Winter outlook 2022-2023 early insights

20 October 2022

entsoe

Reliable Sustainable Connected

Aim of this early report

The current context is a more critical situation than previous winters

- This insights report provides **an early assessment of the security of the electricity supply for the upcoming winter season across Europe**. It identifies adequacy risks that our electricity system may face, based on the assessment of a reference scenario and of various sensitivities, which consider uncertainties that could materialise.

- ENTSO-E and the TSOs have proactively worked intensively since the summer to provide this insight report as early as possible. It further **complements national studies done by TSOs**.

- The report informs on **measures ENTSO-E and the TSOs** are taking to prepare for the winter and coordinate at all levels to build resilience to the uncertainties/risks for the power system in the current context of energy scarcities.

- Measures need to be taken by all actors of the system. This is why continuous & **close dialogue between TSOs, and with European and national authorities** is ongoing to enable timely coordination and support risk preparedness efforts at all levels.

- By **1 December 2022**, the insight report will be complemented and updated with latest available data in the full Winter Outlook Report 2022/2023.

Key findings for winter adequacy 2022/2023 (early insights)

1

Tight periods foreseen with best available projections (reference case)

- Situation this winter is critical but manageable with operational measures.
- Hydrological situation to be closely monitored.
- Nuclear availability is low and adds stress to the system.
- Electricity supply depends strongly on gas in all winter scenarios.
- Simultaneous scarcity situations in various countries need close attention.

- System stress in Irish system, France, Southern Norway, Malta and Cyprus when counting on efficient use of market resources only.
- Loss of Load Expectation raises to higher levels than last winters.
- Minimum gas needs for electricity adequacy equals about one third of total European usable gas storage.

2

Additional risks can materialise (sensitivities)

- Additional stress elements can materialise and become problematic, especially if they coincide.
- Nuclear unavailability higher than foreseen will have local but strong impact.
- Further constraints in fuel supply increase adequacy risks.
- Switch from gas to direct electric heating can stress the electricity system and indirectly create extra demand of gas for power supply.

- Additional nuclear unavailability in Nordic system has notable impact
- French nuclear unavailability has high local impact.
- Further fuel constraints in Germany and Poland would have a local impact on adequacy.
- Fuel switch of residential users would mean higher adequacy risk.

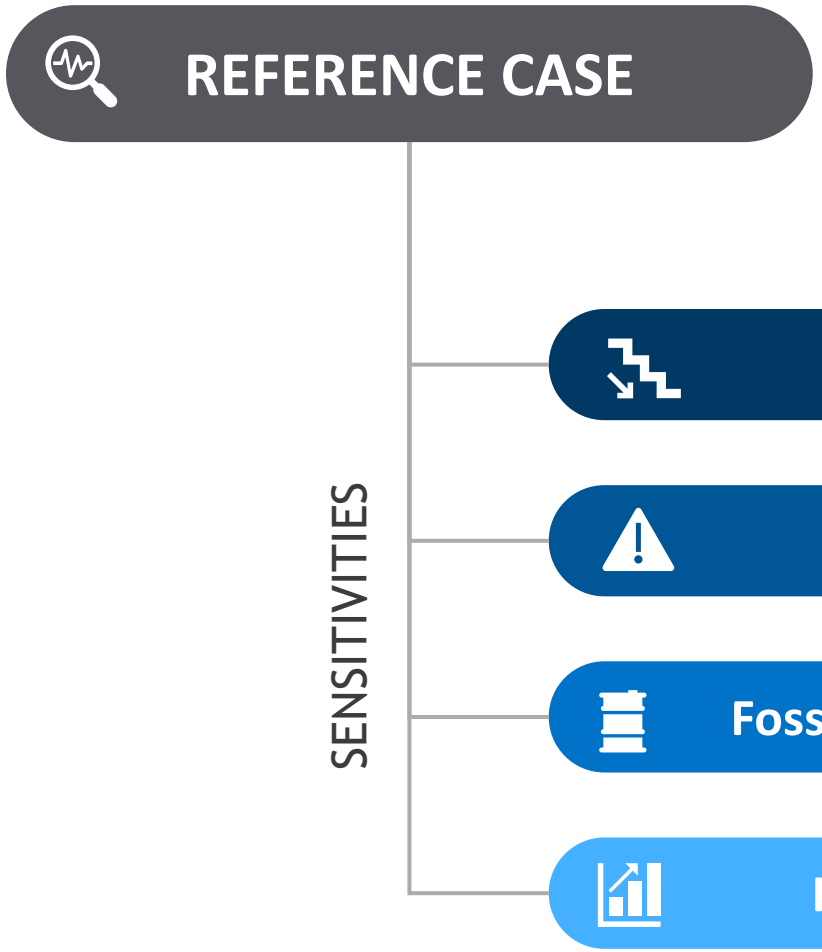
3

Need for early coordinated measures (preparedness)

- TSOs are pro-actively taking measures at national level and closely coordinating at regional and pan-European levels.
- Coordination and cooperation among the European States and National Risk Preparedness Plans are key for this winter.
- Demand reduction reduces significantly the risk for the system.
- System adequacy relies on all market participants.

- If 10% demand reduction objective is met, adequacy risks become negligible and critical gas dependency reduces by 30%.
- Even a 5% peak shaving can mitigate most risks in continental Europe, with a remaining risk in France.

Winter Outlook 2022/2023 scenarios assessed



Best estimate projections for period October to March

- **Including confirmed national mitigation measures**
- **Gas considered last in the merit order**
- **Considering an efficient integrated European market system with perfect foresight**

Effect of EU Emergency Intervention toolkit with i) a 10% electricity reduction in demand or, ii) a 5% power reduction focused on peak hours

Stress test for potential increased/ prolonged unavailabilities of plants in France, Sweden, Finland

Possible constraints on supply of coal and lignite in Poland and Germany during scarcity

Proportion of residential heating switching from gas to electricity, adding further stress on grid and shifting gas consumption

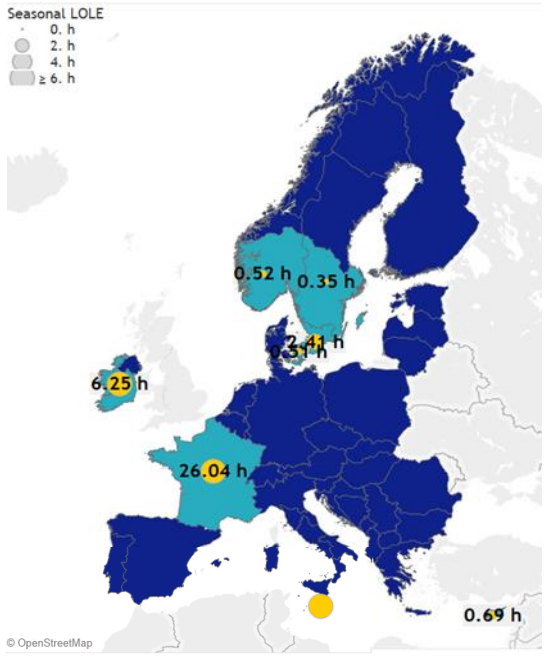
- Assessment based on **one reference case and four sensitivities**. A combination of sensitivities can materialize and may lead to a more stressed situation (combined simulation not yet performed, under discussion to integrate in the full winter outlook by December).
- Every scenario undergoes a **probabilistic assessment** to identify adequacy risks. In case of issues, another run is triggered considering non-market resources (will be integrated in the full Winter Outlook report by 1 December 2022).
- Each scenario is assessed on **dependency on gas supply for electricity generation** at country level and weekly basis.

Reference Scenario: Adequacy levels

- Higher adequacy risk and overall lower margins compared to recent winter periods.
- Adequacy is especially stressed in January/February. Some countries see issues already in November/December.

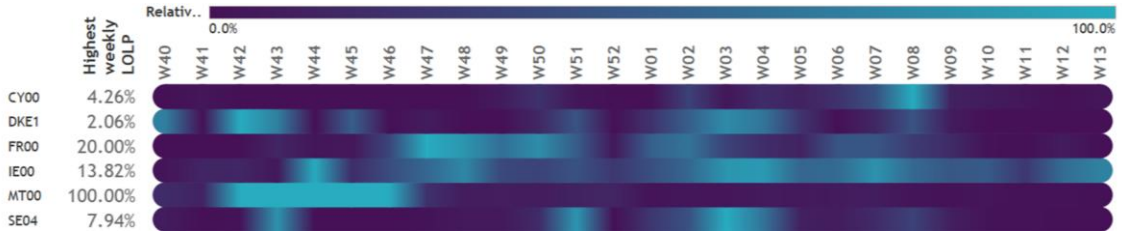
Adequacy (over winter)

- Adequacy risks mostly observed in **France, Ireland**.
- Risks emerge in **Southern Norway and Southern Sweden** under dry scenarios.
- Risks in **isolated/peripheral systems** (e.g. Malta and Cyprus) as every winter.
- Several other countries can expect limited adequacy issues under very specific conditions. Overall **margins are tighter** compared to recent winters.



Adequacy (weekly basis)

- **France and Ireland** see risks before end of 2022.
- **Malta** is relying on non-market resources during planned outage of interconnection with Italy, which minimizes risks to bare minimum. Risks also shifted from October to November.
- **Most risks** in other countries emerge **as of January 2023**) and last until end of February (W01 to W8).
- Some countries see constant risk levels throughout winter, others are more focused on specific weeks.



Key assumptions:

- Low hydro levels Norway and Southern Europe from projections over summer. Newest data project even lower hydro reservoir levels. This will be updated and assessed as part of the full Winter Outlook report by December.
- Nuclear availability based on most recent TSO projections. In particular the French situation is aligned with RTE's report of 14 September.
- Reference demand is in aggregate comparable to last winter. Impact of demand reduction measures is covered in two sensitivities.
- Various national measures are already included based on TSO information such as a removal of production limits (NL), reopening of coal plants (FR), running of more lignite plants (RO), fuel switch (IT), return of grid reserve plants to market (DE).
- Assessment based on pan-European probabilistic modelling. For comparison with national assessments see Page 26

How to interpret the Reference Scenario

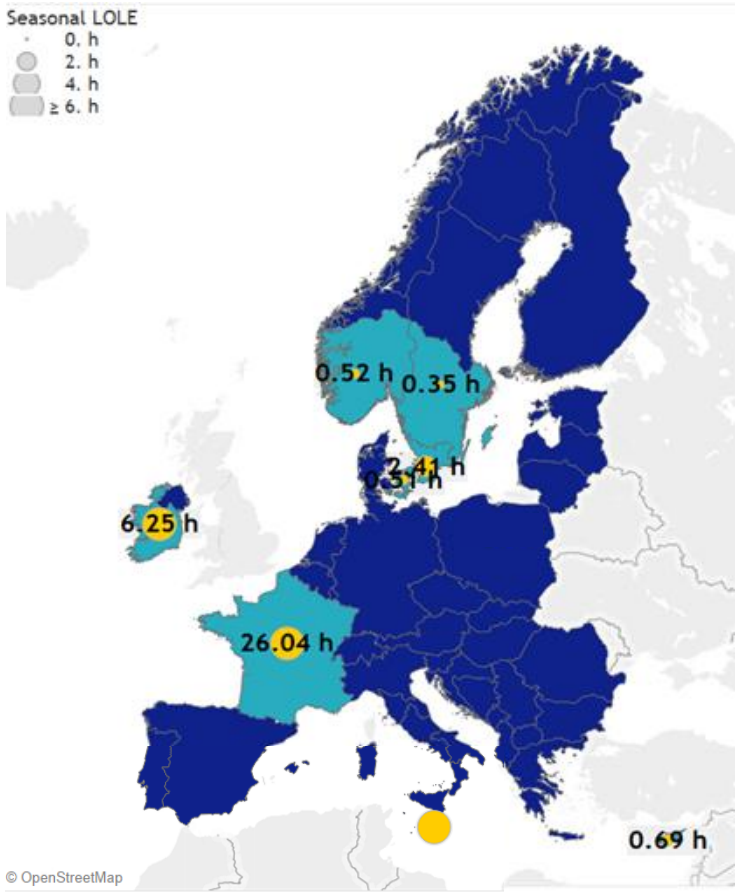
- **Loss of Load Expectation (LOLE)** figures are expressed over the winter period as the average number of hours across all probabilistic years (accounting for climatic variations and unplanned outages) that some demand cannot be supplied. This is a seasonal metric for measuring risk. See FAQs for further context how this relates to a Reliability Standard and Expected Energy Not Served (EENS).
- This assessment takes into account projected **available market resources**. It informs TSOs and market participants on how to take further corrective actions (e.g. planned outage schemes) and available non-market resources, all within an operational timeframe.

- The **previous Winter Outlook 2021/2022** showed adequacy risks in Ireland, France and Malta. For Ireland and France, the levels were substantially lower. For Malta the risk could be almost fully mitigated by non-market resources.
- The Winter Outlook 2020/2021 showed moderate risks in France, Denmark East and Finland, as well as Malta. Earlier reports did not yet use the advanced probabilistic modelling at pan-European level.

- The ENTSO-E Winter Outlook messages align with those of **national studies and communications by TSOs**. Numerical results can differ because of assumptions and construction of scenarios.
- National studies can include a number of **corrective measures by market participants and especially non-market measures by TSOs,** which are part of the risk mitigation. LOLE/EENS figures post-mitigation are expected to be much lower.
- National studies can be based on superimposing several resource risks in the same scenario (**stress-test**). This can give substantial higher LOLE/EENS figures and needs to be seen in context of the probability of such scenario occurring and the approach towards risk management.
- The Winter Outlook does not account for grid constraints within market zones. National studies may consider internal grid constraints (**transmission adequacy**).
- The ENTSO-E Outlook takes value from modelling the full interconnected system based on efficient market functioning and before corrective measures are applied. It therefore handles the phenomenon of **simultaneous scarcities across regions** and assesses to which extent one region can still support the other under normal conditions.

- For an elaborate **list of national studies** and comparisons with the initial Outlook results, see Page 26
- **Malta** has a very high LOLE/EENS level (not explicitly shown) due to size of the system and strong reliance on a limited interconnection. This is expected to be mitigated by non-market resources.

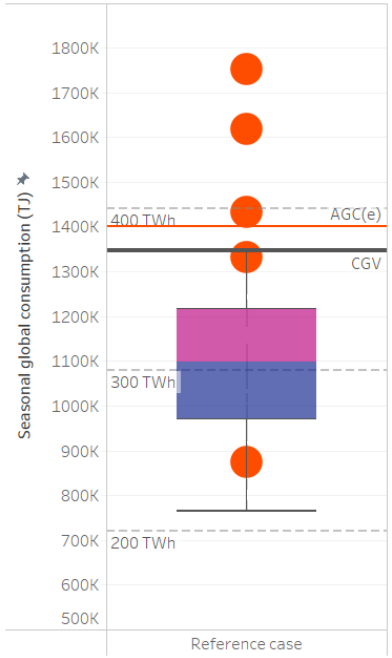
Adequacy (over winter)



Reference Scenario: Critical Gas Volume

- Minimum gas for electricity generation strictly needed to ensure system adequacy (Critical Gas Volume) over the full winter period comes close to actual gas for electricity demand in recent years.
- Gas consumption on a weekly basis surges as of January for most countries.

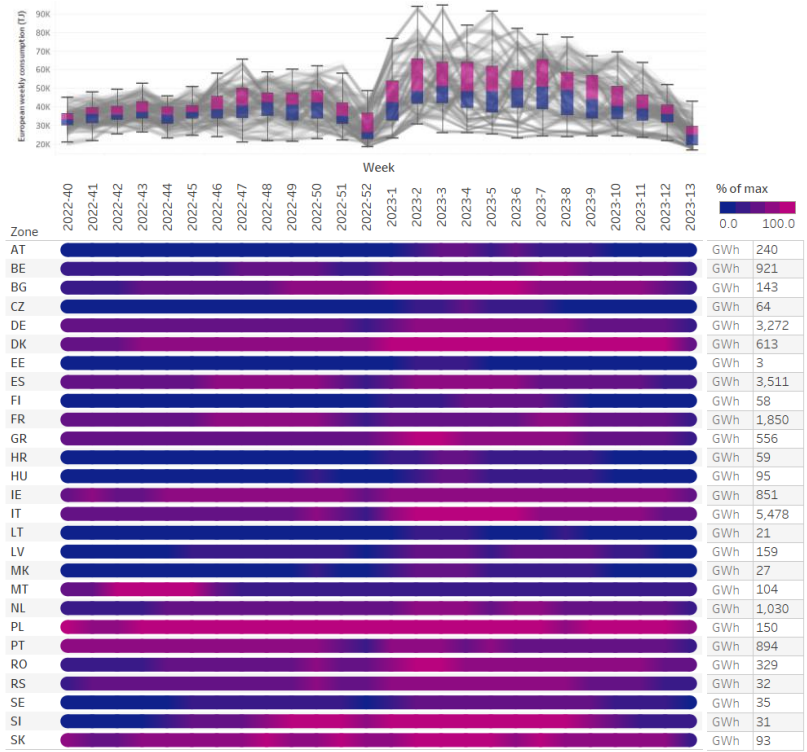
Critical Gas Volume (European countries)



- **Close to historical average** (~375 TWh_{fuel}) which equals about a third of the Working Gas Volume in European countries.
- Major CGV levels in **Germany, Spain, Italy, France.**
- CGV projections consider worst winter scenarios. Actual volumes will depend on weather conditions.

Critical Gas Volumes (CGV) in each scenario refer to lowest volumes of gas absolutely needed for electricity generation using all market resources. AGC(e) refers to average gas consumption for the electricity system over recent winters. Consumption is expressed on gas energy basis (TJ as well as TWh); electricity generation from gas power plants depend on efficiency levels of units, typically around 60% with some variety. The difference between the max CGV level over all climatic years (black line) and the average AGC(e) (orange line) is an indicative measure for how much gas might be saved in the electricity system.

Critical Gas Volume (country/week)



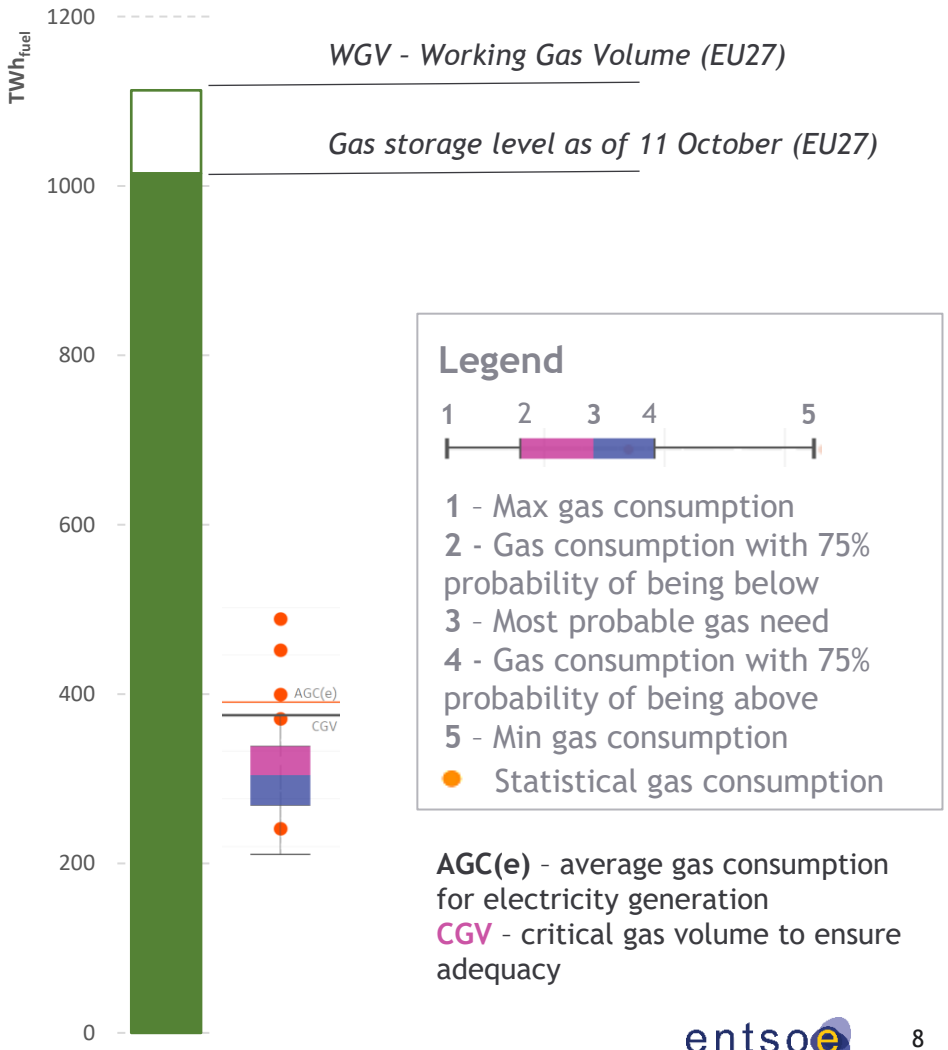
Right column values show the max weekly volume of gas for power generation (expressed as GWh_{gas}) for a country over the entire winter and considering all climatic years. The heatmap shows for each country how the average weekly consumption evolves, also considering all climatic years.

Note1: This does not include non-market resources which may be activated sooner.
Note2: In actual market operation some countries may already see higher volumes of gas-based power generation.
Note3: Actual gas volumes can be higher due to CHPs and ancillary service demand.

How do Critical Gas Volumes inform on electricity system adequacy?

- ENTSO-E's Winter Outlook does not model explicitly any gas supply disruption scenario. Such assessment would entail too many assumptions, incl. time of disruption, duration, regional coverage, priority use across sectors of gas consumptions, use of storage, etc.
- This assessment therefore provides for each scenario the reliance on gas for electricity adequacy via the concept of Critical Gas Volumes. These can be monitored on pan-European basis over a full winter, as well as country/week level. This gas reliance assessment can be read in conjunction with ENTSOG's gas supply outlook under various scenarios.
- Critical Gas Volumes for electricity generation over the winter equals to about a third of the Working Gas Volume of all European storage.
- Critical dependency on gas supply is a key constraint factor: there is limited potential for gas saving in the power system in case of extreme situations (cold spell, other system stress, etc.).

- **Critical Gas Volumes (CGV)** in each scenario refer to lowest volumes of gas absolutely needed for electricity generation using all market resources. This is visualised as a boxplot over all probabilistic scenarios. The European CGV levels refer to EU27 only.
- **AGC(e)** refers to average gas consumption for the electricity system over recent winters. This is factual historical data and visualised as orange dots, with the historical average as orange line.
- Consumption is expressed on gas energy basis (TJ and TWh_{fuel}). Electricity generation output from gas power plants depends on efficiency levels of units (typically around 60% with some variety).
- The difference between the max CGV level over all climatic years (black line) and the average AGC(e) (orange line) is an **indicative measure for how much gas could be saved in the electricity system**. Margins are typically low, and differ on country and weekly basis. These levels can be monitored and updated as winter progresses.

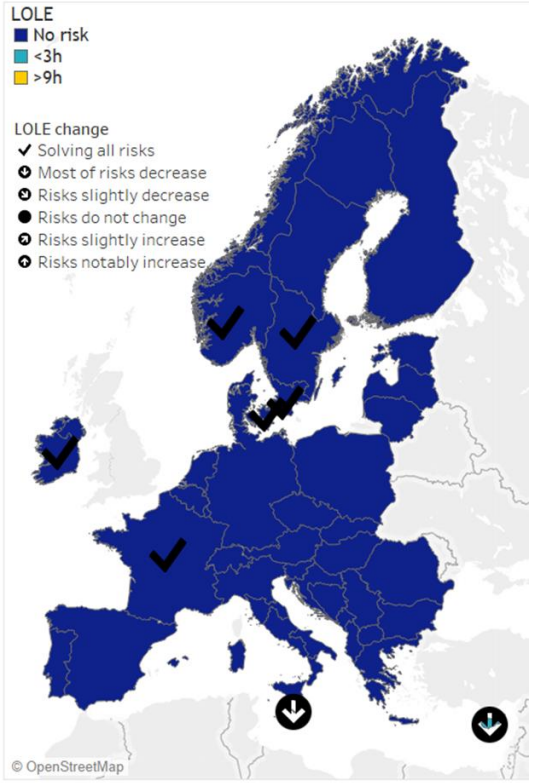


Sensitivity: Low demand (10% electricity demand reduction)

Adequacy risks and Critical Gas Volumes in the power system could be relieved substantially if 10% of electricity consumption is saved across Europe.

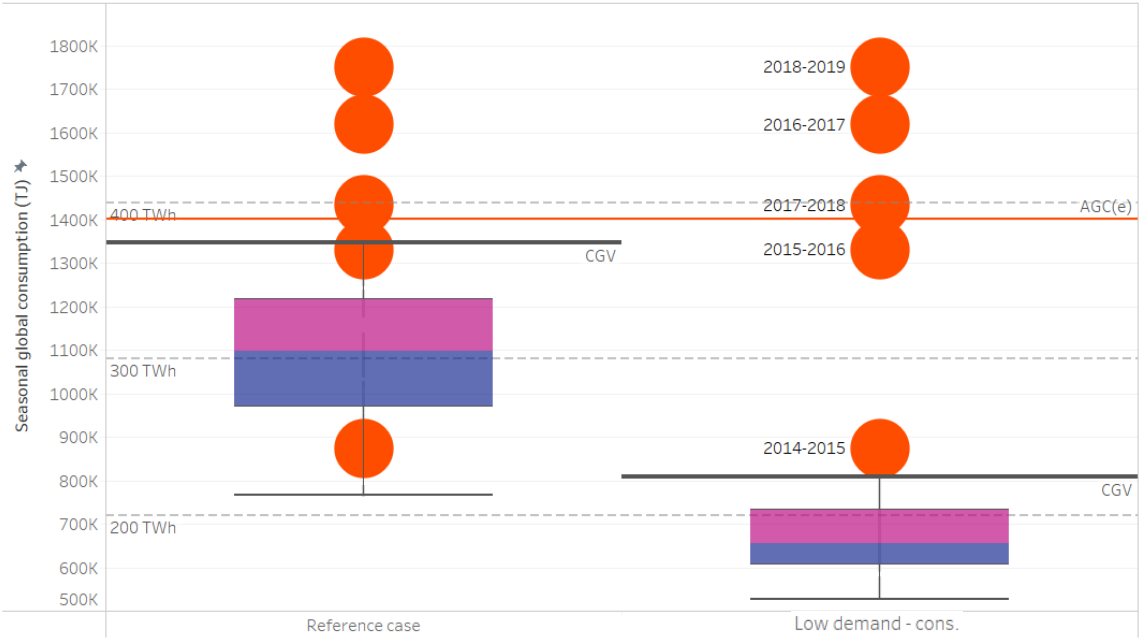
Adequacy

- **Adequacy risks mitigated** across Europe, below reliability standard levels.
- Exception with reduced but noticeable risks still observed in Malta and Cyprus due to low interconnectivity to the rest of the European system.



Critical Gas Volume

About a third of gas could be saved in the electricity sector **(~120 to 150 TWh_{fuel})**.



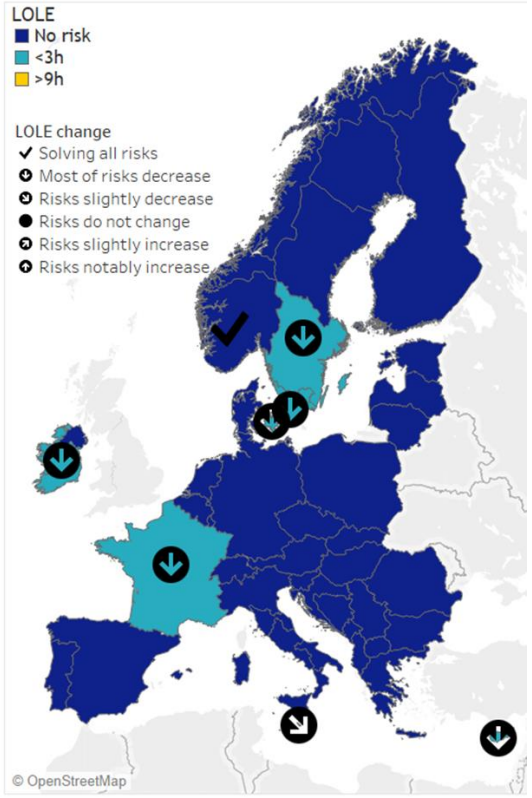
Key assumptions: fixed 10% demand reduction every hour everywhere in Europe.

Sensitivity - Low demand (5% peak power reduction)

Adequacy risks are strongly mitigated across Europe when 5% of peak load is reduced during the most critical hours in each country. As these are focused actions, impact on Critical Gas Volumes is moderate with a 3% reduction.

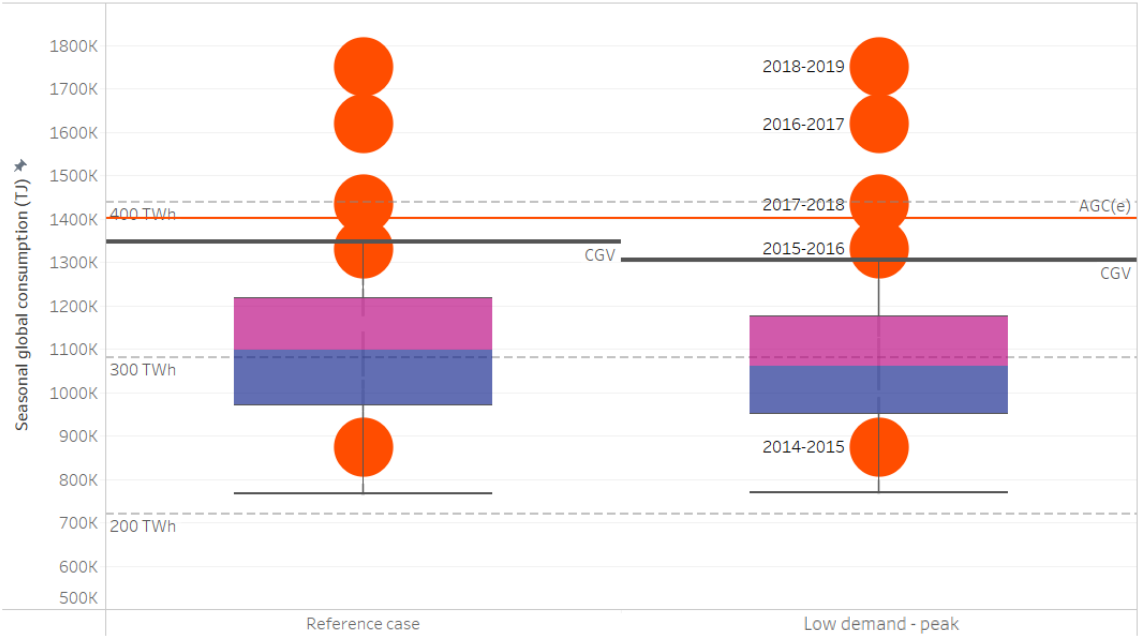
Adequacy

- **Adequacy risks strongly mitigated** in most of Europe
- Exception is **France** where a moderate risk could remain for a dozen of hours.
- Risk in **Ireland** decreases well below the reliability standard.



Critical Gas Volume

As peak production is gas-based, a peak demand reduction still **saves 3% of CGV (~10 to 15 TWh_{fuel})**.



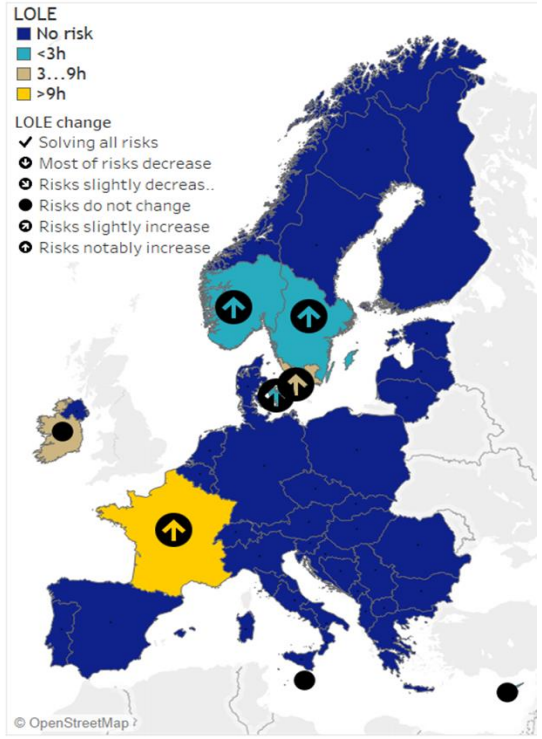
Key assumptions: Demand is decreased in each country by 5% with respect to the reference case, for hours above the monthly 90th percentile (October to March). Note this expands the principle behind the EU target to a longer period of time and to all European countries. The EU target also allows for another selection of peak hours than pure gross demand based.

Sensitivity - Low nuclear

Adequacy becomes more stressed mainly in the French system. Spill-over effects to other countries are limited, unless other stress elements materialize simultaneously.

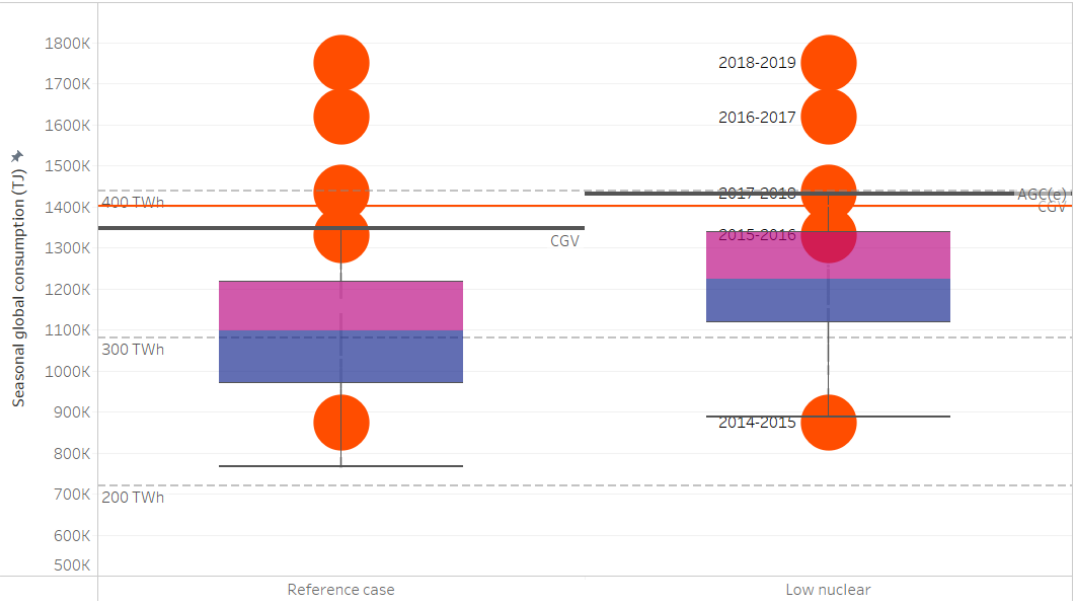
Adequacy

- **Adequacy risks increase substantially in France and Southern Sweden** due to even lower nuclear availability.
- Moderate but **notable impact in wider Nordic area**, with Finland highly relying on imports.
- **Neighbouring systems** are slightly affected under very specific conditions.



Critical Gas Volumes

Gas consumption for electricity generation increases by 10% (~30 TWh_{fuel}) mostly affecting France and Italy.



Key assumptions: Uncertainty around nuclear availability coming winter due to potential delays of planned outages (France, Sweden), delays of commissioning (Finland) and corrosion inspection outcome uncertainty (France).

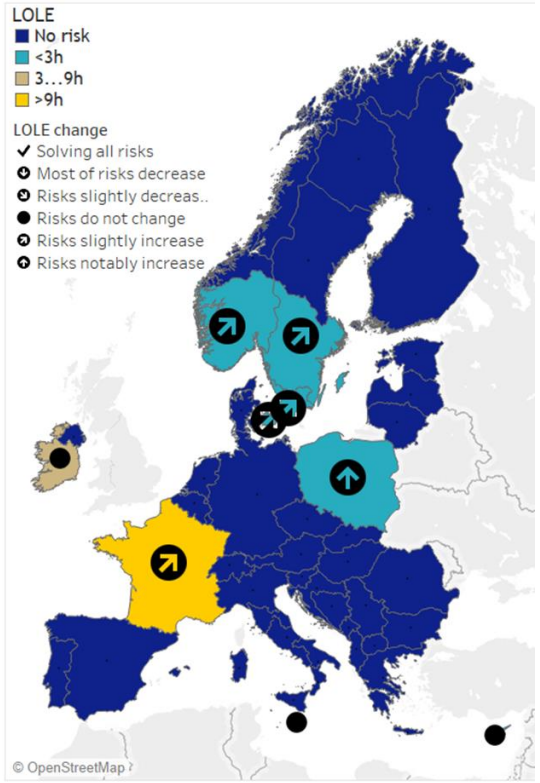
- France - 5GW less nuclear for whole winter compared to RTE's "intermediate scenario" published on 14 September
- Sweden – 1.1 GW less in February (to be updated to full winter outage in full Winter Outlook)
- Finland – 1.6 GW less after mid-Dec. (and +300 MW import NTC)

Sensitivity - fossil fuel constraints

In case of coal/lignite supply constraints in Poland and Germany, especially new risks emerge in Poland. Adequacy becomes more stressed in the Nordics due to resulting lower import availabilities.

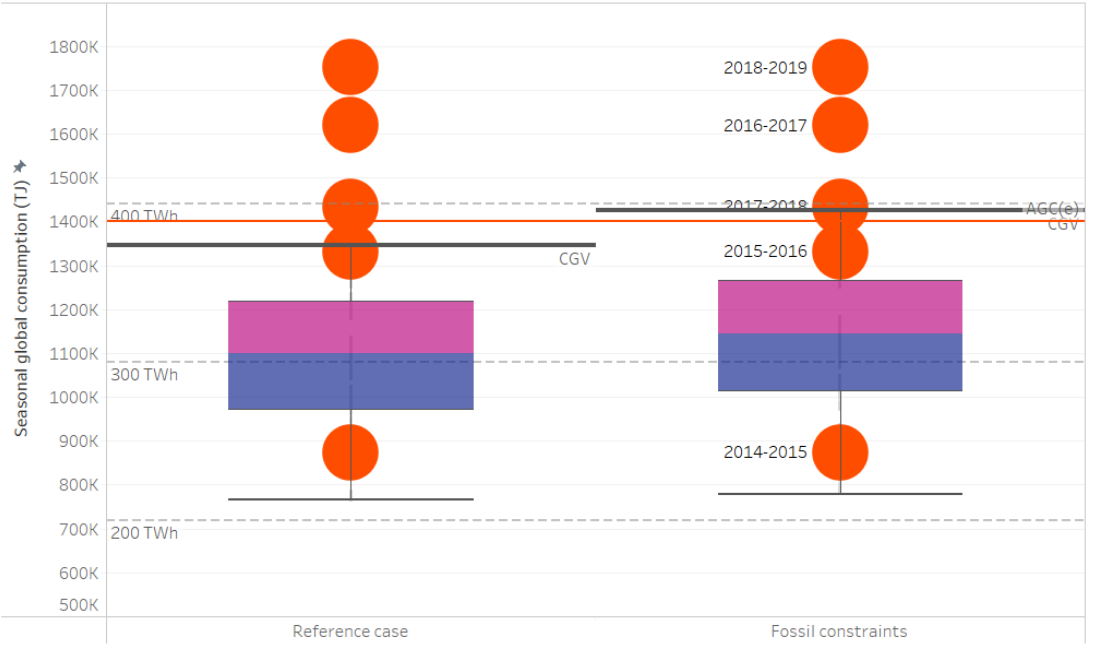
Adequacy

- **Adequacy risks increase slightly in Nordics** due to lower import availability from Germany, while LOLE still remains under 3h.
- Margins around **Poland and Germany** are tighter, but are still manageable.
- **Small additional impact in France** under extreme conditions.



Critical Gas Volume

Gas consumption for electricity generation increases by 6% (~22 TWh_{fuel}), with mostly local effect in Poland and Germany.



Key assumptions:

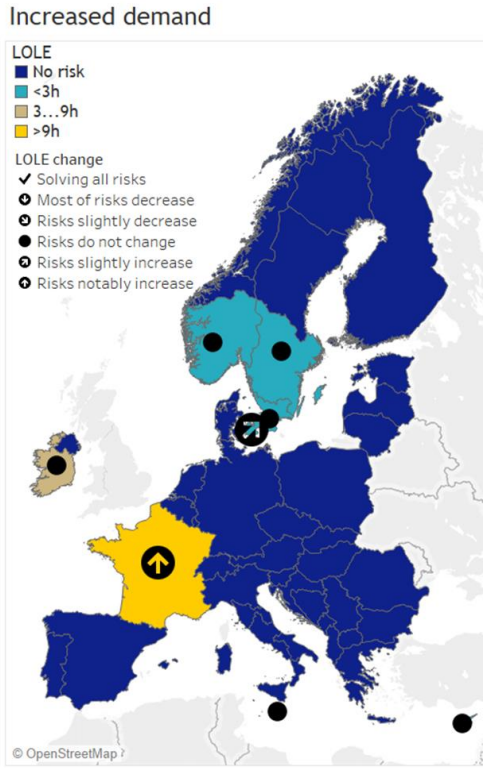
- Germany – increased planned outages for hard coal (+6 GW on average) and lignite (+0.8 GW on average) with respect to reference case;
- Poland – limitations on seasonal generation from hard coal (-6 TWh) and lignite (-2.3 TWh) with respect to historical generation 2021/2022.

Sensitivity - high demand (fuel switch)

Even a modest fuel switch from gas to electricity heating from a part of households impacts countries with already tight margins or actual risks. It also results in a significant increase of the Critical Gas Volume risks due to the subsequent increase of demand from gas to electricity generation in some countries.

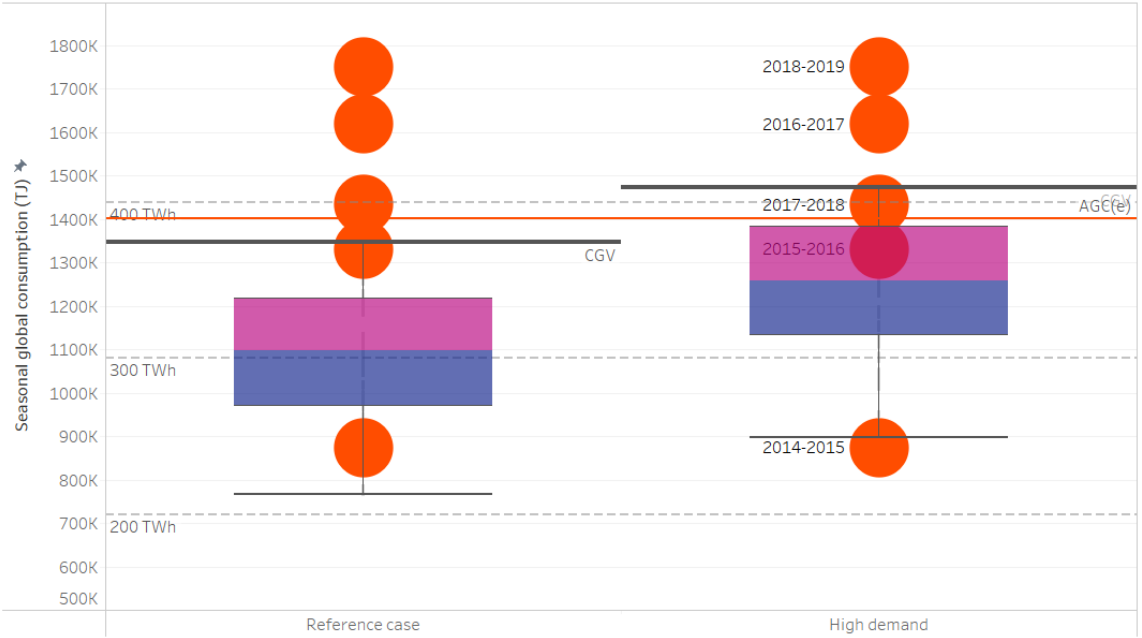
Adequacy

- **Adequacy risk increases mainly in France** (due to 2% increase of the peak demand). Risk increases in Denmark, but still remains low.
- In addition, **margins become tighter** in different parts of Europe, while not yet triggering adequacy risks.



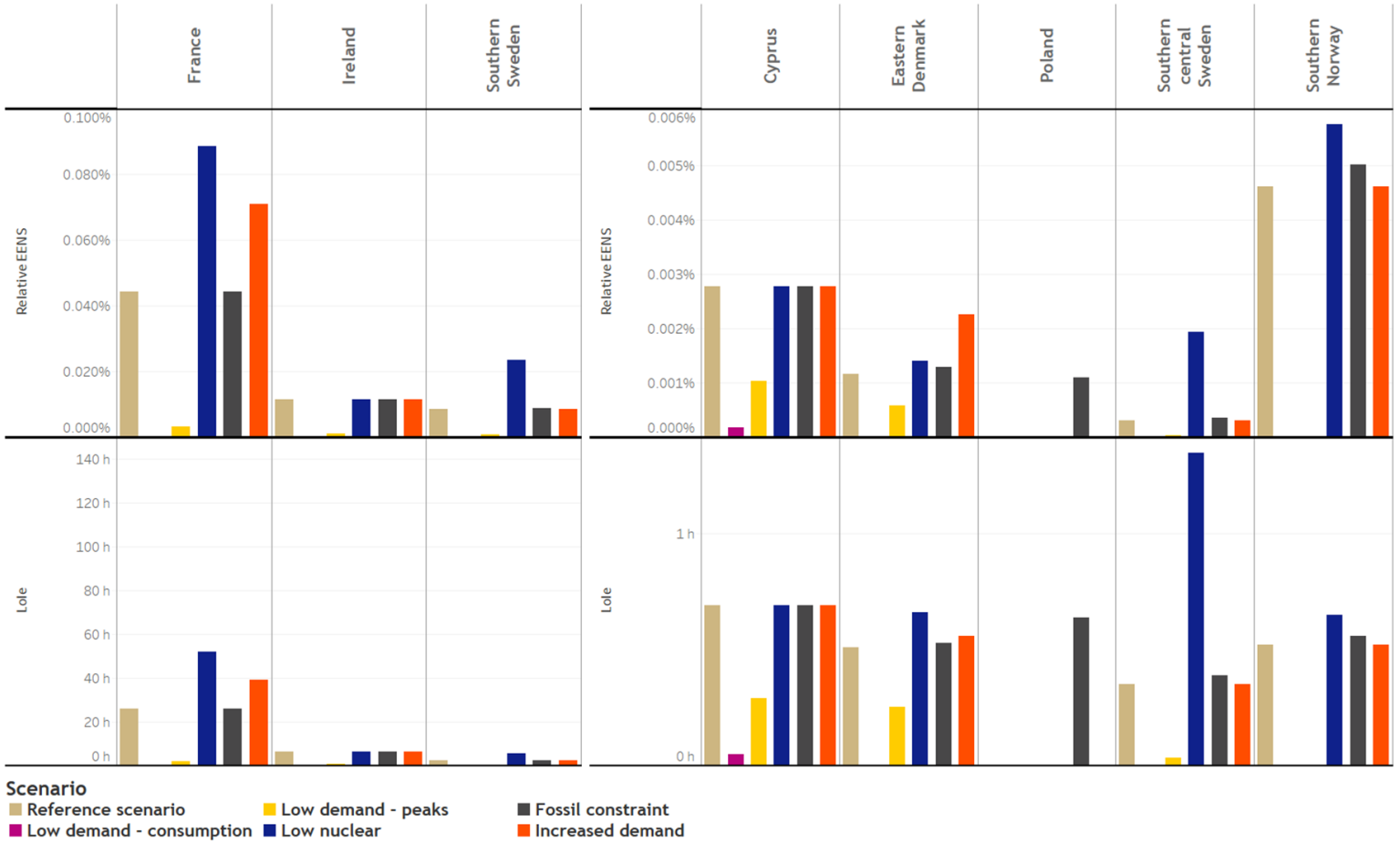
Critical Gas Volume

The impact differs between countries and is linked to the rate of residential gas heating



Key assumptions: 5% of residential heating demand based on gas switches to electric devices. The sensitivity considers national differences in heating. The projection of 5% switch is expert-based to illustrate impact; it is not meant as an actual projection or observation.

Comparison of adequacy indicators



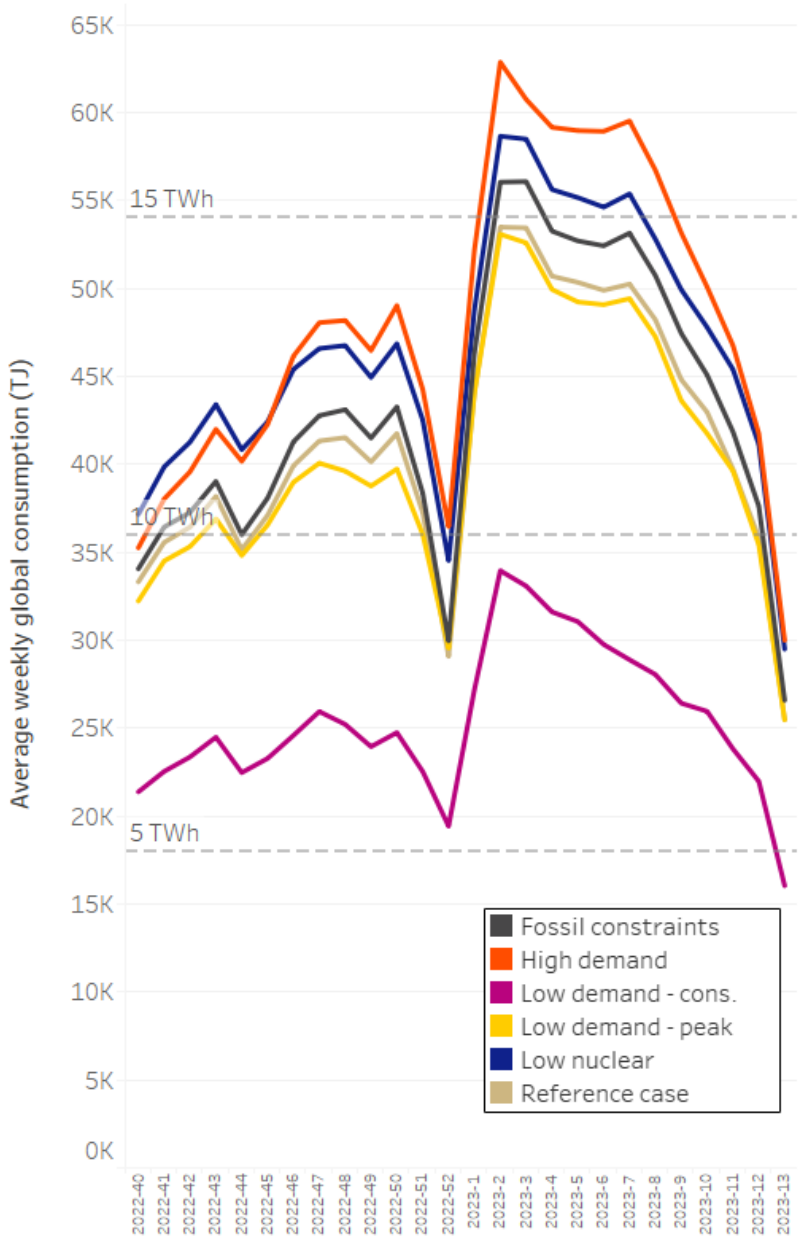
Key insights:

- **Demand reduction** (10% energy reduction as well as 5% peak shaving) has a substantial positive impact on adequacy.
- In addition to the stressed situation for some countries in the reference case (best available projections), additional risks emerge for
  - France, Norway, Sweden in case of lower **nuclear availability** in France, Sweden and Finland.
  - In case of **coal/lignite supply constraints** in Poland/Germany, especially the Polish system sees higher risk, with some spill-over in the Nordics.
  - If across Europe a portion of users **switches from gas to electric heating**, especially the French system sees higher adequacy risks.
- Simultaneous impact of stress elements needs further analysis still.
- In addition to direct adequacy risks, also Critical Gas Volumes differ across all sensitivities, mainly in case of electricity demand variations.

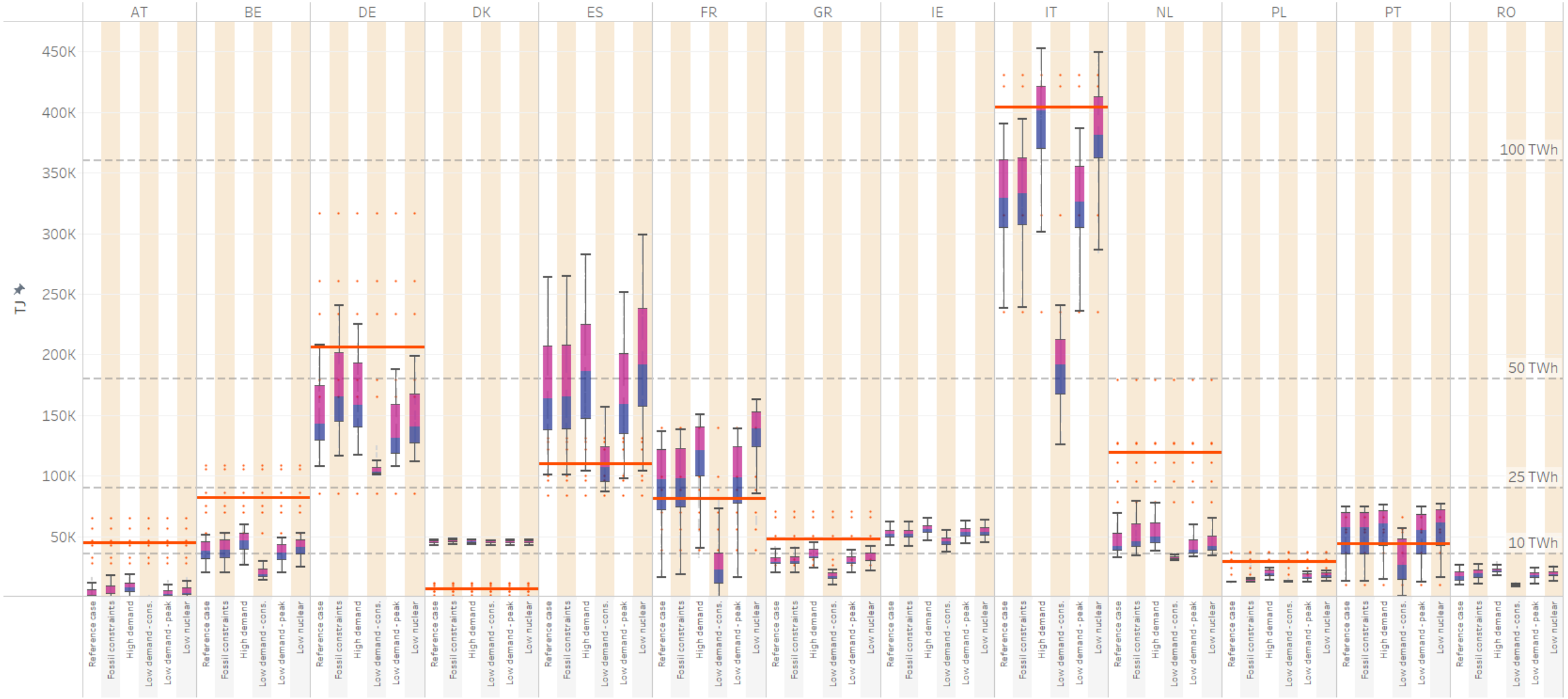
Focus on countries with higher risk in reference case and/or notable impact from sensitivities.
Malta excluded due to high risks, normally mitigated by non-market resources.

Loss of Load Expectation (LOLE): an estimate of how many hours supply would not meet demand and can be checked against national reliability standards to confirm whether the adequacy situation is acceptable.
Relative Expected Energy Not Served (Relative EENS): the expected amount of energy not being served to consumers during the period considered, due to system capacity shortages or unexpected severe power outages, compared to total demand.

Comparison of Critical Gas Volumes (European/weekly level)

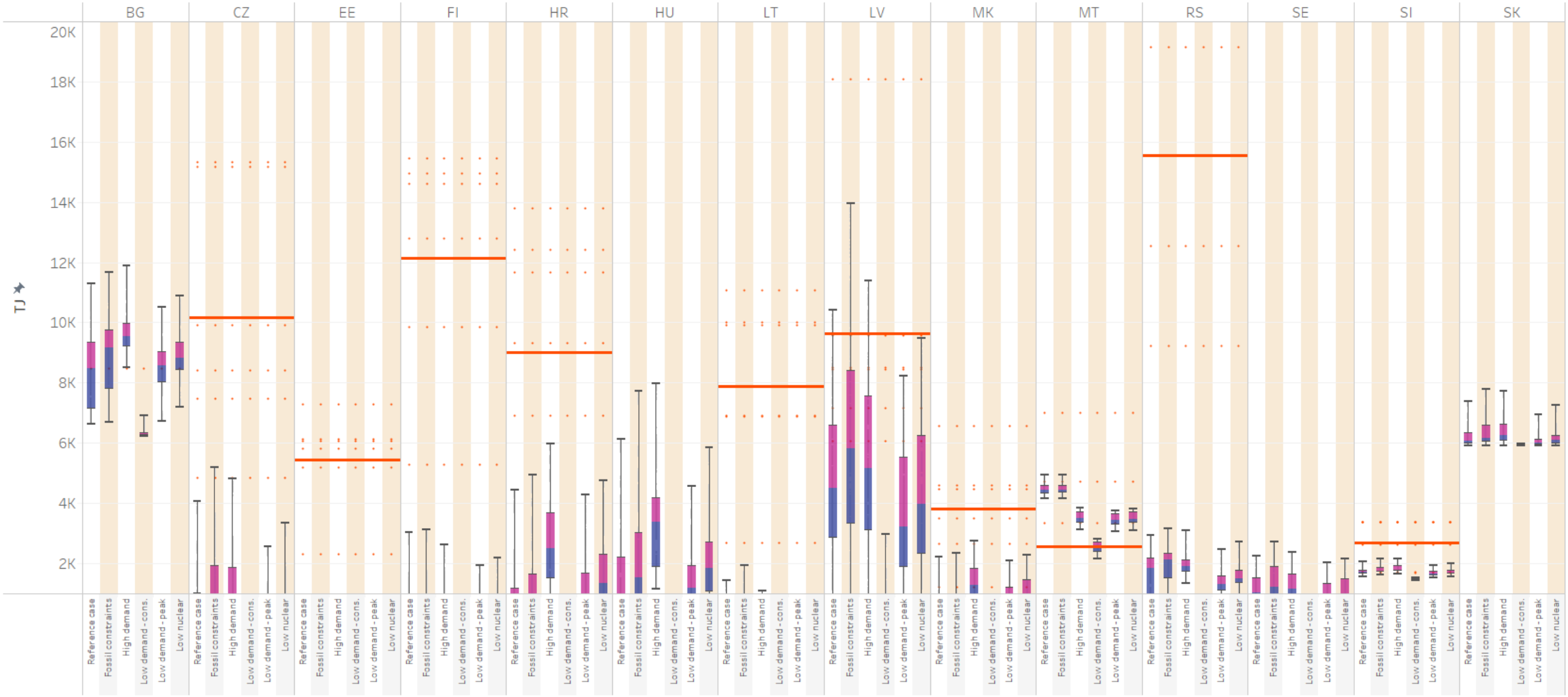


Comparison of Critical Gas Volumes (Country level)



Critical Gas Volumes in each scenario refer to lowest volumes of gas absolutely needed for electricity generation using all market resources.
Note1: This does not include non-market resources which may be activated sooner.
Note2: In actual market operation some countries may already see higher volumes of gas-based power generation.
Note3: Actual gas volumes can be higher due to CHPs and ancillary service demand.

Comparison of Critical Gas Volumes (Country level)



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Note3: Actual gas volumes can be higher due to CHPs and ancillary service demand.

Main assumptions and next steps

Scenarios	Main assumptions
Reference scenario	Best estimate projections • Including confirmed national mitigation measures • Gas considered last in the merit order • Only considering market resources in an efficiently integrated pan-European system
Low demand sensitivity	i) a 10% electricity reduction in demand based on rescaling of every hourly load, and ii) a 5% power reduction focused on 10% of peak (gross) demand hours
Low nuclear sensitivity	Stress test for potential prolonged unavailabilities of plants in France (-5GW compared to RTE's intermediate scenario), Sweden (Ringhals-4 out for longer period), Finland (Olkiluoto-3 out all winter)
Fossil constraints sensitivity	Possible constraints on the availability of fossil fuels: i) hard coal and lignite production in Poland is limited by 8TWh below winter 2021/2022 value, and ii) Germany seeing lower availability of hard coal plants (-6GW) and lignite plants (-800MW) over winter compared to the reference case
High demand sensitivity	Proportion of residential heating switching from gas to electricity, adding further stress on grid and shifting gas consumption

Next steps

- Continuous review of reference case and sensitivities
- Continuous close alignment across TSOs within ENTSO-E, and regular exchanges with relevant authorities
- Winter Outlook 2022/2023 report publication (1 December) based on updated data collected in September 2022
- Regular updates over the winter period & in case significant change of assumptions needed

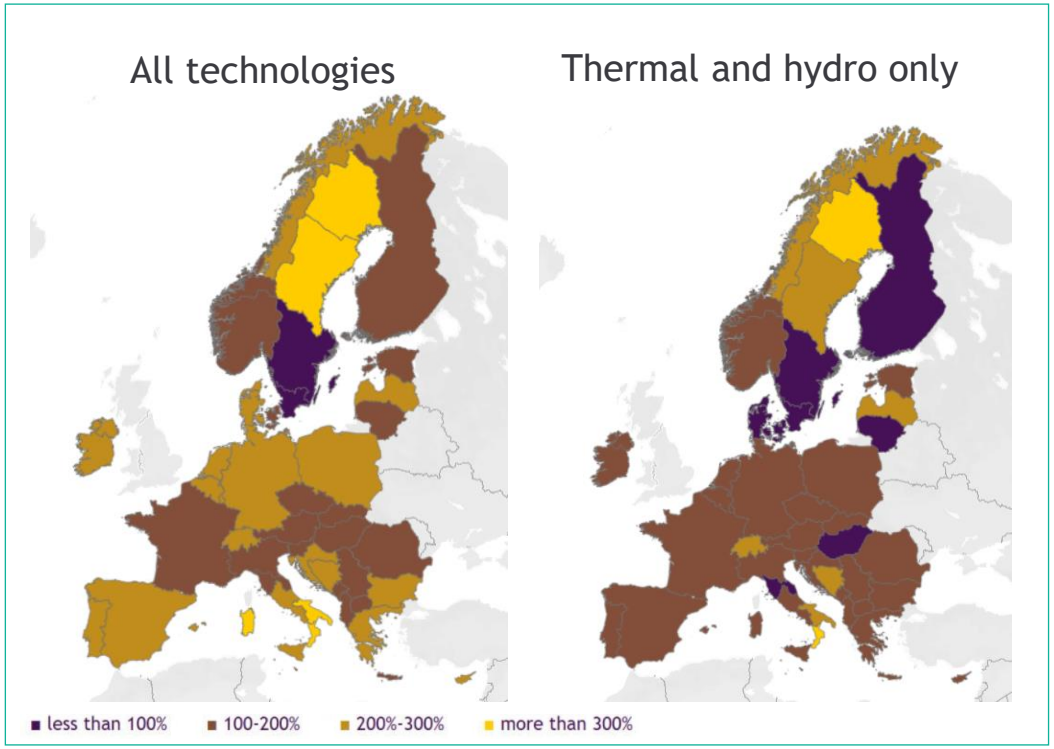
Effective coordination and mitigation strategies at all levels is key

Adequacy risks for the interconnected power system this winter can be mitigated with concerted preparation, coordination and cooperation at national, regional and European level.

	National	Regional	European
Planning cooperation	▪ *TSOs national study updates & raising awareness;* ▪ *Continuously optimised outage planning;* ▪ *Risk preparedness with governments, NRAs, market actors*	▪ *TSOs coordination via established regional STA (short-term adequacy) processes;* ▪ *Outage planning coordination via established OPC (operational planning coordination) processes*	▪ *TSOs coordination via established PAN-EU STA (short-term adequacy) processes* ▪ *Close ENTSO-E monitoring of the situation and potential Outlook updates*
Market integration	▪ *Facilitate markets & incentives for demand response measures as well as cross-border cooperation*	▪ *Cross-border exchanges and cooperation to maximise capacities in a secure manner regionally*	▪ *Efficient pooling of resources is also key for adequacy support*
Operational coordination	▪ *Coordination with governments, NRAs, key stakeholders;* ▪ *Data sharing;* ▪ *Operational mitigation measures*	▪ *Weekly monitoring in RCCs regional short-term adequacy assessments;* ▪ *Established inter-TSO and RCC processes*	▪ *Close coordination across ENTSO-E* ▪ *Alignment ENTSOG/ENTSO-E*

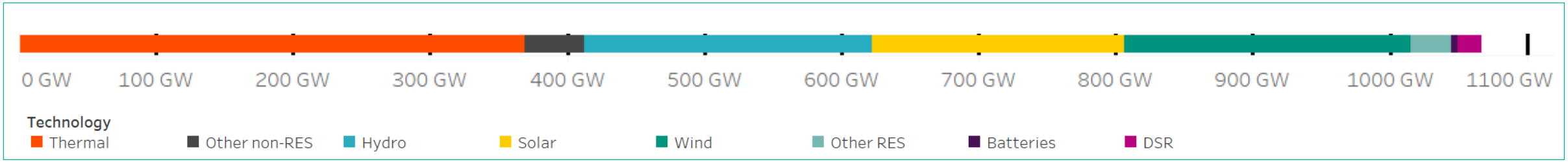
Annex

Generation mix



Ratio of net generating capacity over peak demand

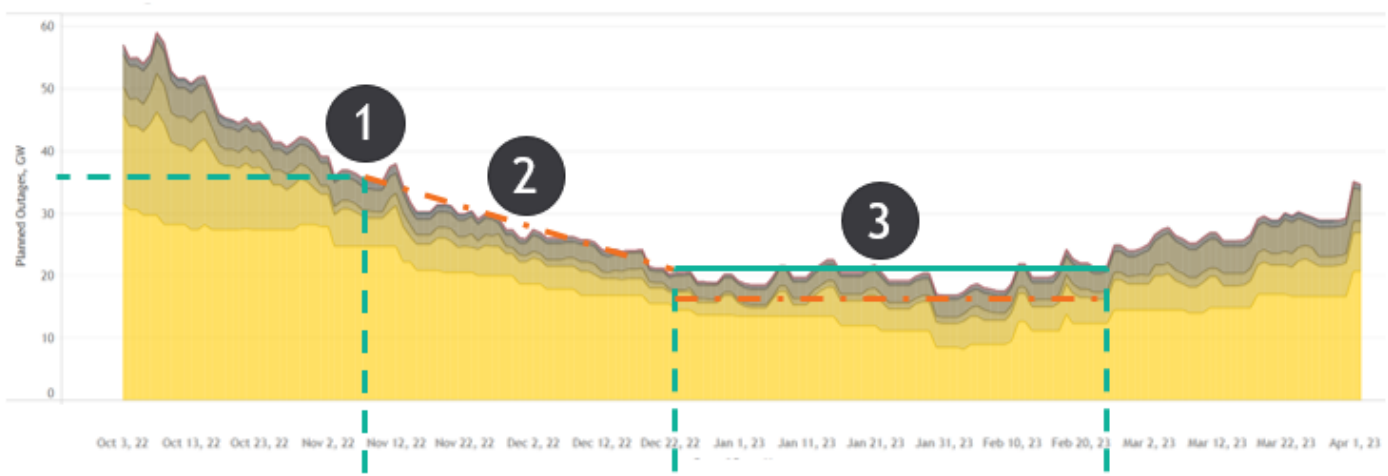
- Notable renewable expansion was recorded together with a small thermal capacity decrease since winter 2021/2022. Solar capacity increased by 20%, wind capacity by 10%, hydro capacity by 1%. Thermal capacity decreased by 2%. Part of the decrease was compensated by returning thermal power plants to the market.
- Sufficient generation capacity to supply consumers is available in most countries. However, generation unavailability (planned or unforeseen) and actual renewable generation infeed have an impact and some countries may rely stronger on imports.



Total net generation capacity in Europe

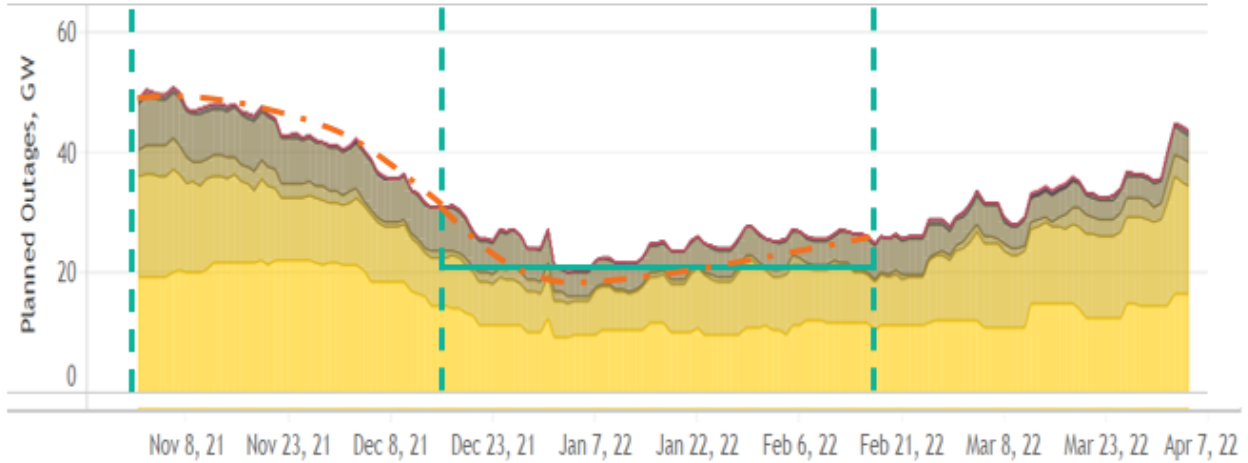
Planned generation availabilities better spread compared to last winter

WO 2022-2023



- Oil
- Hard Coal
- Lignite
- Gas
- Nuclear

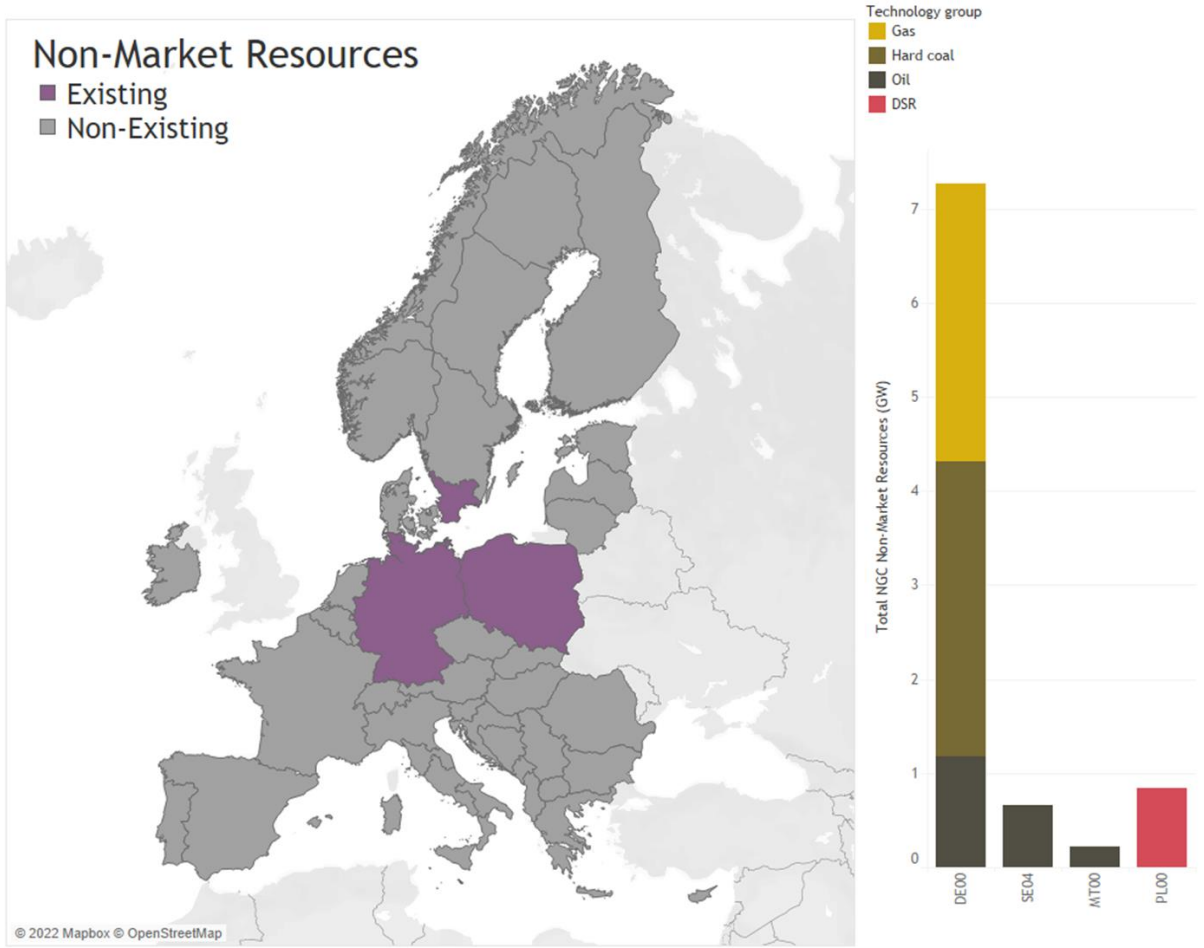
WO 2021-2022



1. Lower planned outages in early days of winter
2. More responsible preparation for the coming winter
3. Planned outages during highest risk weeks remain steadily low

Note: Based on data collection over summer. Planned outages should be compared with caution as some could still be under scheduling. Updates will be included in the later full Winter Outlook report

Non-market resources can support adequacy in critical situations

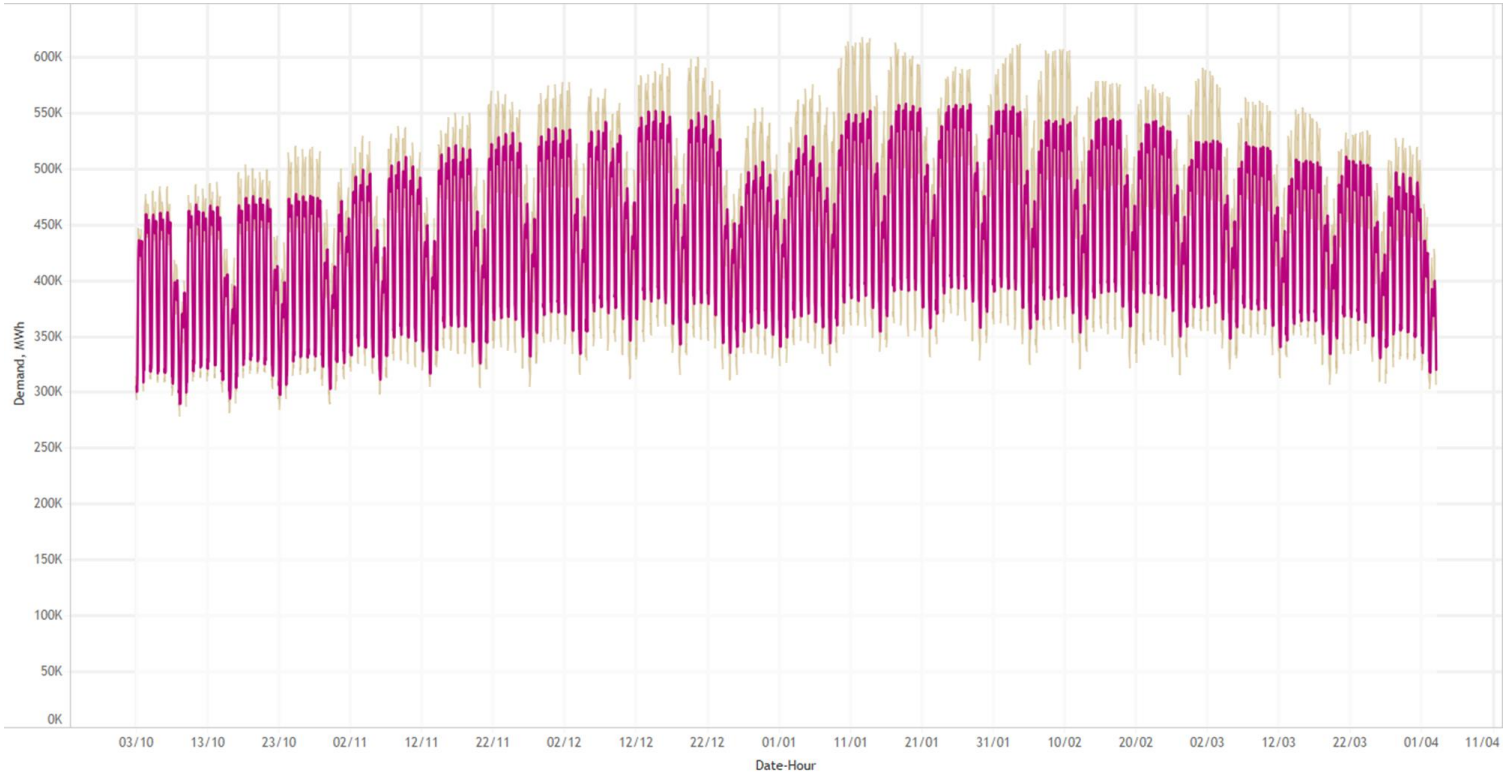


Changes of non-market resources since last winter have neutral or positive impact on adequacy in electricity markets.

- No Member State contracted generation capacity which was previously operating in electricity markets.
- Some non-market resources in **Germany** are returning to the market. They may be partially replaced by currently shut down units. German gas power plants previously contracted as non-market resources cannot return to electricity markets due to existing legislation.
- **Finland** did not contract non-market resources for winter 2022-2023. Part of previously contracted capacity is being prepared for commercial use due to favourable market conditions.

In the full Winter Outlook report (1 December) additional adequacy assessments are done including non-market resources, which are expected to alleviate some risks.

European demand levels

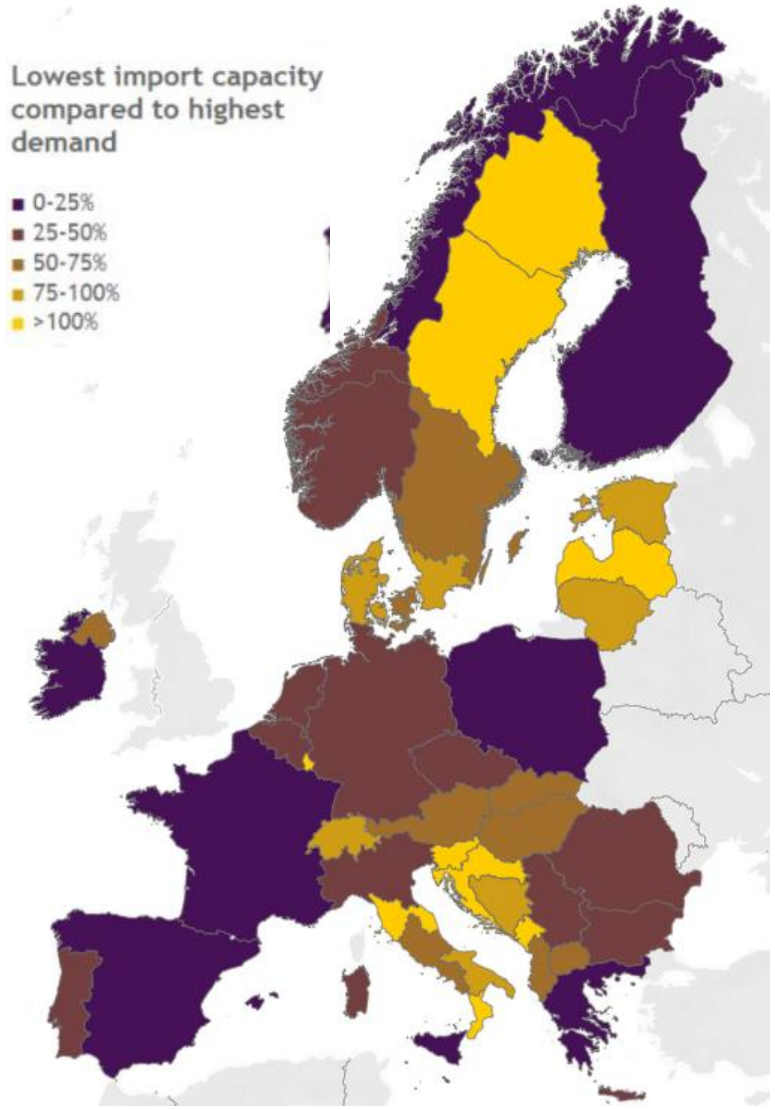


Range of lowest and highest electricity demand

Mean electricity demand

- Based on TSO estimates
- Reference scenario shows electricity demand with usual variability, comparable with last winter
- Highest European demand expected mid-January to mid-February
- Actual weather conditions will have large impact
- At European scale, electricity demand projections are comparable to Winter Outlook 2021/2022, with a post-COVID rebound in demand counterbalanced by a high price effect supressing demand.
- Impact of EU demand reduction targets covered in dedicated sensitivity.

Interconnection levels



- System adequacy relies on all market participants.
- Efficient market integration and pooling of resources at regional level are key for adequacy support this winter.
- TSOs will coordinate to maximize exchange capacities regionally through close coordination and cooperation within relevant RCCs.
- Cross-border cooperation and close coordination at all levels will be key to ensure that the European power system is adequate.

Note: Poland indicates its exports would be limited in the coming winter

- Tight adequacy in day-to-day operations. A lot of generation capacity restrictions are submitted to PSE (Polish TSO) by producers due to insufficient coal stocks, often below legally required levels.
- Generation capacity restrictions caused by fuels shortages are identified in a day-to-day operational process, resulting in binding allocation constrains in export direction for the hours when generation adequacy issues are identified.
- It is expected that the adequacy situation experienced today will not improve and may even get worse. In the Winter Outlook, these fuel restrictions (and consequently export restrictions) are applied during the Autumn and Winter seasons, for the reference case and all sensitivity scenarios.
- In the Winter Outlook assessment net exports from Poland to neighbouring countries are restricted. Transits are still possible within the provided Net Transfer Capacities.

National assessments and context

Germany

- National study
- Compared to the probabilistic assessment of the ENTSO-E outlook, the German national study (stress test) determines the resource adequacy in a deterministic manner focusing on only one weather year (2012) and one power plant availability set. 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 +++). These scenarios cover not individual risks one by one but combine possible shortcomings in availability of nuclear, coal and gas power plants together with higher demand due to electrification of residential heating.
- These scenarios are the reference for the German data in this winter outlook. The stress test scenarios can be understood as being a 'stacked risks' scenario, combining the sensitivities of this report (low nuclear, fossil constraints, high demand).
- The results of the German stress test are:
  - Scenario +: 0h/a
  - Scenario ++: 1-2 h/a v
  - Scenario +++: 3-12 h/a
- In addition, operations of nuclear power plants, which were due to be decommissioned by of end of 2022, are now foreseen to be extended until 15 April 2022. This will be considered in the updated Winter Outlook report.

Poland

- Limitations in coal and lignite energy generation during winter were assumed for the 'fossil fuel constraint' sensitivity scenario based on an assessment of coal/lignite availability. The assessment shows high level of imports into Poland. Some LOLE / EENS can be seen in this scenario in some climate years, which means that the level of demand and RES infeed, i.e. weather conditions, are the main drivers of LOLE / EENS occurrence.
- PSE points out that in recent times, due to relatively low electricity prices in Poland compared to those in Europe, the level of commercial imports to Poland is low. The market situation is not expected to change during the coming winter. Further assessment is needed whether the imports simulated in the sensitivity and which allow PSE to balance the system are feasible. If not, a consequence may be that if fuel shortage risks materialize, expected imports might actually not take place and therefore LOLE / EENS may increase.

Ireland and Northern Ireland

- National assessment
- The national Winter Outlook report predicts a higher adequacy risk this winter in Ireland with a LOLE figure of 51 hours. The expected energy not served (EENS) which gives a better insight on the potential impact to electrical energy consumers is more closely aligned, with the national winter outlook figure being 12 GWh compared to the 6 GWh based on the studies for this early insight report. Some of the differences can be attributed to differences in inputs as a result of the different data freeze dates. Updated data has been supplied and we expect the final ENTSO-E Winter Outlook to be more closely aligned.

Finland

- National communication

France

- National study

Sweden

- National study
- Press news – prolonged Ringhals 4 downtime
- The main conclusions in The Winter Outlook align with early findings in Swedish national studies

Norway

- National assessment

Glossary

AGC(e) refers to average gas consumption for the electricity system over recent winters. (Source: Eurostat)

Corrective measures/corrective actions (Non-market measures used by TSOs) refer to available operational mitigation measures which are triggered by TSOs as last resort after all market and non-market resources are exhausted, in order to avoid a controlled shedding of demand. The main mitigation measure is voltage reduction, as it reduces the consumption by several percent while keeping all consumers supplied.

Critical Gas Volumes (CGV) in each scenario refer to lowest volumes of gas absolutely needed for electricity generation using all market resources. The European CGV levels refer to EU27 only, to allow for comparison with the AGC€.

Expected Energy Not Served (EENS) is the expected amount of energy not being served to consumers during the period considered, due to system capacity shortages or unexpected severe power outages, compared to total demand. Relative EENS expresses the absolute EENS as a ratio over total demand.

Loss of Load Expectation (LOLE) is an estimate of how many hours supply would not meet demand and can be checked against national reliability standards to confirm whether the adequacy situation is acceptable.

Non-market resources can include generation, demand-side-response and storage resources, among others depending on the country and are resources dedicated to ensuring grid security and stability, as well as transmission reliability margins used for coping with variability of power flow. They are kept outside the market but can be called upon in the event of a supply shortage to ensure security of supply.

Supply margins (or simply margins) are an indicator of how far away system is from adequacy issues. It tells how much extra generation could be dispatched or how much extra energy could be imported or the equivalent of how much demand could increase until adequacy issues would be observed.

Working gas volume (WGV) refer to the amount of natural gas that can be injected, stored and withdrawn during the normal commercial operation of a natural gas storage facility

Study Zone naming convention