However, practical operational experience of APG as well as expert opinions of Austrian stakeholders show that the published values are underestimating the actual critical gas volume needed to ensure security of supply in the Austrian electricity sector. The following reasons have been identified: heat volumes of CHPs, as well as gas supply for some ancillary services (e.g. redispatch) are not considered in the current approach.

Summer Review 2022

Following an initial estimate carried out by the Austrian Weather Service (ZAMG), the year 2022 is very likely to be one of the five warmest years in the history of measurements and might even end up being number one in history.

In the evaluation period January to November 2022 (in the lowlands of Austria), the current year is similar to 2018, which was the warmest year measured so far. In the regions with higher altitudes, 2022 has been even warmer. The course of the remaining months (November and December) will determine the final placement.

The hydro production in Austria during the summer months was very low. Especially between mid-June till mid-September, only 70% of the average production of the previous years was generated.

Belgium

Winter Outlook 2022-2023

Next winter, the availability of the production park in Belgium is high during the whole winter period. The only unavailable units will be the two nuclear units that are going in phase-out (Doel 3 [1GW] 24/09/22 and Tihange 2 [1GW] 01/03/2023).

For all planned outages during the winter that have an impact on the market, it is possible to delay the works in case of adequacy issues that require full exchange capacity. This is also the case on the request of neighboring countries.

Therefore, in normal conditions, Belgium has a lot of export potential (reduces by end of the winter due to the nuclear phase-out). In severe conditions (high load combined with low wind/CHP) only import need to cover additional outages. Only in very extreme situations (low probability) would there be an adequacy risk for Belgium.

Summer Review 2022

No adequacy issues were recorded during the past season.

Bosnia and Herzegovina

Winter Outlook 2022-2023

No adequacy issues are expected for the Winter of 2022-2023.

Summer Review 2022

No adequacy issues were recorded during the past season.

Bulgaria

Winter Outlook 2022-2023

The maintenance of all thermal units has finished according to the agreed schedule and no further planned outages are expected during the winter season of 2022-2023. It should be mentioned, however, that Bulgaria is experiencing a reduced availability of hydro resources during this winter period due to ongoing rehabilitation of the largest Bulgarian hydro cascade. The Pumped Storage Hydro Power Plant Chaira – the largest pumped storage plant in the Balkans is also out of commission due to serious technical problems. This may be a concern if the winter turns out to be harsher than usual combined with elevated forced outage rates of important thermal and nuclear units.

Summer Review 2022

No adequacy issues were recorded during the past season.

Croatia

Winter Outlook 2022-2023

No adequacy issues are expected for the Winter of 2022-2023.

Summer Review 2022

No adequacy issues were recorded during the past season.

Cyprus

Winter Outlook 2022-2023

It is unlikely that Cyprus would experience adequacy issues during winter 2022-2023. However, because Cyprus is an isolated island, there is a small probability that adequacy issues could arise, through a combination of unplanned outages and unfavourable weather conditions.

Cyprus does not use natural gas in its generation mix, and will thus not be directly affected by any gas shortages.

Summer Review 2022

No adequacy issues were recorded during the past season.

Czech Republic

Winter Outlook 2022-2023

No significant adequacy issues are expected for the Winter of 2022-2023 (considering standard conditions of thermal units' operation and gas supply). With the current development, we observe how the electricity demand responds to high energy prices throughout the sectors. Since October the savings have been causing the electricity demand to fluctuate at levels comparable to the first Covid year of 2020.

We expect gas units' utilization to decrease in the Outlook as commodity forward prices remain high. However, these units are capable of higher-than-expected utilization in case the situation on the gas spot market develops favorably and there are no restrictions on gas delivery.

The Czech Republic is concerned about the situation of extraordinary gas supply. For the Czech Republic, a very low CGV value was calculated. The reason is that the methodology for CGV calculation does not fully cover all specifics related to operating the Czech thermal units. For example, we see a stronger dependency on gas supply for CHP units delivering heat to central heating systems. Furthermore, gas-fired units providing balancing reserves are crucial for maintaining the security of supply, especially in case of unexpected simultaneous outages of large thermal blocks when margins are tighter.

Based on these assumptions and according to the proposed legislation, the Czech Republic raises awareness of following additional monthly needs in normal conditions:

- 15 mcm – gas needed for electricity generation from CHP units
- 10 mcm – ancillary services allocated on gas units in case of high peaking of coal power plants
- 28 mcm – gas for backup to maintain generation adequacy in case of unexpected longer-term shutdown of big units due to unexpected maintenance or repairs (Czech specificity of having very large NPP blocks in the grid, criterion N-1)
- 4 mcm – gas needed for stabilization of coal-burning in coal-fired power plants

Although the Czech power system is expected to remain robust with positive margins and export capabilities throughout the whole horizon of the Winter Outlook, the potential support of the European balance could be at risk if the low CGV allocation remains as defined by the current version of Winter Outlook 2022-2023.

Summer Review 2022

No adequacy issues were recorded during the past season.

Denmark

Winter Outlook 2022-2023

Energinet expects a stable winter with no adequacy issues. Outages on the power plants and interconnectors are minimal.

There are only few restrictions on the connections to Germany, TenneT, Sweden, and Norway. The Connections to 50Hz (Kontek) and TenneT NL (Cobra) are out of operation due to necessary repairs and yearly maintenance.

Even with low wind- and solar production, no adequacy issues are expected due to the need for district heating where CHP plants will also produce power.

Due to the modeling guidelines and data collection, an artificially high Critical Gas Volume (CGV) is found in the studies for Denmark. This is due to the modeling of Combined Heat and Power plants (CHP) where the generation is locked to a profile resembling the heating demand in the district heating sector. This makes the CHPs related to district heating account for ~80% of gas-fueled capacity in Denmark. Relaxing the heat constraint ("must run constraint"), if there are alternative heat sources such as heat pumps and electric boilers available, would give a lower CGV.

Summer Review 2022

No significant incidents happened in the Danish power system during the summer 2022. The relatively dry spring and summer have taken a toll on Nordic hydro stock and have also decreased the power output from wind to below-normal levels for the period. This situation has during summer lowered the level of the power adequacy surplus but has not critically impacted the power balance.

Estonia

Winter Outlook 2022-2023

No adequacy issues are expected for the Winter of 2022-2023.

Summer Review 2022

No adequacy issues were recorded during the past season.

Finland

Winter Outlook 2022-2023

Adequacy in Finland is the most strained during the winter season and especially during cold and still weather periods, as electricity demand is strongly dependent on outdoor temperatures and generation is more and more dependent on wind conditions. As in the previous winters, imports from neighbouring countries are needed to cover peak demand, especially in case of low wind generation.

Compared to the previous winter, electricity and almost all fuel imports from Russia to Finland have been suspended or ended, which has weakened the supply. Other notable developments include commissioning of new wind power and Olkiluoto 3 nuclear power plant, however, the latter has been delayed multiple times and the current schedule for starting regular electricity generation is uncertain. Due to the many uncertainties related to the electricity supply in Finland and the Baltic Sea area, Fingrid informed consumers in August that they should be prepared for power shortages in case unfavorable scenarios take place.

There have been many measures taken ahead of the winter season to ensure adequacy of electricity. These include among others securing fuel supply with an on-going commissioning of an LNG terminal, informing consumers to save electricity, and Fingrid opening a voluntary power system support procedure. One example of the results is that Finnish electricity use decreased by around 7–8 % in September and October 2022 compared to last year. The measures taken are expected to mitigate risk for power shortages even if some of the unfavorable scenarios take place. It is very important, however, that the power system and market operate under normal conditions to secure supply of domestic generation and imports.

Summer Review 2022

No adequacy issues in electricity were recorded during summer 2022 despite the suspension of electricity and gas supply from Russia to Finland on May 2022. Summer Outlook 2022 simulations carried out before the summer had the same outcome and thus supported the message.

The lack of electricity import from Russia was compensated by importing more electricity from Sweden and by generating more electricity in Finland, especially wind power. In electricity production, the share of gas is small especially during the summer and it was mainly replaced with other fuels. Finland's self-sufficiency in electricity generation is constantly improving. In particular, the amount of Finnish wind power generation is increasing every year.

Overall, the electricity adequacy is usually better during the summer season compared to the winter, as electricity demand is lower. Typically, the summer peak demand amounts to 60–70 % of winter peak demand. However, annual maintenances of power plants and some interconnectors are often carried out during the summer period, which leads to less generation capacity available. There were no major forced outages or delays in the maintenances during the summer, however, regular electricity production in Olkiluoto 3 nuclear power plant was delayed from the anticipated start in Autumn 2022.

France

Winter Outlook 2022-2023

Due to low availability of French nuclear power plants, adequacy risks in France are higher than previous winter.

ENTSOE diagnosis of "Loss of Load Expectation" (LOLE) for France is consistent with RTE national study: a lack of margin during few hours is possible this winter but should be manageable thanks to operational measures. Adequacy issues could appear for standard climatic conditions but are more likely in case of a cold winter due to high thermosensitivity of French electric demand.

Power demand evolution is a key parameter of the security of supply for this winter. In case of downwards evolution, being through voluntary sobriety measures and/or due to high electricity prices, the risk will be lower. In September, a first drop in electricity demand has been observed but needs to be confirmed over the next weeks.

Finally, the security of supply of the French electricity system relies on a close cooperation with neighboring countries and exchanges between European countries to continue to work properly.

In all cases, RTE closely monitors all the parameters contributing to the security of supply and will update its diagnosis on a monthly basis[1]. The preparation of Winter 2023/24 will require a closer investigation of gas and electricity coupling due to the risk of starting next winter with lower gas storage level.

Summer Review 2022

No adequacy issues were recorded during the past season.

[1] *Actualisation de l'étude Perspectives du système électrique pour l'automne et l'hiver 2022-23 (Novembre) | RTE (rte-france.com).*

Germany

Winter Outlook 2022-2023

The first section describes the German preparations for the Winter 2022/2023. The scenarios and results of the Winter Outlook are discussed and compared to a national study in the second section. The German non-market resources are described in the third section. The fourth section provides further details on the German data collection.

Preparations for Winter 2022/2023

Germany conducted intensive preparations for the Winter 2022/2023. Due to the gas shortage caused by the war in Ukraine according to corresponding changes in legislation ("Ersatzkraftwerkebereithaltungsgesetz", limited until 31 March 2024) coal-fired power plants

- already in grid reserve or
- to be decommissioned in 2022 or 2023 due to coal phase-out or
- lignite power plants in stand-by ("Sicherheitsbereitschaft", English: "security readiness reserve")

are temporarily and conditionally allowed to return or stay in the market to reduce gas consumption in the electricity sector and to support security of supply. Additional measures (further extended market operation of lignite power plants, approx. 1.2 GW) to further improve security of supply are currently in legislative procedures.

In alignment with the German Federal Ministry of Economics and Climate Protection, for the Winter Outlook 2022/23 certain hard coal/lignite power plants out of these categories (comprising a total capacity of 6.7 GW) were assumed to be (further) available for the market. A return to market of previously grid reserve or lignite power plants in stand-by alleviates adequacy risks under normal market operations, but consequently reduces the available non-market resources.

Due to the current situation the operation of three nuclear power plants which were originally due to be decommissioned by the end of 2022 has been extended until 15 April 2023. This positively affects generation adequacy in winter 2022/23. However, NGC of those plants decreases towards the end of their (prolonged) operation as fuel elements become exhausted during extended operation. This means, that in March 2023 only 2.5 GW out of the 4 GW installed capacity of these nuclear plants will be available.

Besides these measures affecting the electricity generation, the German government approved numerous measures for the winter period targeting at saving energy and particularly gas consumption in other sectors, e. g. heating.

Remarks on Winter Outlook 2022/2023 scenarios and results

The assumptions on conventional power plants mentioned in the previous section were included in the German data set for the reference case calculations of Winter Outlook 2022/23. Based on this reference case a sensitivity data set with (i) an additionally reduced availability of coal power plants assumed to return to market and (ii) a reduced availability of coal power plants located in Southern Germany (due to problems with fuel supply because of low river water levels) was delivered.

Assumptions for the reference and sensitivity scenarios are derived from a German national study (extraordinary analyses winter 2022/23). As compared to the ENTSO-E Outlook, these analyses assess not only resource, but also transmission adequacy. Additionally, compared to the probabilistic assessment of the ENTSO-E Outlook, the German national study determines the resource adequacy in a deterministic manner based on the climate year 2012 and one set of power plant outage patterns. The national study identifies the number of hours with loss of load for three scenarios. These three scenarios present a risk funnel from low-risk scenarios (scenario +) to high-risk scenario (scenario +++). The scenarios do not cover

individual risks separately but combine possible shortcomings in availability of nuclear, coal and gas power plants together with higher demand due to electrification of residential heating. The high-risk scenario (scenario +++) can be understood as a 'stacked risks' scenario, combining the following sensitivities of the ENTSO-E Winter Outlook initial insights report: low nuclear, fossil constraints and high demand (the latter only sensitivity of the Winter Outlook 2022-2023 early insights). Additionally, a local gas-shortage in Southern Germany and Austria is assumed in the national study. The results of the German extraordinary analyses show the following numbers for hours with loss of load per year: 0 h/a for scenario +, 1-2 h/a for scenario ++ and 3-12 h/a for scenario +++.

The LoLE-figure of 0 h/a for Germany in the reference case of the Winter Outlook coincides with the results of scenario + from the national study.
The combined sensitivity (combining low nuclear and fossil constraints) represents the tensest situation for Germany considered in Winter Outlook. Even if the typical adequacy parameters (LoLE and ENS) do not indicate any risks for Germany, it can be concluded from the CGV analysis that an increasing share of electricity supply (9% gas consumption increase) will be provided by gas-fired plants. This development is a clear indicator that margins are also becoming tighter in Germany to ensure domestic supply and export in scarcity situations as gas-fired units are dispatched last in merit order. In particular, a potentially reduced gas availabilty at the end of a very cold winter poses a more significant risk to this scenario compared to the reference scenario.
A more detailed analysis of the combined sensitivity showed that hours with maximum prices (equal to the cost of unserved energy) occur in Germany, which are not visible in the reference scenario. Even though ENS is not observed for Germany itself, this means that for very few hours Germany is in a "cluster" of several bidding zones which are not able to cover the overall demand of the cluster. Thus, a higher adequacy risk can be concluded for Germany as compared to the reference scenario.
In contrast to the combined sensitivity of the Winter Outlook, however, scenario +++ explicitly shows hours with adequacy risks due to additional exacerbating factors (local gas shortage and increased demand as mentioned above).

Although Germany is not affected by adequacy concerns in all published Winter Outlook scenario results, the stressed situations in France, Poland and Sweden entail increased risks also for Germany compared to previous winters. Due to a high installed capacity of gas power plants in Germany it is of most importance that those plants are sufficiently supplied also in a gas shortage situation. The effects of such a shortage are only indirectly modeled through the increased load sensitivity of the Winter Outlook 2022-2023 early insights (representing a shift of gas heating to electrical heating), while gas fuel limitations for generation of electricity are not considered.
The Critical Gas Volume (CGV) calculation and its methodology has been introduced in this year's Seasonal Outlooks for the first time and calculated figures deviate, especially for Germany, from statistical ones. This may partly be caused by deviations in climate-conditions as the Eurostat data only cover the winters from 2014 to 2019, while PECD data used in simulation cover 1982 to 2016. For instance, the bottom three outliers in the CGV figures are the warmer-than-average winters 2014/15, 2015/16 und 2017/18. Another reason for this deviation might be based on the input data basis and modelling approach of CHP units and accounting of CHP gas consumption in the scenarios presented compared to Eurostat methodology. However, CGV analyses provide valuable insights when comparing CGVs for different scenarios.

Non-market Resources

Based on knowledge/assumptions at the time of data collection, the non-market resources for Germany contain:

- Grid reserve: Used to resolve congestions and contains different types of power plants located in Germany. Currently, it comprises a total capacity of 6.1 GW.
- Capacity reserve: Since 1 October 2022 and until 30 September 2024, a total contracted capacity of 1.1 GW of power plants outside the market is available as reserve for unforeseeable demand balancing events. These power plants must be available within maximally 12 hours and are activated in case of a lack of market clearance (D-1 and ID). They can also be used to resolve grid congestions.

Parts of the above-mentioned non-market resources have primarily a different purpose than coping with resource adequacy risks, such as congestion management. Therefore, non-market resources may already partly be exhausted for their primary purpose and not be available for resource adequacy purposes.

Additional remarks on the German data collection

The pumped-storage power plants (PSPs) of the “Kraftwerksgruppe Obere Ill-Lünersee” (turbine capacity: 2.1 GW; pumping capacity: 1.4 GW), which are installed in Austria but assigned to the German control block, remain in the German dataset. For the same reason, the pumped-storage power plant Kühtai and storage power plant Silz (total turbine capacity: 0.8 GW; total pumping capacity: 0.25 GW) are also included in the German dataset.

Compared to the snapshot of data provided at the beginning of October 2022 to perform the final Winter Outlook simulations, there has been an improvement regarding the number of coal-fired power plant units returning temporarily to the market. In sum, around 1.5 GW additional installed capacity will be available during the 2022/2023 winter that are not considered in the scenario input data and simulation results shown in this report.

Summer Review 2022

Hard coal shipping problems due to low water levels in the rivers Rhine and Neckar and other logistic issues (e. g. limited railway transportation capacity) led to reduced availability of affected power plants especially in Southwestern Germany.

Reduction of gas deliveries from Russia did not affect the availability of gas for electricity generation.

Beginning in August, first coal-fired plants returned from the reserves back into the market.

Greece

Winter Outlook 2022-2023

For the upcoming winter, there is no scheduled maintenance of generation units. Nevertheless, there is high possibility that scheduled unit maintenances maybe urgently extended in the heart of winter causing adequacy uncertainty in case of high demand.

In addition, the exact period of the commissioning initiation of two new units (lignite and gas unit) is still uncertain due to technical reasons. Both units expected to be in commissioning mode operation during winter period.

IPTO is in continuous contact with the Gas Transmission System Operator in order to be able to initiate the switch fuel procedure in some bi-fuel units (gas to oil) in case of emergency. The operation with alternative fuel is limited up to a few days and is only considered as an urgent countermeasure in case of lack of gas supply and not a continuous operation mode.

Water reservoir levels are similar with the previous years despite the fact of the drought and the absence of inflows, due to the low usage of hydro power plants during summer. However, the continuing absence of rain and drought conditions raise concerns about the availability of hydro power plants during the winter.

The total import capacity remains the same as in winter 2021-2022 while there is no scheduled maintenance or capacity limitations on any interconnection lines for the upcoming winter.

A decrease on consumption during the upcoming winter is expected in comparison with winter 2021 due to the high energy prices and global energy saving measures.

The expected generation and import capacity are sufficient to cover Greek energy needs under normal conditions and we do not expect any adequacy issues given that Gas supplies will be continuous and redundant to cover domestic demand.

However, Greek system will be highly depended on import transfers during high demand periods in order not to face any adequacy issues in high demand peaks.

Summer Review 2022

No adequacy issues were recorded during the past season.

Hungary

Winter Outlook 2022-2023

Based on the tendency of last winters' system loads, despite the last years' decreasing energy consumption, among extreme weather conditions there is a possibility for a new peak load record, due to the expected increase of electrical heating. On the other hand the Hungarian power system is expected to be safe during this winter period. The level of maintenance is low and carefully distributed in time which is an important factor beside the almost constantly required import in order to guarantee the system adequacy.

Due to the low level of maintenance the needed amount of reserve capacity could be provided. However, the recent market conditions (considering the often negative Clean Spark Spread, plus the rising prices of gas, electricity and CO_2 emission price) can cause serious uncertainty in the running of gas power plants, whose absence can lead to a lack of balancing capacities. Furthermore, the increasing PV generation in the Hungarian system cause higher uncertainty in operational planning periods and real time system operation as well, which causes a higher level of reserve requirement.

A possible gas shortage presents a serious challenge for the operation of the Hungarian power system. While most of the gas power plants can use oil as an alternative fuel, it causes a reduction in some of their balancing energy.

As for preparedness, gas power plants, which can use alternative fuel supply data weekly for MAVIR about their alternative fuel storage levels. There isn't any power plant taken out of mothballing. MAVIR tests the gas power plants' ability to switch to oil as an alternative fuel and its impact for the power plants' balancing energy. So far MAVIR has tested half of the gas power plants. Most of them were successful; there is one which needs to be repeated, there are some which can only be done after their maintenance. The tests show acceptable results considering the conditions. However, running with oil for an extended period of time (beyond couple of days) could lead to difficulties in supply.

Uploading gas storages goes according to the plans and according to the opinion of the Hungarian Gas TSO hopefully serious difficulties in supply can only occur in extreme weather conditions or in case of a long-lasting, complete gas disruption from Russia.

Summer Review 2022

No adequacy issues were recorded during the past season.

Ireland

Winter Outlook 2022-2023

There is an expectation that the system will enter the Alert State at times over the winter period, most likely at periods of low wind and low interconnector imports. There is a high probability of the system entering the Emergency State at times, due to insufficient generation being available to meet the demand. A key assumption underpinning the winter outlook analysis, based on best information available at the time of writing, is that there will be uninterrupted reserves of natural gas from both the Moffat terminal and the Corrib gas field, with no shortage issues.

Summer Review 2022

Generation margins remained tight in Ireland throughout the summer period. This was mainly driven by high forced outage rates and long periods of low wind generation. The Ireland power system entered the Alert state due to tight generation margins on seven occasions since last winter:

- 08:00 to 18:30 on 09/04/2022
- 08:00 to 15:00 on 12/04/2022
- 08:15 to 10:55 on 05/05/2022
- 14:31 to 18:25 on 12/07/2022
- 16:30 to 19:50 on 18/07/2022
- 13:42 to 22:30 on 09/08/2022
- 18:00 to 19:15 on 22/08/2022

Italy

Winter Outlook 2022-2023

Upward adequacy assessment

Import from neighbouring countries is expected to be necessary (up to 4 GW) to restore adequacy margins and to cover consumption in critical hours.

Critical situations could happen in case of high demand due to cold spell, low import from neighbouring countries, or if unplanned outages rate of generation units is higher than the typical values.

In a low demand scenario, risk for the adequacy is estimated to remain within standard levels, while the system is seen as more stressed in the other sensitivity scenarios (low nuclear, low fossil, high demand). In fact, lower remaining capacity from neighbouring countries could result in less import and lead to more critical adequacy situations.

Postponement and/or cancellation of maintenances could be used as countermeasures together with demand response measures and additional market interventions.

In addition, improved regional coordination processes (including regional weekly adequacy assessment - STA project and Critical Grid Situation process) will support the definition of proper and efficient countermeasures in case the risk of incurring in critical situations will be detected at short term horizon.

To reduce energy consumption as foreseen in the recent EU Regulation, Terna, in cooperation with competent authorities, is promoting public campaigns for voluntary demand reduction.

Generation capacity in Italy

During 2022 both renewable capacity (+1.8 GW) and, for the first time in the last 10 years, thermal power capacity (due to new power plants selected in capacity market auctions), increased.

Currently the total amount of installed renewable and conventional power is around 58,5 GW and 61,1GW respectively.

Since the beginning of November, the first link of the new 'Piossasco – Grande Ile' HVDC connection with France is operational.

While some improvement has been observed in recent weeks, the level of hydro reservoirs remains well below the historical range.

Gas consumption for electricity production

Minimum gas for electricity generation strictly needed to ensure system adequacy (Critical Gas Volume) over the full winter period comes close to the amount of gas for electricity recorded in recent years.
This is due to the reduced hydro output and lower expected net-import, mainly balanced by increased coal generation.
In the "Reduced nuclear" scenario, gas consumption is expected to further increase. Adequacy assessment has been performed considering full gas availability.

Downward regulation assessment

The worst weeks for downward regulation are expected to be the last week of December and the first week of January, characterized by several public holidays. In order to guarantee system security, Terna could adopt enhanced coordination with neighbouring TSOs and special remedial actions, such as the curtailment of inflexible generation. Further special actions, such as application of allocation constraints to transmission capacity, could be planned in cooperation with neighbouring TSOs.

Summer Review 2022

During last summer, the electricity demand showed a slight decrease (-0.5%) as compared to the same period of the previous year.

The decrease in demand was mainly due to the lower consumptions. In fact, the drop in demand, without considering the effect of temperature, falls down to -3.3%. Temperature values slightly influenced the trend of the demand, being the summer 2022 on average moderately hotter than 2021, with a trend inversion in the last part of the season. On the other hand, the peak demand in summer 2022 was significantly higher than in 2021 (+4,5%).

Margins were very tight during various days in the second half of July: high temperatures led to a lower-than-average availability of hydraulic resource, to several failures or limitations on thermal production units and to a high occurrence rate of firings that limited the availability of critical network elements and transmission branches. Moreover, high prices all over the Europe implied low import levels and an export position on some borders for many hours.

For these reasons, multiple non-costly and costly countermeasures were applied in all the operational timeframes, in particular on business date July 25th, which was the most critical day.

Thanks to the application of such countermeasures, the electricity supply to consumers was continuously guaranteed.

Latvia

Winter Outlook 2022-2023

No adequacy issues are expected for the Winter 2022-2023.

Summer Review 2022

During the Summer 2022 the power system adequacy In Latvia was very tight and the wholesale electricity market price in August reached a peak of 4000 Euro/MWh. Mostly the reasons for so high electricity prices in Baltic States are described below:

1. Uncertain situation with future natural gas imports from Russia, due to war in Ukraine, which caused gas savings for the coming winter and reduced the gas CHP availability during whole summer.

2. Starting from first part of May the cut off of electricity import from Russia – approx. hourly capacity 300 MW.

3. As usual high capacity CHPs in Latvia are planning their maintenance works during the low load periods in summer and therefore full generation capacities of CHPs in August were not available.

4. Very low water inflow level on Daugava river and limited hydro production on Latvian hydro power plants, due to scheduled maintenance works on hydro dam which requested to keep the water level at minimum.

The adequacy risks were minimized with available cross-border capacities and successful cooperation among TSOs in Baltic Sea region, which help us relay on energy imports from Nordic and Continental Europe power systems.

Lithuania

Winter Outlook 2022-2023

Total import capacity to Lithuanian Power system remains at the similar level as it was during the previous winter period. No significant capacity limitations or outages of HVDC interconnections are planned for the upcoming winter.

From January 1st, 2023 additional 520MW will be available to the market due to removal as tertiary reserve service, this will improve the market adequacy in our and neighbouring countries. Due to having operational LNG terminal in Lithuania, interconnection with Poland, gas storage in Latvia and planned LNG terminal in Finland it is expected that Lithuanian gas-fired power plants will not experience gas supply shortage. Therefore all net available capacity in gas-fired power plants could be used for ensuring the system adequacy.

Early ENTSOE Insights of Winter outlook does not indicate adequacy risks in Lithuania during upcoming season.

Summer Review 2022

In summer of 2022, national consumption was 7% lower than in summer of 2021. This summer balance portfolio consisted of 33% local generation and the rest was imported from neighbouring countries. Last summer we had similar results of 36% local generation and 64% imports.

On August 17th wholesale electricity price in Lithuania reached a peak price of 4000 EUR/MWh for one hour. During that time our DC links were importing 100% of available NTC's. Therefore Lithuania had to activate peak load reserve.

No adequacy issues happened during summer 2022. Import contributed significantly to adequacy in Lithuania, however local generation continues to increase, especially solar and wind.

Luxembourg

Winter Outlook 2022-2023

No adequacy issues are expected for the Winter 2022-2023.

Summer Review 2022

No adequacy issues were recorded during the past season.

Malta

Winter Outlook 2022-2023

Comments on Critical Gas Volumes:

The Critical Gas Volumes identified for Malta in the Winter Outlook are well below the gas volumes historically consumed by critical gas fired power plants in Malta. All gas-fired power plants in Malta are considered critical and gas-fired power generation covers approximately 70% of electricity demand in Malta, followed by 20% from the electricity interconnector and 10% from renewable energy sources. During emergencies, but for a limited period of time, Malta has the capability to run gasoil-fired power plants. It is to be noted that gasoil-fired emergency plants can only be used in case of an emergency and due to technical constraints and limited capacity, cannot fully replace gas-fired power plants. In the Winter Outlook assessment, such gasoil fired power plants are considered as non-market resources and Malta believes that they should not be taken into account when calculating critical gas volumes, as they are not a long-term alternative to gas-fired power generaiton in Malta. Additionally, reducing gas in Malta down to the critical gas volumes identified in the Winter Outlook would increase Malta's reliance on electricity imports over its electricity interconnector with Sicily (and hence could lead to more gas demand in Italy). Reducing gas down to the volumes identified in the report may have a negative impact on Malta's security of electricity supply.

Summer Review 2022

Montenegro

Winter Outlook 2022-2023

No adequacy issues are expected for the Winter 2022-2023.

Summer Review 2022

No adequacy issues were recorded during the past season.

Netherlands

Winter Outlook 2022-2023

No adequacy issues are expected for the Winter 2022-2023.

Summer Review 2022

No adequacy issues were recorded during the past season.

The legal restriction on coal-fired power plants has been lifted to save gas.

Northern Ireland

Winter Outlook 2022-2023

The results suggest that with the loss of just a single large unit in Northern Ireland, there is a risk of the system entering the Alert State, most likely at periods of low wind and interconnector imports. The risk of the system entering the Emergency State, due to insufficient generation being available to meet the demand, is low.

Summer Review 2022

No adequacy issues were recorded during the past season.

North Macedonia

Winter Outlook 2022-2023

No adequacy issues are expected for the Winter 2022-2023.

Summer Review 2022

No adequacy issues were recorded during the past season.

Norway

Winter Outlook 2022-2023

There has been high attention about reservoir levels in Southern Norway before the winter. The reservoir levels have been very low due to low precipitation and high export caused by high continental fuel and power prices since previous winter, summer and early autumn. In the Middle and Northern Norway, the problem is opposite, with very high reservoir fillings and low power prices. From week 38 there has been a significant improvement in reservoir levels in Southern Norway as shown in the figure below.

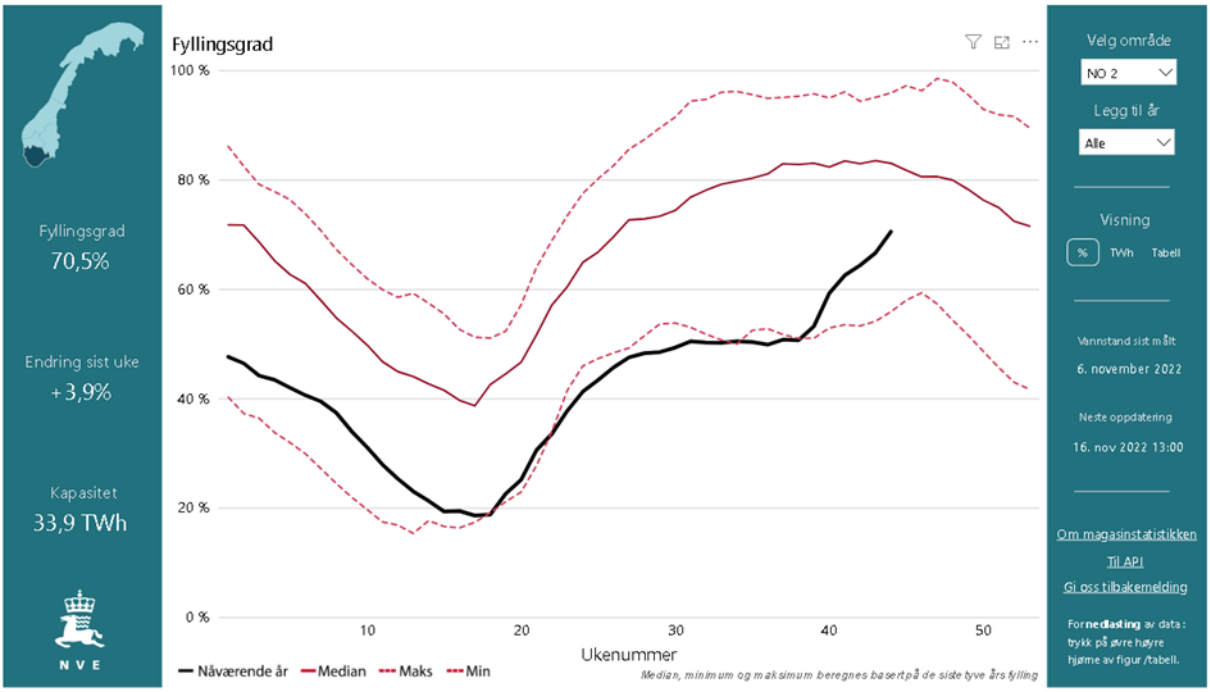

Figure 1 Reservoir levels in price area NO2 week 44 - 2022. Source NVE

- Some actions were taken by Statnett and the authorities, as rising attention level to yellow (strained). There were no restrictions on generation and/or export, but the producers with reservoirs were requested to save water for the coming winter. To secure the supply in case of reduced import possibilities further actions was discussed. In September the authorities have introduced monitoring of the generation from the major reservoir generators in Southern Norway. This is reported weekly by Statnett, and it seems like the major producers have been saving water. Statnett was also instructed to work out an analysis of extremely severe situations (SAKS) which was finished within 1st October. As mentioned above, the risk for rationing has been reduced due to high precipitation the last weeks. From week 47 the attention level is reduced to normal (green), but the power situation will still be closely monitored.

- Under normal situations, there should be enough import capacity to cover any deficit in Southern Norway. But if there is no generating surplus in other countries to export to Norway, there could be a problem. Rationing of demand could then be necessary in a short period in the spring before the snow melting. Especially if there could be low precipitation and cold weather during the winter. Anyhow the high power prices have decreased the demand somewhat, both by customers reducing their demand and companies shutting down. On the other hand, there is a significant amount of electrification and new industries in line, waiting to be connected to the grid. It does not seem like

these customers have been frightened by high power prices, But, as mentioned above, the risk for rationing has been reduced significantly due to high precipitation the last weeks.

The concern in Norway is more lack of energy or water resources during the spring, rather than an adequacy problem during the winter. In many ways this is a similar problem to gas shortage in Europe. Improved gas supply and storage in Europe also has a positive effect on Norway. There is still a significant higher level of uncertainty of several factors important for the energy supply in the coming months, as well for the coming summer and next winter (2023-2024).

Summer Review 2022

No adequacy issues were recorded during the past season, apart from rising attention level to yellow in Southern Norway and requests to save water. This may have reduced generation a little, but this has not brought to any adequacy or downward regulation problems during the summer. The main direction of foreign connections was export during the summer, but the exchange has been more balanced during the autumn. Probably due to increased water values calculated by the hydro power producers.

Poland

Winter Outlook 2022-2023

ADEQUACY

Input data

Data to main Winter Outlook report was delivered by PSE (Polish TSO) after September's ENTSO-E call for data update and it was valid for that time.

For the Reference Scenario PSE provided no limitation in hard coal / lignite according to the optimistic evaluation of coal availability in Poland. In case of Polish power system, Combined Sensitivity includes PSE's estimate of possible limitations on coal supply during the winter season related to a.o. logistical constraints, such as the level of hard coal imports and bottlenecks in coal unloading at seaports, bottlenecks in rail transport to power plants, supply from domestic coalmines, etc.**Results**

Winter Outlook simulations show no adequacy issues for Poland in the Reference Scenario. However, it is worth to highlight some important observations:

- Very high level of hard coal / lignite generation
- Low level of import
- Very Low level of gas generation (gas is at the end of merit order list)

Combined Sensitivity results for Poland show 10h of LOLE / 12.4 GWh of EENS (average values). The EENS vary from 3 GWh in climate winter 2010-2011 till 136 GWh in climate winter 2005-2006. The important message is that all LOLE / EENS cases refer to 10 climate winters out of 34 simulated. This means that weather conditions, i.e. RES infeed as well as level of load is crucial for adequacy for Poland. Main observations from this scenario are:

- The recorded level of hard coal / lignite generation in accordance with the provided limitations
- Very high level of import in most of climate winters
- Very high level of gas generation as the result of coal limitations and periodically exhausted import capacities / available capacity outside Poland

Conclusions

At the time of Winter Outlook publication, the risk of the Polish coal supply limitations cannot be excluded. In particular, further assessment is needed whether the imports simulated in the Combined Sensitivity which allow PSE to balance the system in most of CYs are in fact feasible, since due to relatively low electricity prices in Poland compared to those in other countries in Europe, the level of commercial imports to Poland is very low. Import to Poland materialize only occasionally, even during actual scarcity hours observed in day-to-day operations. The market situation is not expected to change during the coming winter, so the consequence may be that LOLE / EENS will appear in more CYs of Combined Sensitivity and their average values will increase.

In any case, in the event of a shortage, PSE can activate resources contracted under the Polish Capacity Market - generating units have to deliver power to the system in the contracted amount, while DSR units have to reduce load also according to the contract. These actions are taken not in selective manner, means all resources under capacity agreement are obliged to react after announcement of the system stress event on Capacity Market.

CRITICAL GAS VOLUME

Based on the Winter Outlook adequacy simulations, ETNSO-E calculated the so-called Critical Gas Volume (CGV) – the amount of gas needed for electricity production to meet adequacy. In the case of Poland, the CGV strongly depends on the Winter Outlook scenario. Gas volume in the Reference Scenario is significantly lower than that from Combined Sensitivity, which is at the same level as historical gas consumption during the winter 2021/2022. It is worth saying that in the project of " gas solidarity" regulation[2], the gas volume was taken from the Reference Scenario, which means that this volume will not be enough to cover gas consumption in gas-fired power plants if coal supply constraints materialize in Poland.

ALLOCATION CONSTRAINS

Net exports from Poland may be limited during winter 2022-2023. The adequacy assessment in each scenario considered a lack of net exports from Poland throughout the winter period. Polish power system is however considered as fully available for power transit between neighbouring power system (e.g. between Lithuania/Sweden and Germany/Czech Republic/Slovakia). The underlying reason is that many utilities experience a limited coal stock, often below legally required levels. This results in generation units unavailability leading to periods with scarcity risks in the Polish power system, especially during high load and low RES infeed. For these periods, PSE applies allocation constraints in order to maintain the power system within operational security limits, which is a legally prescribed means defined by CACM Regulation and included in regional capacity calculation methodologies. Allocation constraints are calculated on daily bases, for each hour individually based on actual adequacy situation. PSE experience from day-to-day operations, as well as estimates regarding the future situation performed on basis of information provided by generators, demonstrate that the adequacy situation experienced today will not get better and may even be worse during the coming winter. For this reason, in order to avoid providing an incorrect picture of the situation, PSE decided to deliver the most realistic information for the purpose of for the Winter Outlook 2022-2023, i.e. that net exports from Poland will most likely be limited.

Summer Review 2022

On 23 September 2022 (Friday), PSE (Polish TSO) announced system stress events for the first time on Polish Capacity Market between 19.00 and 21.00. This was a procedure, triggered due to the forecasted reserves lower than necessary for that evening peak, caused by forecasted very low RES infeed as well as outages of the Polish thermal generating units.

The forecasted low level of system reserves allow PSE, in line with the Poland's ordinance on the Capacity Market, to announce the aforementioned system stress events in order to trigger additional deliveries activated via the Capacity Market (both, generation and demand side).

The activation let PSE successfully operate Polish power system during these hours.

2 Proposal for a COUNCIL REGULATION Enhancing solidarity through better coordination of gas purchases, exchanges of gas across borders and reliable price benchmarks

Portugal

Winter Outlook 2022-2023

Portuguese national studies are performed using high detailed modelling, taking into account the specificities of the system, namely hydro generation.

As required by the current Portuguese national legal framework, REN collaborates with the Portuguese General Directorate of Energy in the elaboration of the annual National Adequacy Assessment Monitoring Report to identify the mix of resources required to comply with the reliability standards in force: Probabilistic Load Supply Index ≥ 1 and LOLE ≤ 5h/year. The most recent National Adequacy Assessment Monitoring Report (RMSA-E 2022) addresses the horizon 2023–2040.

Although not fully comparable with Winter Outlook in terms of methodology and assumptions, on that report (RMSA-E 2022[3]), for year 2023, the decommissioning of all coal power plants before the end of 2021 and the unavailability of a Combined Cycle Gas Turbine unit in the beginning of 2023, results in risk of dependence of the Portuguese system on imports from Spain and noncompliance with the current national reliability standards. Under these conditions, some mitigating measures may be necessary to handle operational reserve needs and ensure security of supply, as listed below:

#	Measures
(Demand)	Load reduction market product for eligible consumers with whom there are annual contracts for the provision of this service
(Supply)	Request for the activation of a support program with the Spanish System Operator
(Demand)	Occasional load shedding of non-priority consumptions, according to the protocol between the electricity transmission and distribution network operators

In RMSA-E 2022, load reduction (1st measure identified) needs for 2023 ranging from 600 – 1050 MW were identified, depending on hydro conditions. For this purpose, an auction for specific market product of 800 MW was launched on November 8th by the Portuguese NRA.

Moreover, following the REPowerEU Plan on May 2022, the Resolution of the Portuguese Minister Council nr. 82/2022 defined preventive measures to deal with the current situation and possible future energy disruptions, bearing in mind the guarantee of security of energy supply. Strategic limitations to hydro levels in large reservoir were stablished as well as the Energy Savings Plan for 2022-2023 that includes separate reduction measures for the areas of energy, water efficiency and mobility, and covers the Public Administration and private sectors.

As mentioned in the Winter Outlook report, the security of electricity supply in Portugal is highly dependent on generation from natural gas. However, no risks for the gas supply are expected during winter as long as there is no stress in the gas markets (on November 23rd the level of underground gas storage of 3,9 TWh is completely full).

[3] *https://www.dgeg.gov.pt/media/ck2pa4s2/rmsa-e-2022.pdf*

Summer Review 2022

No adequacy issues were found during 2022 summer season despite hydro conditions were extremely severe. Hydro storage levels were in fact the lowest in the record, therefore not surprisingly hydro generation was only 24% of the average in July and 48% of the average in August. Wind generation was also below the expected values, so the generation/demand balance had to be met resorting to high levels of imports and to a greater contribution from the natural gas combined cycles.

From the demand side it should be noted the increase from last year levels: a remarkable 7.2% increase in July, the more critical period for adequacy during summer season, essentially due to high temperatures. Since August the increase has begun to slow but it's still on positive grounds.

Romania

Winter Outlook 2022-2023

Transelectrica expects adequacy issues for winter 2022 – 2023. In the case of the peak loads, the consumptions cannot be covered by domestic resources in the absence of production in the wind and solar power plants. The consumption coverage can be achieved by importing between 1500 MW and 3000 MW from neighboring systems if electricity is available in the region. The situation will be critical in the case of unexpected unavailability of other generation units. In the current context at the European level, the existence of sources available for export at the regional (European) level has a high degree of uncertainty.

Other aspects that will increase the risks for adequacy are the following: high values of consumption at peak load, estimated decrease of the production in gas power plants, low production in solar power plants during the winter season, volatility of the wind power plants, limited capacity to compensate the deficit through the hydro power plants, lack of storage and demand side response, the need to supply electricity to Ukraine and Republic of Moldova.

For the winter period of 2022-2023, Transelectrica expects the necessity to increase the power produced in coal thermal power plants compared to the winter of 2021-2022, in order to reduce the risk of adequacy issues of the power system.

The current European context marked by general concerns on the continent's energy security in the upcoming winter, against a general background of an already tight supply situation aggravated by the recent major disruptions of Ukraine's energy infrastructure, describe an extremely stressed energy landscape at both continental and regional levels. The recent decision by Russia to halt natural gas supplies to the Republic of Moldova added to an already stressed regional situation due to the previous suspension of Ukraine's electricity exports, as Republic of Moldova is heavily dependent on energy imports to meet its domestic demand for gas and electricity. Currently, the electricity demand of the Republic of Moldova relies almost entirely on imports through a combination of forward supply arrangements with Romanian generators, spot acquisitions from the EU day-ahead market (via Romania) with the remainder being provided by Transelectrica as emergency assistance by activation of resources available in the Romanian balancing market.

Given the recent developments mentioned above, Transelectrica has conducted a thorough and comprehensive assessment of Romania's resource adequacy for the 2022-2023 winter season. The purpose of such national analysis was to capture the potential impact on adequacy of the simultaneous stress elements that may occur in the Romanian power system, considering the most recent input data available and specific sensitivity scenarios for the winter ahead, that the ENTSO-E Winter Outlook report might have not factored in.

The national assessment of Transelectrica builds on the ENTSO-E Winter Outlook reference scenario without demand reduction - considering that the exports to the Moldovan system (not explicitly modelled) account for about 5% of Romania's domestic load – and also includes additional current system stress factors of reduced thermal plant availability due to fuel supply shortage (either gas or domestic lignite and hard coal) totaling minus 416 MW in November-December / minus 368 MW during January-March. respectively.

It is worth mentioning that the situation in Republic of Moldova leads to a significant additional burden on available Romanian resources. Most of the Republic of Moldova's elecricity demand is supplied by Romanian generators (either through forward contracts or by emergency assistance) and the energy imported from the wider EU market via Romania reduces Romania's cross-border import capacity.

In terms of methodology, the hourly Monte Carlo probabilistic approach developed by ENTSO-E for medium and short-term adequacy assessment was followed by the national adequacy assessment, however, addressing specific sensitivities and focusing on a limited subset of three climate years from the Pan European Climate Database that revealed adequacy issues for the Romanian power system.

The results of the national market analysis show that in the reference scenario the risks of not covering electricity consumption with domestic production resources are minimized by using the country's cross-border import capacity. Thus, approximately 90% of the time during the cold season, the balance of exchanges in RPS is net import. Covering an important part of the net domestic consumption through the maximum use of the cross-border import capacity involves major risks related to the potential lack of resources at the regional or European level, caused by possible problems in the natural gas or electricity transmission network, etc.

As a result, in addition to this national reference scenario, an extreme sensitivity case was also analyzed, modelled under similar assumptions, but with a limited contribution of the imported electricity from neighboring energy systems, up to a maximum level of 1500 MW to account for the potential impact of lower availability of non-domestic resources, like prolonged unavailability of nuclear power plants or limitation of fossil fuel production in some countries, etc.

From this sensitivity analysis it is observed that in the case of such uncertainties related to the external availability of electricity, the average values of the expected reliability indicators dramatically exceed those signaled initially, registering a maximum of the instantaneous LLD value per week of 28 hours for a specific Monte Carlo simulation (with an average LOLE of 13.8 hours for the entire winter season). In this sensitivity case, high-risk configurations are also detected at the end of 2022, not only in January and February 2023, as in the reference scenario.

Additionally, in an attempt to best capture the simultaneous effect of extreme stress elements in a critical scenario (i.e. lignite/coal supply constraints, lower gas availability, increasing demand, transmission bottlenecks etc) we also added a deterministic evaluation to the probabilistic adequacy assessment.

From the analyses carried out by Transelectrica, the electricity consumption at the evening peak in the winter 2022-2023 cannot be covered from own sources in the absence of production in the wind power plants, as in the modelled scenario, without an import of electricity (between 1500 MW – 3000 MW), subject to the actual availability of this amount of electricity in the region. In the event of an unplanned disconnection of an important RPS generation asset (combined-cycle power plant at OMV Brazi Petrom, nuclear Unit1/Unit2 at Cernavodă) the import requirements to cover the peak demand will increase accordingly (between 2,500 MW and 3,800 MW). We note that in the current context, the existence of sources available for export at the regional (European) level has a high degree of uncertainty.

In the current geopolitical context, correlated with the deficit of electricity at the European level, including the supply shortage in Ukraine and Republic of Moldova, the problems for ensuring security of supply of electricity in the winter period 2022-2023 can be mitigated by maintaining the current lignite generation fleet at CE Oltenia in operation, as it uses domestic fuel which represents a major advantage in the difficult context for securing primary energy sources.

The increase of lignite-fired generation requires a high availability of the generation units at CE Oltenia, given their significant risk of unplanned unavailabilities. This can be achieved by postponing the retirement of units no. 3 from TPP Rovinari and unit no. 7 from TPP Turceni.

The need to postpone the closing date for lignite thermal unit no. 3 from TPP Rovinari and lignite thermal unit no. 7 from TPP Turceni (which were originally due to be decommissioned by the end of 2022) was issued taking into account the following:

- current energy and geopolitical context with high uncertainties regarding the availability of natural gas,
- hydropower reserves diminished by the prolonged drought,
- the situation of nuclear power plants from Europe, which have a much reduced availability, compared to previous years,
- data recorded in the operation of the Romanian Power System (RPS) in October 2022 (public on the website of CNTEE Transelectrica SA)
- some following specific aspects regarding the safe supply of consumption of electricity in winter 2022 – 2023:
  - Electricity consumption at peak load in the winter of 2022-2023 is estimated at approximately 9,000-9,500 MW. The maximum consumption recorded in January 2022 was 9,283 MW;
  - From the analysis of the available generation units on market and the energy resources available during the winter period, during the days when there are no climatic conditions for the operation of renewable power plants, a maximum of 7,000 MW can be produced at the RPS level;
  - In January 2022, the power produced in coal-fired thermal power plants was between 827 MW and 1,388 MW, and in natural gas-fired power plants between 830 MW and 1,893 MW. The power produced in the hydroelectric plants exceeded 2,500 MW only for about 20 hours, and that in the

nuclear plant was between 1,230 MW and 1,434 MW. The significant contribution of natural gas thermal power plants to cover electricity consumption is noted;

- In January 2022, the net electricity produced in natural gas power plants was 1,138 GWh. Thus, in January 2022, the average hourly power produced in natural gas thermal power plants was 1,530 MW. For the 2022-2023 winter period, there is a risk that the operation of natural gas-based thermal power plants will be significantly reduced compared to the previous winter due to the lack of availability of the primary energy source. A reduction in the maximum power that can be produced in natural gas power plants of approximately 500 MW is estimated. An aspect with great influence for the operation of natural gas power plants in the winter of 2022-2023 will be given by the purchase price of natural gas for plants that also provide heating;
- In January 2022, the power produced in wind power plants was between a minimum value of 0 MW and a maximum value of 2,718 MW. During January 2022, the power produced in wind power plants was less than 500 MW for about 5 days, respectively less than 1,000 MW for about 11 days. The maximum power produced in the photovoltaic power plants was 567 MW. During the periods with low production in wind and photovoltaic power plants, electricity consumption was ensured by a high level of production in natural gas thermal and hydroelectric power plants, respectively by massive imports from neighboring power systems;
- Greater attention must be paid to wind power plants, as they are mainly located in the South-Eastern area of the RPS, with no uniform even distribution across the territory of Romania, an aspect that can lead to the total sudden lack of production in wind power plants. Significant restrictions in the operation of wind power plants also occur in frosty periods where wind turbines stop at an ambient temperature lower than -20 degrees and restart if the temperature is higher than -15 degrees. In the south-east area, there are operating restrictions for wind power plants also due to ice deposits on the blades of wind turbines and the occurrence of vibrations. The situation can become critical at the evening peak, where there is no production even in the photovoltaic power plants;
- In January 2022, RPS balance was between a maximum export value of 505 MW and a maximum import value of 1,989 MW. The values of the import balance were mainly recorded at the peak of winter load and reduced production in wind and photovoltaic power plants;
- Within RPS, there are no longer available power plants based on alternative sources, where natural gas can be replaced by fuel oil. Moreover, the level of hydraulicity is much lower in 2022 compared to 2021 (electricity produced by hydroelectric plants in the period January - September decreased in 2022 to 10,812 GWh, compared to 14,633 GWh during the similar period of 2021). Also, the energy stock in the main hydropower installations on 01.10.2022 was 2,168 GWh, lower than 2,449 GWh on 01.10.2021, which leads to lower energy reserves on 01.12.2022, with a negative impact on the RPS adequacy for the winter period 2022-2023, against the background of a much reduced hydraulic level on the inland rivers, on the Danube and in Europe;
- The total import cross-border capacity of the electrical transmission network is estimated at approximately 3,000 MW for the winter period 2022 - 2023. However, in the current market conditions (prices with considerable increases, primary sources greatly reduced compared to previous years) the coverage of the adequacy needs of RPS from import have acquired a high level of uncertainty, especially during the peak periods of maximum winter consumption;
- The lack of dispatchable consumers and of demand side response, and of the storage facilities such as pumped storage hydro power plants or batteries to help compensate for the deficit of electricity in periods when power plants from renewable sources do not have operating conditions or thermal power plants on coal or natural gas operate at low values of the generation;
- RPS balance follows the trend of recent years, in which Romania became a net importer of electricity while previously Romania used to be a net exporter.

The main conclusion of our national winter outlook is that in order to maintain resource adequacy in the 2022-2023 winter season, it is crucial for Romania to keep two lignite units (of 330 MW installed capacity each) in active service at least for the upcoming winter. These units were initially planned to be retired on 1st of January 2023 according to Romania's committed timeline of the coal phase-out calendar.

An extended adequacy study at national and regional level, will be further conducted considering updated input datasets and assumptions.

Summer Review 2022

No adequacy issues were recorded during the past season.

Serbia

Winter Outlook 2022-2023

For the upcoming winter, we might issue some problems to cover demand due to the possible energy crisis and unexpected weather conditions. Also price of the energy could cause some disturbance.

The Maintenance of power units and transmission network are planned to be completed before the significant increase of demand. Only the major overhauls of the two hydro generators are planned, but missing power of 200 MW does not significantly affect the adequacy.

In case of shortage of gas, it is estimated that it may increase consumption up to 300 MW and further increase over this margin in winter peak is not possible due to constraints in distribution system (experience from the gas crisis in 2009).

Problems to cover demand might occur at extremely high peak loads under severe weather conditions, especially in January, and then energy imports will be required.

Summer Review 2022

The last summer passed with some unexpected problems. Higher temperature periods, big prices of energy on the spot market, low level of the rain and high levels of maintenance caused the lack of energy and occasional needs for energy imports in July and August. Also, the import of energy was mainly continued during the September and October.

Slovakia

Winter Outlook 2022-2023

Since February 2022 compared with the year 2021 decrease of electricity consumption and production of Slovakia is observed for every month. Concerning winter 2022/2023 we assume the decrease of electricity consumption compared with winter 2021/2022.

New nuclear unit (Mochovce 3) has been commissioning since the 9 September 2022 when initial nuclear fuel loading was started. The minimal controlled power of the new nuclear unit was reached on 22 October. After all necessary tests are completed, Mochovce 3 will move from physical to power start-up. In the next phase of commissioning, so-called power start-up, the nuclear unit power will be increased step by step and a number of tests will be carried out. Commissioning will be completed with 144-hour trial run of Mochovce 3 at full capacity. The electric power of the new nuclear unit will be 471 MWe.

During the winter period the maintenance schedule is reduced to minimum. The cross-border capacities for electricity import are sufficient.

Summer Review 2022

Generation and consumption of electricity of Slovakia in summer 2022 (from June to September) compared with summer 2021 significantly dropped down. Generation index of summer 22 compared with summer 21 was 82.4 % and consumption index was 89.3 %. Decrease of electricity consumption was caused mainly by very large consumers because of high electricity prices.

Decrease of electricity production was especially from fossil fuels and hydro power plants. Electricity production from fossil fuels (except for nuclear production) substantially decreased (index 56.0 %). Especially decrease of electricity production from natural gas (index 35.1 %) was evaluated. Due to dry summer 2022 the electricity production of hydro power plants was also considerably lower (index 64.8 %). Renewable electricity sources (except for hydro) also decreased (index 88.0 %).

Slovenia

Winter Outlook 2022-2023

In the last two winter periods we observed lower load peaks and energy consumption, due to covid-19 situation, however the upcoming winter might be different. We expect load and energy peaks to return to levels before covid-19 pandemic, therefore Slovenia in the light of the unpredictable gas supplies and related possible increase of electricity consumption due to partial switching to electrical heating, applied some preventive measures listed below.

Planned outages:

Our biggest unit Nuclear power plant Krško (700 MW) is scheduled for maintenance during the October, where the consumption is still expected to be low.

Are there any fuel switching happened in your country?

In Slovenia, the production of electricity with gas, but also with extra light fuel oil, is mainly used to provide reserves to replace production in case of frequency deviation due to unexpected outages of aggregates.

Are there any power-plant that is taken out of mothballing (back in the market) in your country?

There isn't any power plant taken out of mothballing.

Are there any other mitigation measure taken or that will be taken during the winter?

Measures of reduced cooling capacities during the summer, reduced heating capacities during the upcoming winter and other power consumption measures like no lighting of public buildings have been and will be applied, which translate into savings of primary energy sources (for Slovenia, e.g. coal). This indirectly means more remaining stocks for the winter and thus the ability to operate with a higher power of thermal blocks of thermal power plants in time when we expect higher consumption.

Additional measures have been applied in order to have gas and coal storages full at the beginning of winter period.

Our government also prepared a legislation in order to mitigate and manage crisis situation on the energy supply fields.

In Eles and Slovenia member state, we are well aware of the possible aggravated situation for the coming winter, which is why detailed analysis of the sufficiency of production capacity to cover consumption have been carried out also simulating possible scenarios of electricity shortages.

However we expect our generation and import capacities (also with newly introduced SI-HU border) to be sufficient to cover all energy need of Slovenia and that with joint efforts at pan European level we will be able to keep the supply of electricity to end customers uninterrupted.

Summer Review 2022

Spain

Winter Outlook 2022-2023

No adequacy issues are expected in Spain for the upcoming Winter, but tight adequacy margins are expected to be met due to the following reasons:

- High level of exports to neighboring countries expected.
- Low hydro levels in reservoirs if draught conditions continue. In the beginning of November, the level of hydro reserves is around 27%, which is 17 points below the average values for the same period of the year.

No risks for the gas supply are expected. However, the importance of the electricity generation from combined cycles and gas supply in Spain shall be highlighted, specially, given the background of stress in energy markets.

Concerning mitigation measures:

- A specific balancing product has been put in place since the 1st of November: Active Demand Response Service. It's an urgency market- based measure to be applied in exceptional situations to tackle a shortage of manual balancing reserve, aiming also to encourage the participation of demand response in balancing services.
- In order to reduce demand of energy, a set of mandatory measures were set up by the government since September:
    - Temperature limited to 19-27ºC in businesses and public buildings.
    - Mandatory automatic door closing system in businesses and public buildings
    - Public buildings (unoccupied) and businesses (store windows) must turn off light at 22:00h

Summer Review 2022

No adequacy issues were met during 2022 summer. However, adequacy margins were tight during short periods in mid-June and July due to:

- High temperatures which affected the maximum power available from combined cycles.
- Low levels in reservoirs.
- High level of exports to neighboring countries.

Sweden

Winter Outlook 2022-2023

In terms of maintaining adequacy in Sweden, the winter period is the most critical. This is due to the correlations between outdoor temperatures and demand, where demand peaks have a strong correlation to the coldest periods. During strained conditions and peak demand, imports via interconnections are expected to play an important role in maintaining adequacy. To help secure adequacy during peak demand, Svenska kraftnät contracts a strategic reserve. For the coming winter 2022/2023 this strategic reserve capacity is 562 MW and thus unchanged compared with the previous winter.

This winter the European energy system, and thus also the Swedish energy system, is impacted by due to reduced supply of natural gas from Russia. For Sweden, the consequences are expected to primarily consist of high power prices for the southern bidding zones. As the nuclear power reactor Ringhals 4 is out of operation due to repair work until 31 January, increased import will be needed to supply the Swedish power demand compared with previous year. This, together with the uncertain global situation with reduced import possibilities, contributes to reduced power adequacy for the winter period.

However, high prices and a focus on saving electricity has reduced Swedish electricity consumption somewhat. Should this trend continue throughout the winter period the risk of a power shortage could be heavily reduced.

Summer Review 2022

In terms of maintaining system stability and adequacy, the summer of 2022 in general had better conditions compared to the previous two summers.

Recent grid investments, as well as more outspread maintenance for nuclear reactors and less planned outages in the grid compared to the previous summer, are the main reasons for the improved situation.

During the last years, operational situations with flows from east to west in Sweden have increased significantly in addition to the common north to south flows. Decommissioning of conventional power plants (i.e. four nuclear reactors) in the south of Sweden, strong expansion of wind power in the north of Sweden and Finland and increased export to Norway and Denmark are three drivers for the new flow patterns. Grid elements that have not been limiting the market outcome previously are now new bottlenecks in the Swedish grid. To maintain operational security Svenska kraftnät have had to adapt the export and import transfer capacities for mainly bidding zone SE3. Although the transfer capacities have increased this summer due to aforementioned reasons, the transmission grid has been heavy loaded both day and night and especially during the summer heat waves.

During the summer, high continental power prices have led to increased prices also in the Nordic and especially in the Southern parts of Sweden and Norway. During some of the summer months, Sweden has been the country in Europe with the highest export of electricity.

Switzerland

Winter Outlook 2022-2023

No adequacy issues are expected in the "Winter Outlook 2022-2023" report for the upcoming winter.

In accordance with the Ordinance on the Establishment of a Hydropower Reserve (WResV) established recently, Swissgrid procured a hydropower reserve for the coming winter in the course of a tendering procedure. A total energy volume of 400 GWh was procured at an average price of EUR 739.97/MWh. The hydropower reserve comprises an energy volume of 500 GWh with a tolerance of plus/minus 166 GWh, to be held in reserve from 1 December 2022 to 15 May 2023 and only used when required. (https://www.swissgrid.ch/en/home/about-us/company/winter22-23.html#hydropower-reserve)

Furthermore, the grid connection of a 250 MW reserve power plant until February 2023 is underway in Birr (canton Aargau) (https://www.swissgrid.ch/en/home/about-us/company/winter22-23.html#grid-connection-of). The installation of the reserve power plant follows an ordinance issued by the Federal Council recently (https://www.admin.ch/gov/de/start/dokumentation/medienmitteilungen.msg-id-90464.html).

A constantly updated and potentially changing list of measures can be found here:

https://www.swissgrid.ch/en/home/about-us/company/winter22-23.html#hydropower-reserve

Summer Review 2022

The summer of 2022 was the second hottest summer since 1864 and it was characterized by three heat waves. Precipitations were very scarce. Insolation was strong, in some regions it was the strongest since 1864.

During the summer of 2022,

- no adequacy issues occurred.
- the operation of the grid was quite smooth. The few incidents that took place did not affect the security of supply.

Turkey

Winter Outlook 2022-2023

No adequacy issues are expected for the Winter 2022-2023.

Summer Review 2022

No adequacy issues were recorded during the past season.