

21 November 2022

**POSSIBILITIES FOR PHASING OUT RUSSIAN GAS
FROM THE EU ENERGY SUPPLY FOR THE WINTERS OF 22/23 & 23/24**

1. Assess the impact of a full Russian gas supply cut scenario using the EGMM¹

- Gas bill to Europe
- Utilization of LNG infrastructure
- Regional price convergence

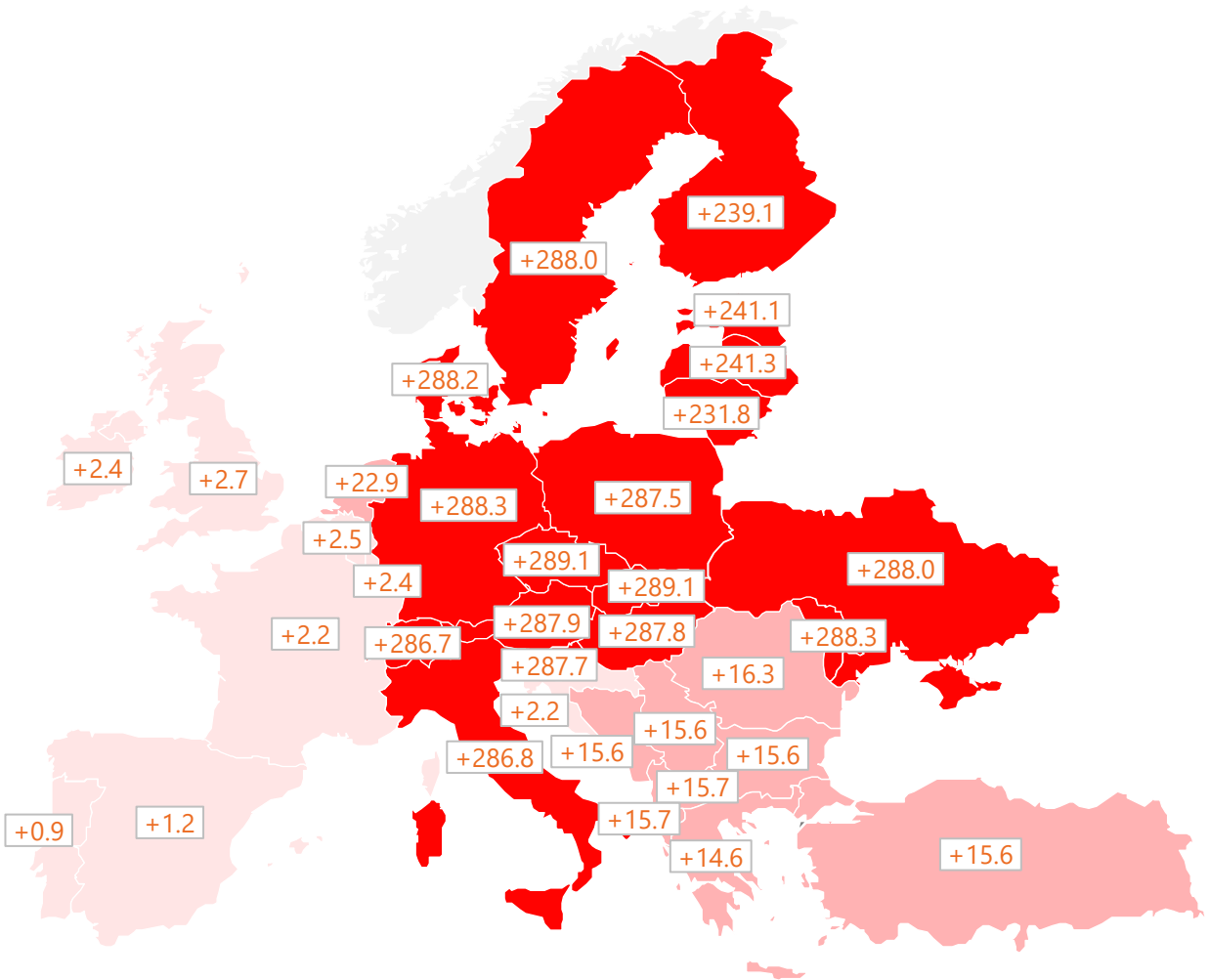
2. Update the analysis with the recent market developments

- To follow up on the recent developments of the gas market
 - Updated infrastructure (Baltic Pipe, PL-SK , IGB, new LNG terminals in NL and DE, FI, GR (Q1 2023)
 - Updated demand forecast for the power sector (-35%), for the industry (-15%) and the same building demand reduction potential as we assumed last time (average winter~15%)
 - Assuming that the storages are filled by October 80% in 2022 and 90% in 2023
- To extend analysis to 2023/24

3. Identify strategies and measures to counter the gas supply crisis

Phase 1: full Russian cut without further measures

Price change compared to 2021 (EUR/MWh)



Key findings



-902
TWh/yr

EU27 demand adjustment
compared to 2021



1 226
TWh/yr

LNG supply to EU27
(incl. NO, DZ)



+290
€/MWh

Price change in CEE
compared to 2021



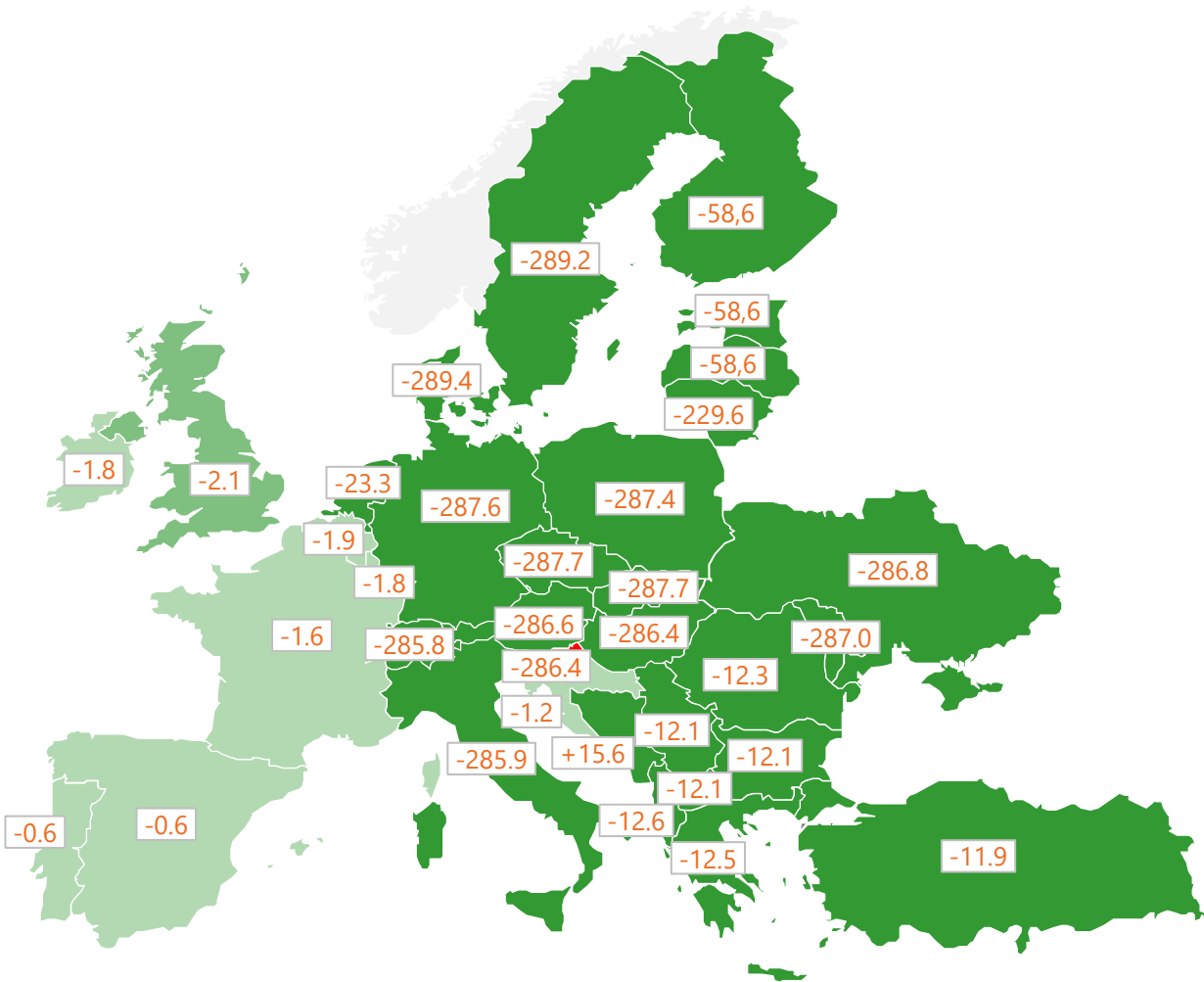
+149
%

EU 27 gas bill
compared to 2021

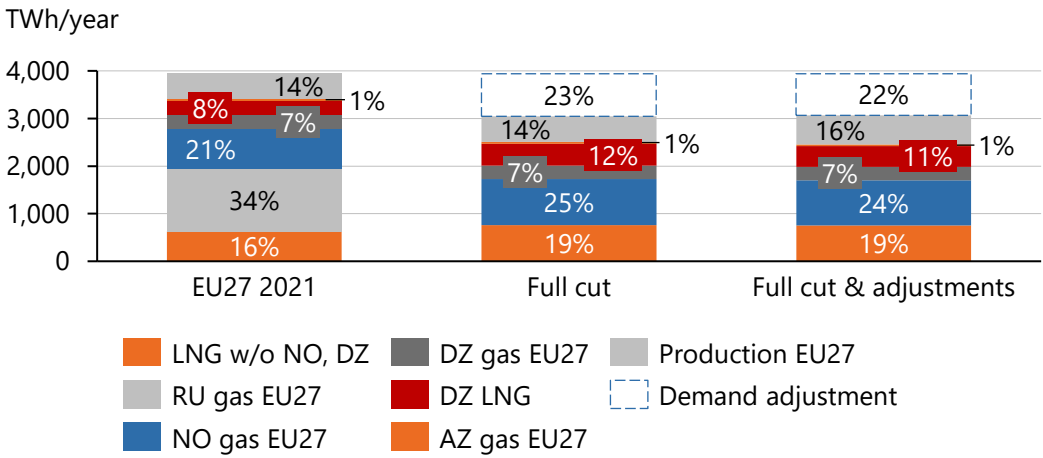
- CEE is hit most: Price zones emerge based on ability to access to LNG and global markets
- Internal congestion: LNG inflow can not increase further with existing infrastructure

Phase 1: full Russian cut with demand reduction

Price change compared to full cut (EUR/MWh)



Key findings





+1

-288

€/MWh

Price change to 2021
Price change due to measure



+21

-68

%

EU27 gas bill to 2021
EU27 gas bill due to measure

- Combined effects of demand reduction and supply measures in Full cut scenario would bring a new equilibrium to Europe with 22% less gas consumption and 20% higher gas bill compared to 2021

Scenarios

2022

Modelling 2022/23 with measures and 80% storage obligation, no RU supply from 1 October 2022

- a) 10% year-end storage level
- b) 20% year-end storage level
- c) 30% year-end storage level
- d) 40% year-end storage level
- e) 50% year-end storage level

2023

Modelling 2023/24 with measures and 90% storage level obligation, full RU supply cull whole year

- a) Starting with 10% storage level in March
- b) Starting with 20% storage level in March
- c) Starting with 30% storage level in March
- d) Starting with 40% storage level in March
- e) Starting with 50% storage level in March

2024

Main assumptions



Demand side

- European demand would change compared to 2016-2020 (~400 bcm/yr) average by -15% in the industry & building sector and -35% in the power and heat generation sector (assuming average winter, low nuclear and hydro availability)



Supply side

- Additional LNG terminals (+ 1500 GWh/day by the end of 2023)
- Additional pipelines: IGB, Baltic Pipe, SK-PL, GIPL, reverse flow on Trans-Balkan, reverse flow on UK pipelines to the continent and FR-DE
- +80 TWh production in DE, DK, NL



Global market

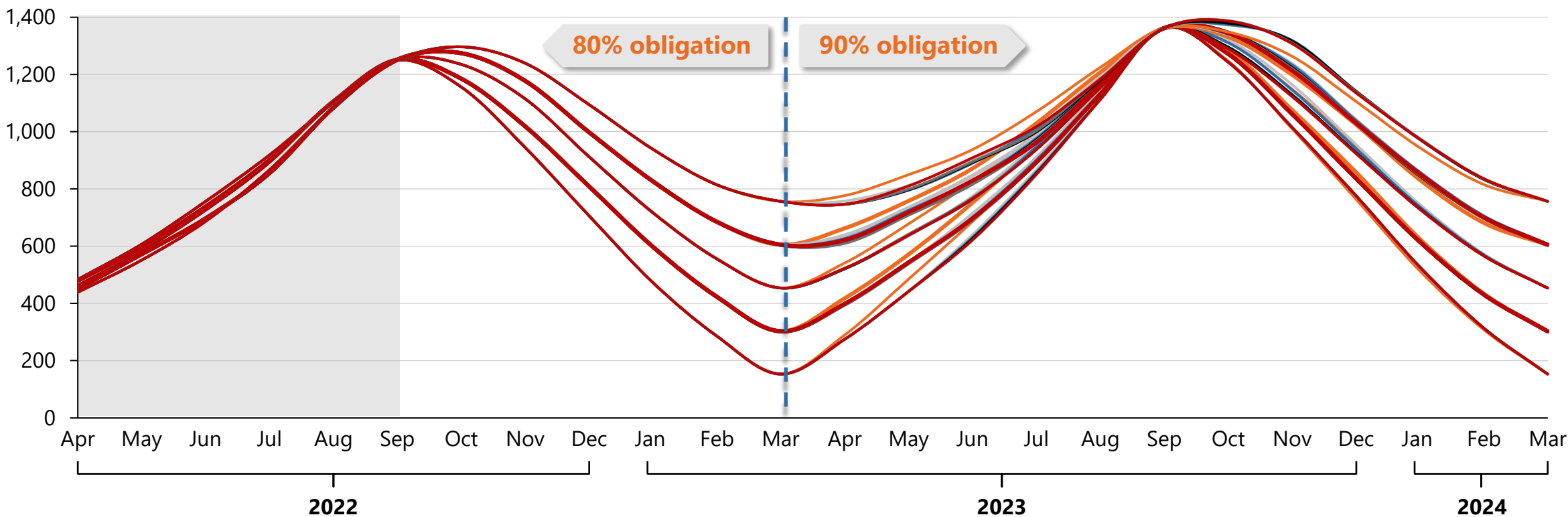
- JP price reflecting global availability and price of LNG: 25/50/75/100/125/150 EUR/MWh



Regulatory

- EU storage obligations are taken into account: 80% in 2022 and 90% in 2023
- No export ban applies and UIOLI provisions are effective

End-of-month storage levels in the EU27 (TWh/month)



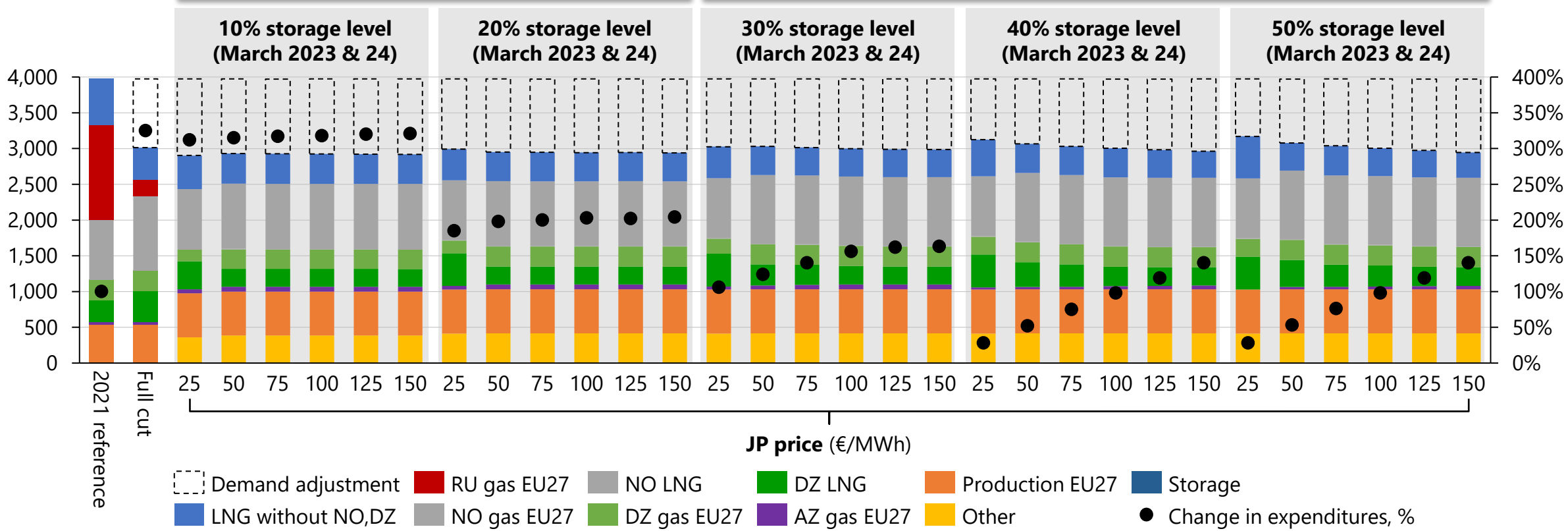
- Optimal storage level selected based on combined gas bill for the two gas years 2022/23 and 2023/24
- Storage fill up level combinations
 - Starting level 2022: 27% (fact) and full cut of RU gas from October
 - Starting levels March 2023: 10-20-30-40-50%
 - End of year Storage level March 2024: 10-20-30-40-50%

Gas bill dependency on LNG price

EU27 Supply mix and 2nd year's gas bill (TWh/year and % of 2021)

⚠️ Europe sets high prices globally

With sufficient storage levels Asian prices set European spot



• For the 2023/24 winter, at least 30% storage starting level is needed and the gas bill still might increase 0-50%, depending on Asian prices



LNG prices

- For the 2023/24 winter, at least 30% storage starting level is needed and the gas bill still might increase 0-50%, depending on Asian prices



Storage levels

- Low storage levels induce high injection demand due to regulation and peak price in summer (as seen in 2022)
- **Sufficiently high (>30%) starting storage** inventory by end of March 2023 (combined with EU measures) **effectively mitigates the adverse effect of missing RU supplies**
- With **inadequate (<30%) storage inventory**, Europe is willing to pay any price for refilling its storages and **does not efficiently reduce the gas bill** even with combined supply and demand EU measures

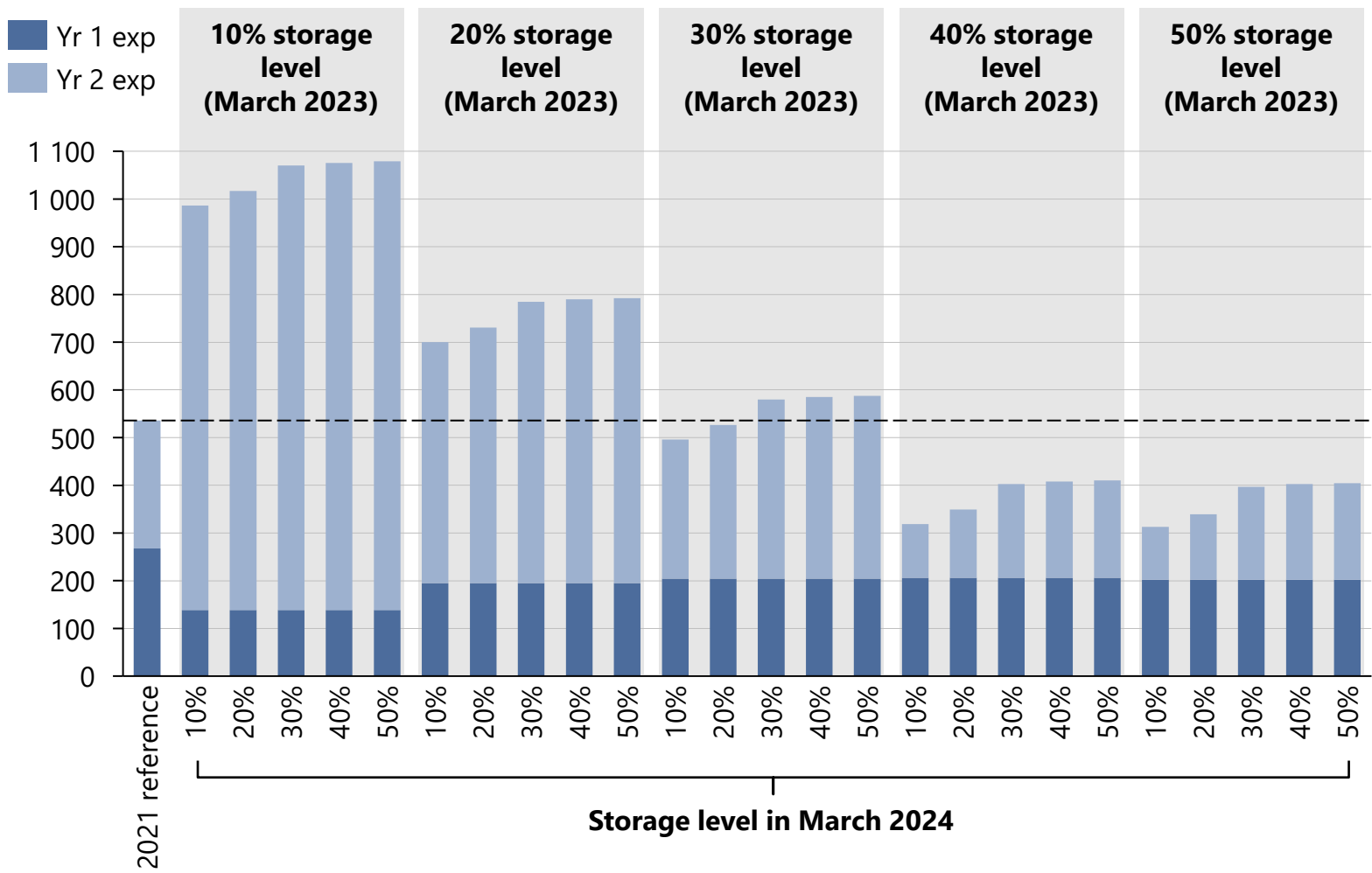


Gas bill

- EU gas bill for Yr1 below 2021 level with storage full and 20% demand saving
- EU gas bill for Yr2 is determined by starting storage inventory and global LNG price

Impact of storage levels on gas bill

Two-year EU gas bill¹ (bn EUR/year)



Key findings

- **Using storage stocks next winter may ease the gas bill on the short run**, but create high cost of rebuilding the storage inventory without RU gas
- EU27 started injection season in 2022 with 27% fill-up rate. Similar utilisation may help reach a before-the-war gas bill
- It might be tempting to use last year's stocks to reduce gas bills in the first year, but this comes at a high cost at the second year (see 10% / 20% scenarios)
- High stocks provide high security and possibility in reducing the two-year gas bill (compared to 2021)

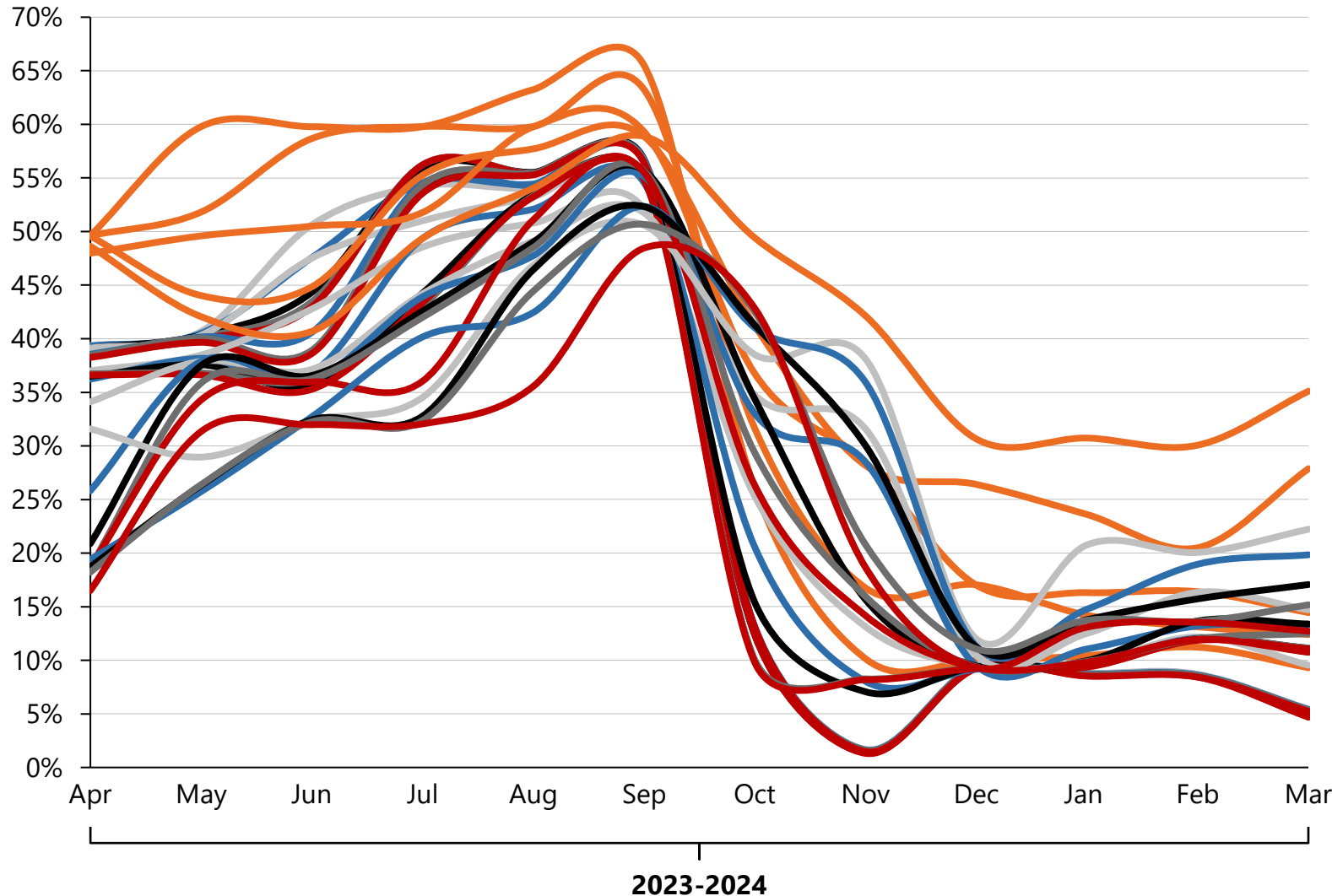


Don't use up all of the storages in the first year!

¹: Assuming 75 EUR/MWh JP price for 2023, AvW, LH, LN, +Sup

Utilisation of LNG terminals

Monthly average utilisation of LNG regasification capacities (EU27, %)

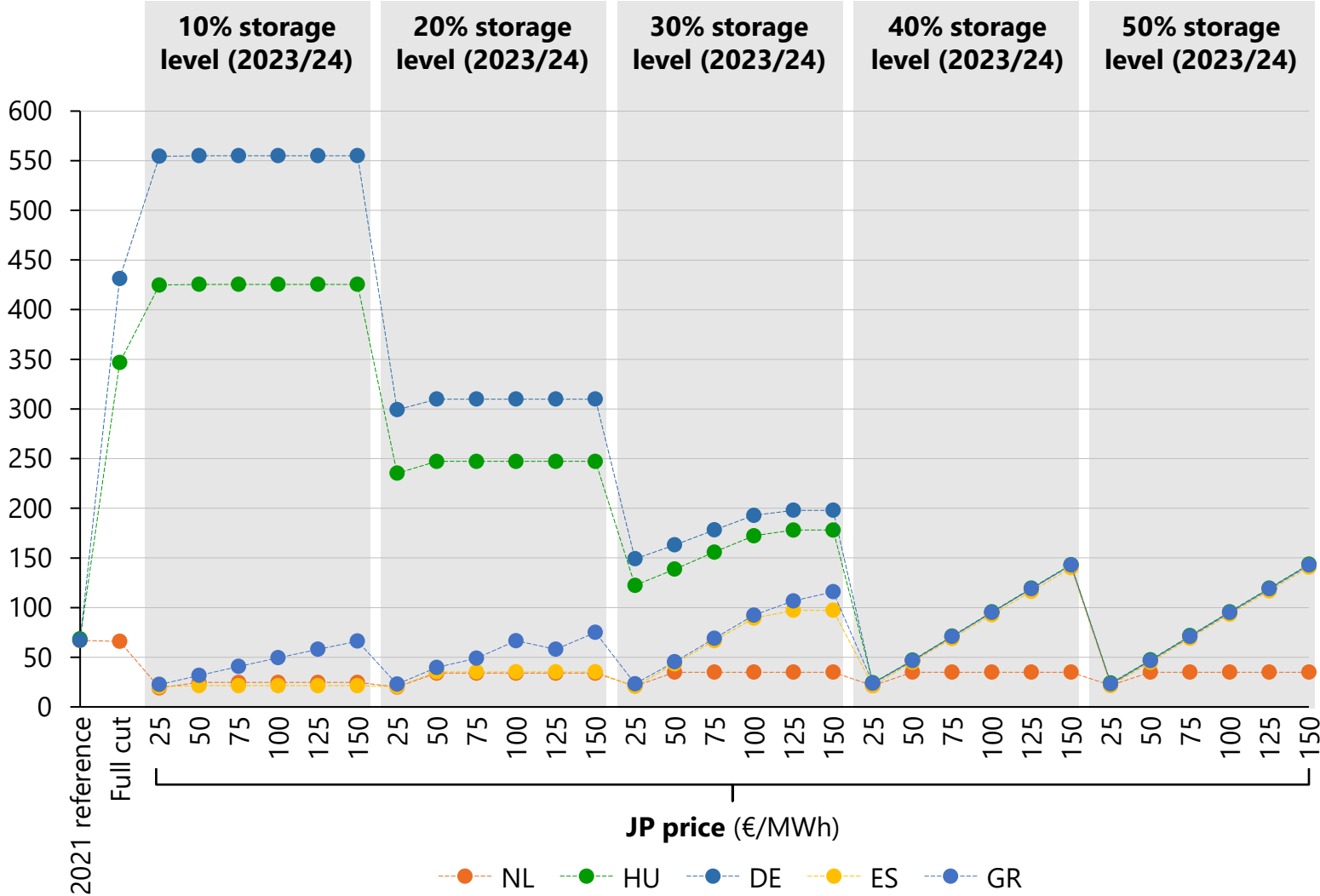


Key findings

- A 90% storage obligation is driving LNG utilisation
- European seasonality on LNG demand as modelled seems to complement Asian demand patterns
- On a global scale, this distribution of LNG might tempt price competition between the two major regions (Asia can use more in the winter, Europe in the summer – making good use of the storage infrastructure)

Price convergence on selected markets

Modelled yearly gas prices on selected EU markets (2023/24)
(EUR/MWh)



Key findings

- Price convergence between the three regions (WE, CEE, SEE) improves with higher storage levels at the beginning of 2023/24



Sensitivity 1: Demand sensitivity

- Scenarios assume lower level of responsiveness than assumed in Save gas for Safe Winter, with no considerable demand adjustment

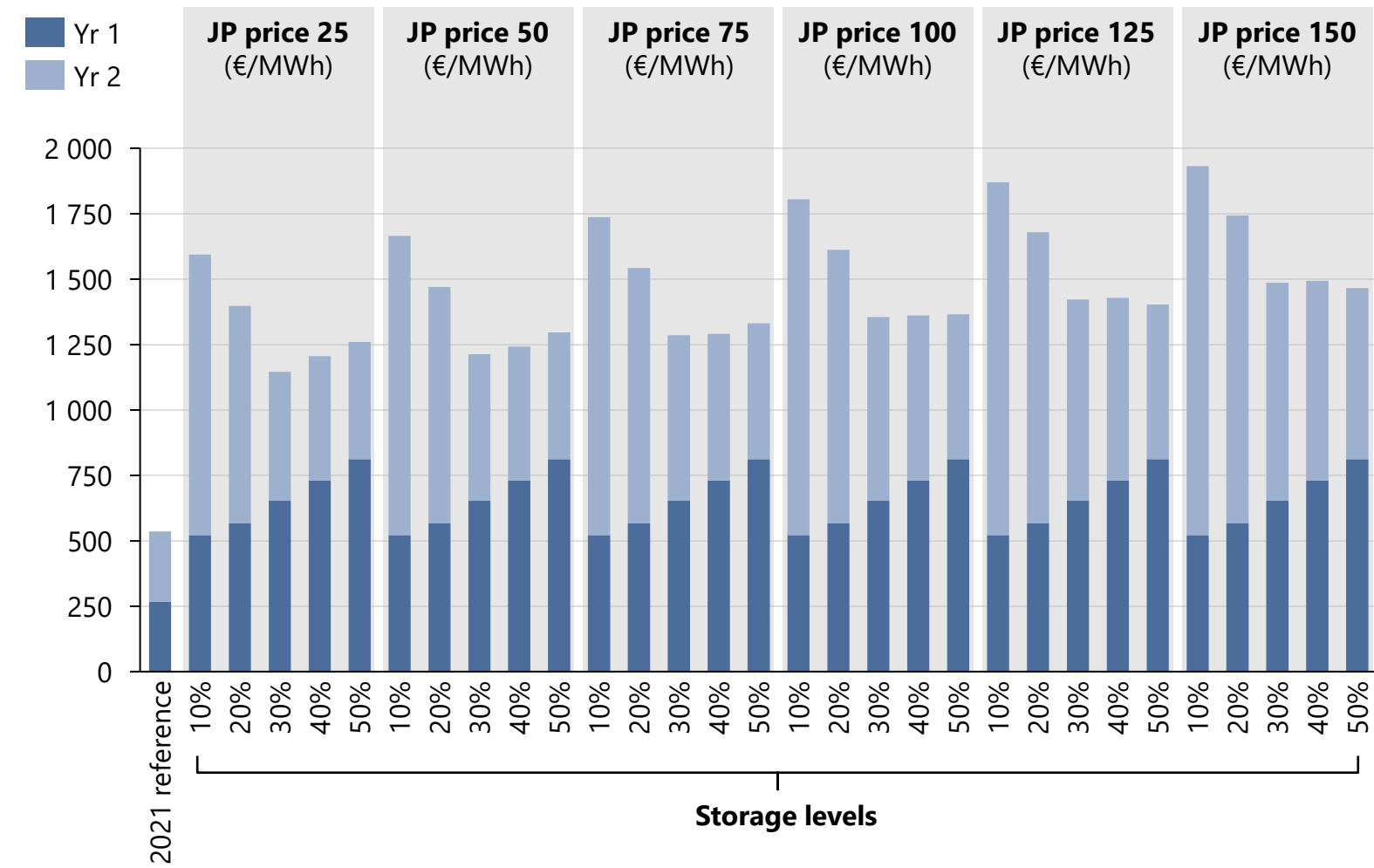


Sensitivity 2: Export restriction

- No gas exports to EU at UK-BE, UK-NL directions
- Trans-Balkan corridor: TR-BG, BG-RO, RO-UA not used in reverse mode
- The Balkan Stream: BG-RS, RS-HU is reserved for the long term (RU) supply contracts and can not be used for short term trade

Sensitivity 1: Demand sensitivity

EU27 Two-years¹ gas bill (bn EUR/year)



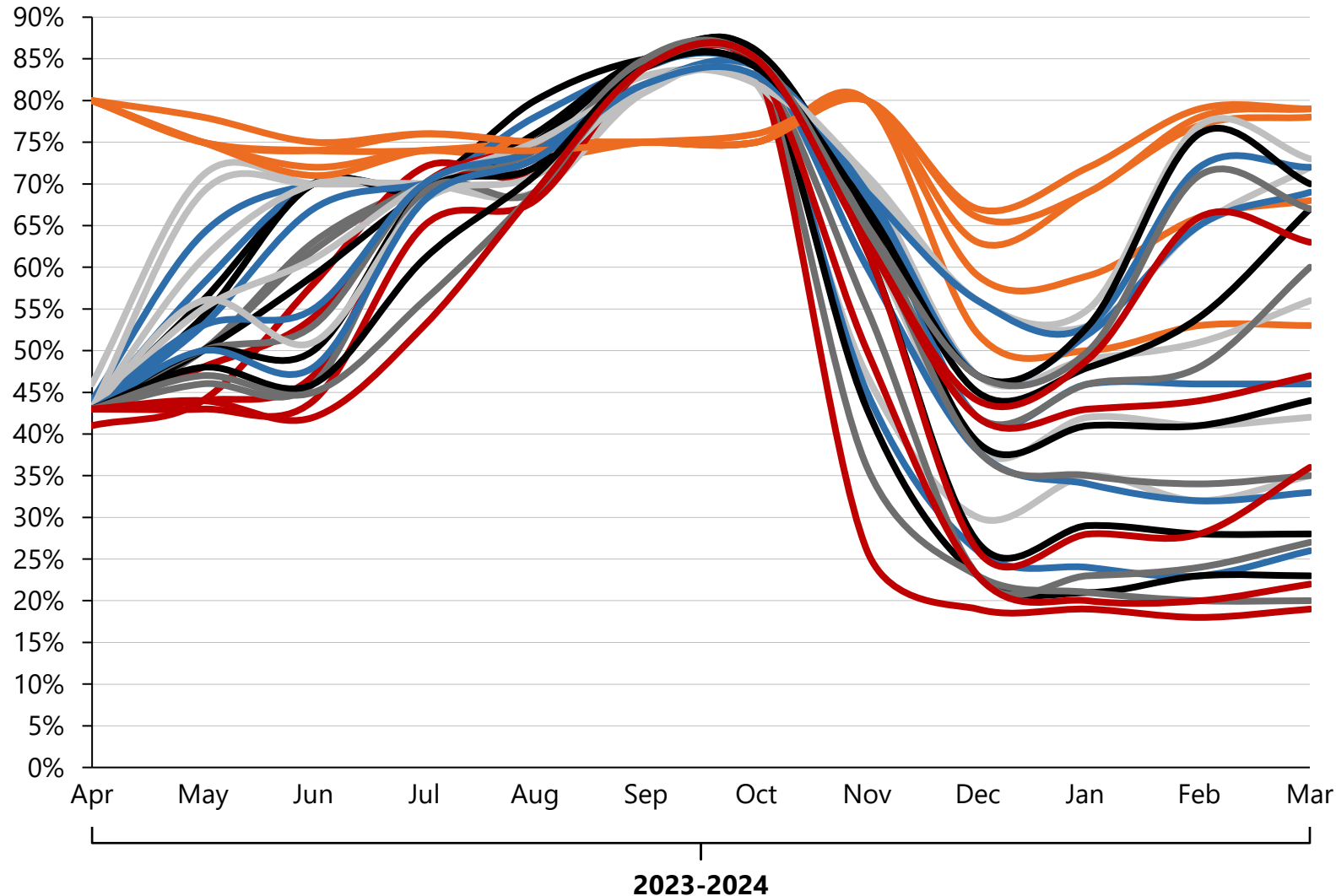
Key findings

- With lower demand savings the EU gas bill can not return to pre-war levels in 2022/23
- Yr2 gas bill is in the range of 150-300% increase compared to 2021 even with high storage stock levels
- The combined gas bill for the two year remains in the range of 1100-1900 Bn Euros:
 - The LNG price level does not change the gas bill proportionally: difference a 25 €/MWh and 150 €/MWh JP is ~14-23%
 - The level of the storage stock at the end of the first year is much more decisive.

1: The first year JP price is 75 €/MWh

Sensitivity 1: Demand sensitivity

Monthly average utilisation of LNG regasification capacities in the 2nd year
(EU27, %)



Key findings

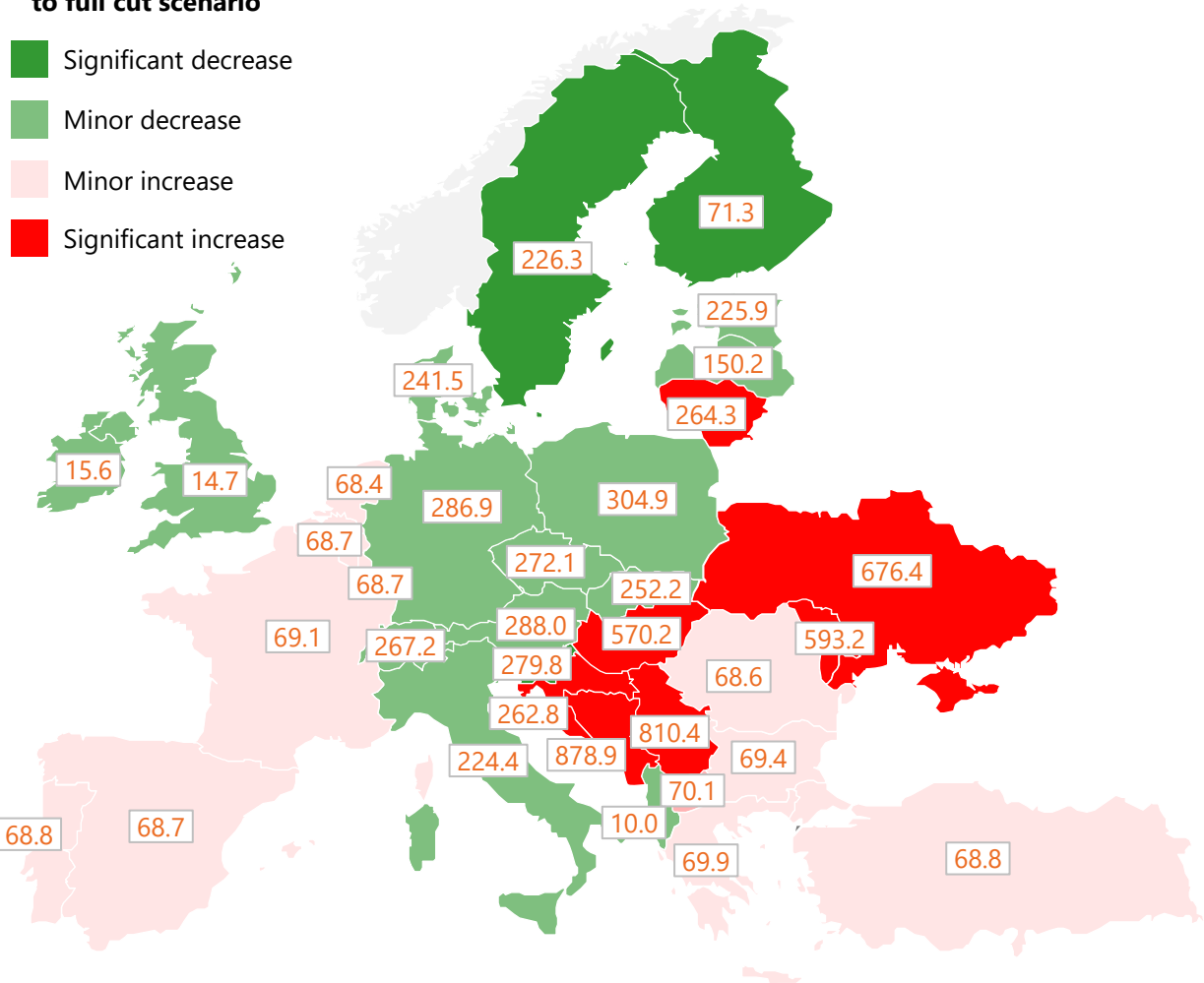
- LNG terminal utilisation peaks in summer
- LNG terminal utilization of the second year is depicted on a monthly basis:
 - In the 50% storage cases (orange lines) the utilization of terminals is higher and more evenly spread within the year than in the others
 - In the >50% cases the peak is in September-October, then sharply drops
 - Due to the storage obligation the first half of the gas year results in congestion on many terminals (NL, IT, PL, GR, LT, DE)

Sensitivity 2: UK & Trans-Balkan supply restriction

Average price¹ (EUR/MWh)

Price change compared
to full cut scenario

- Significant decrease
- Minor decrease
- Minor increase
- Significant increase



Key findings

- Without UK and Trans-Balkan, 90% storage target cannot be met if storages are used up in the first year to 10%
- Only slight increase in Yr1 EU27 gas bill from 2021
- At most doubling of two-year EU27 gas bill, depending on global LNG availability and storage use
- Extreme price in small group of CEE countries, Ukraine, Moldova, Hungary, Serbia and Bosnia will be a separate crisis zone if export is banned from the South – high storage stocks can help

1: No UK and Trans-Balkan, JP 75 EUR/MWh, storage 30%



Successful measures

- The supply and regulatory measures applied in 2022 resulted in good preparedness of the EU for the 2022/23 winter even in a case of a full Russian supply cut



Price surges

- The Russian strategy to reduce supplies together with storage obligation that increased the injection demand throughout 2022 resulted in extremely high prices on TTF but later prices fall back. This is well reflected in our modelling results



Recommendations

- We found that about a **30% storage stock at the beginning of the next gas year** (March 2023) **mitigates best the high EU bills**
 - **Demand reduction must be around 20%** to achieve this goal
 - **Asian LNG price is less decisive** for the EU gas bill **than the storage stock** by March 2023
 - Would the **UK ban exports to Europe**, the **EU gas bill would increase slightly**, at the same time UK LNG terminals remain underutilised.
 - An export ban from the South (Trans-Balkan and Balkan Stream) would result in the **emergence of a new crisis zone stretching from Ukraine, Moldova, Hungary to Serbia and Bosnia**. This can be prevented by 40% or more storage stock at March 2023.

Contacting the authors

Borbála Tóth

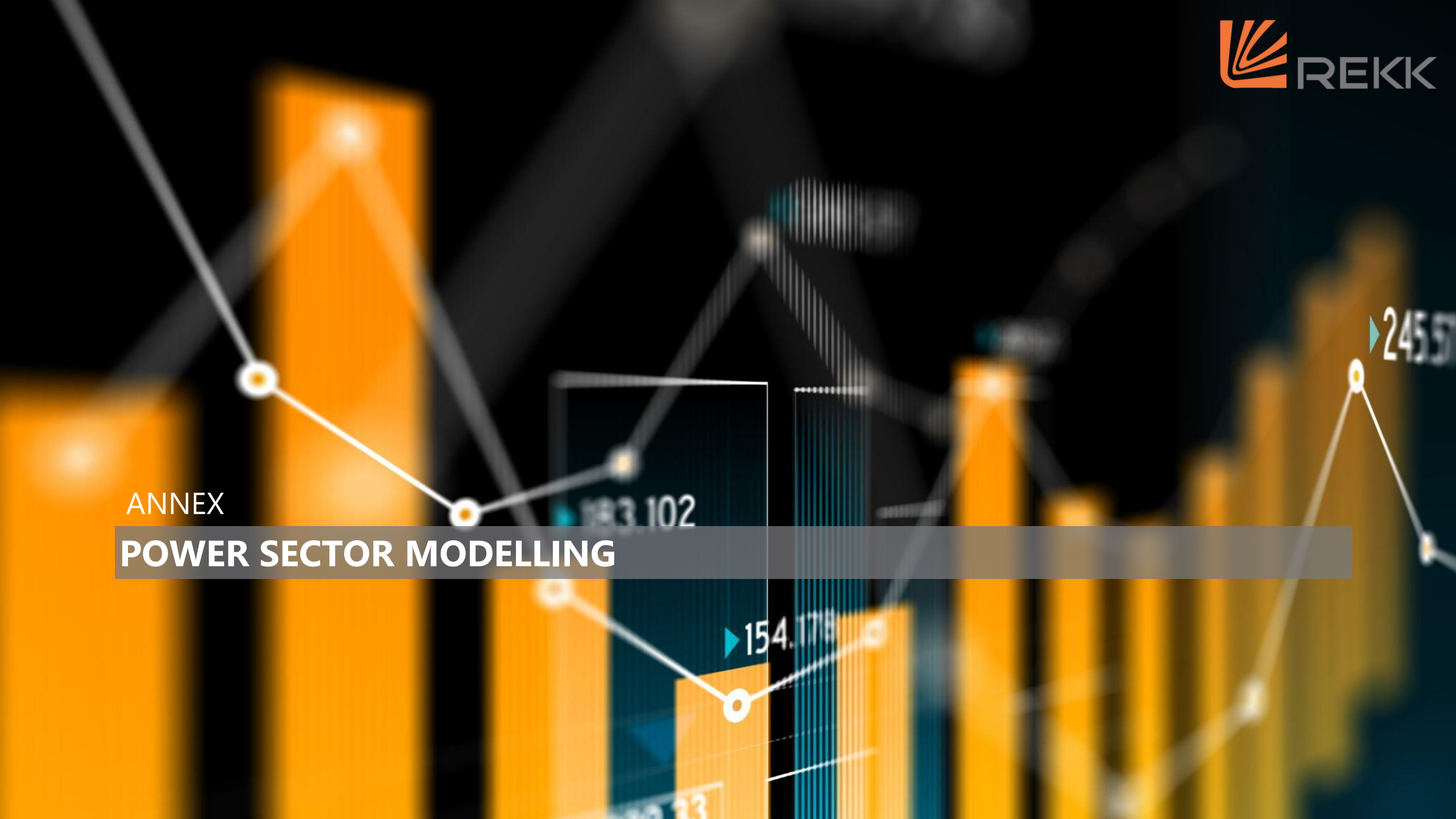
`borbala.toth@rekk.hu`

Péter Kotek

`peter.kotek@rekk.hu`

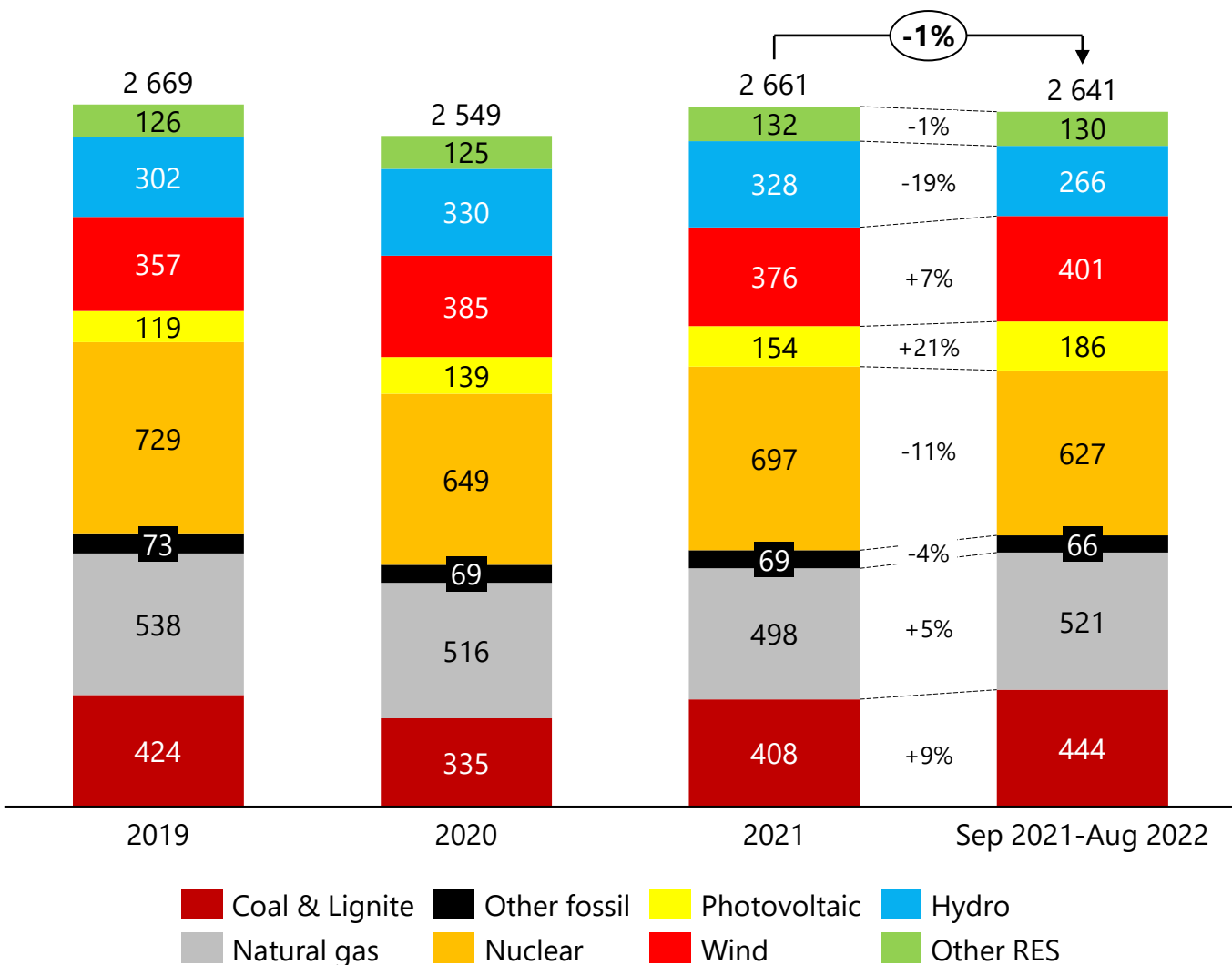
ANNEX

POWER SECTOR MODELLING



Baseline for the modelling of the power sector

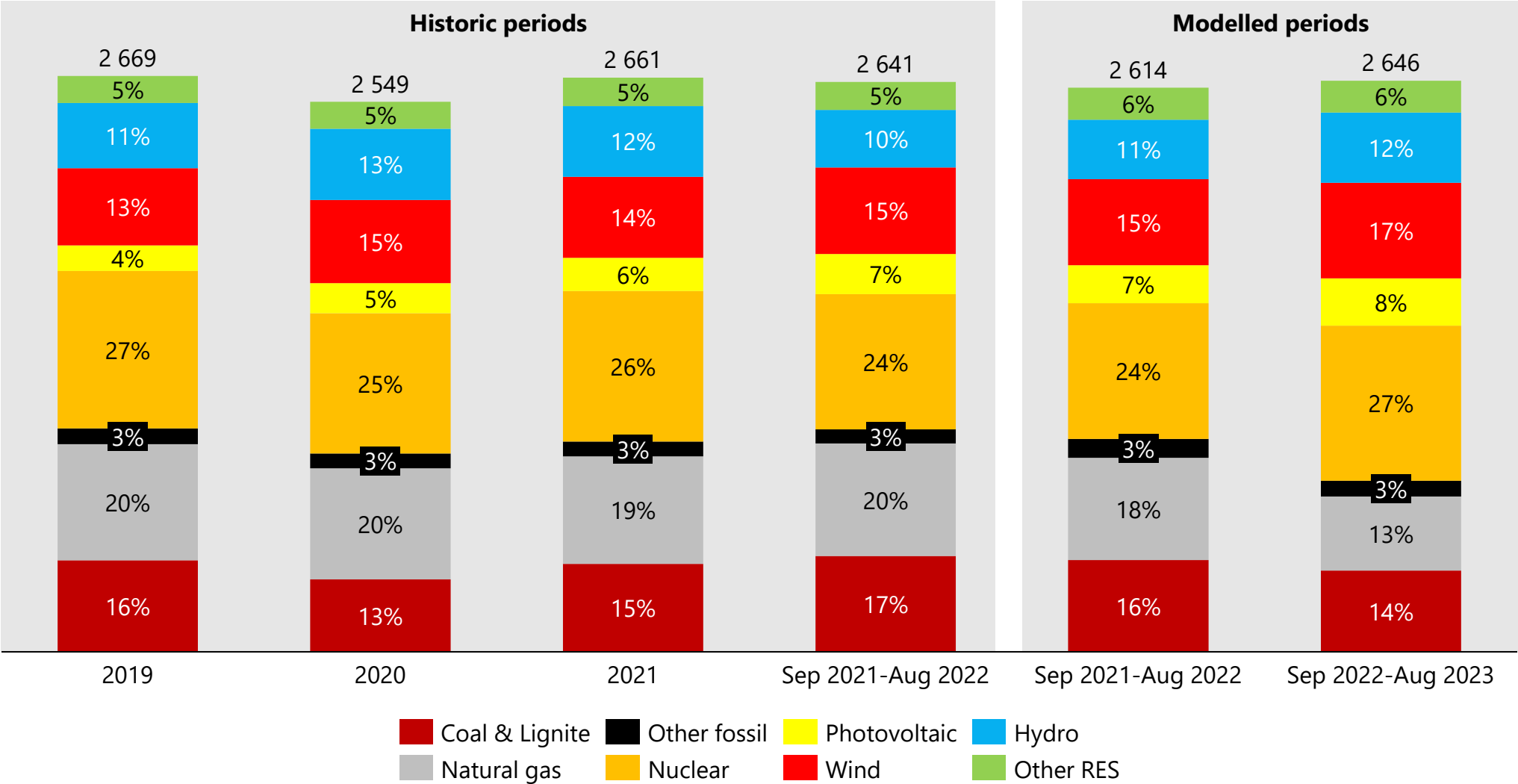
EU27 power production mix (TWh)



Assumptions for modelling

- a) Natural gas price (TTF price):**
 - Base scenario: 105 €/MWh in 2022 Sept-2023-Aug and 31 €/MWh in 2030
 - MinGas scenario: 300 €/MWh in both in short run modelling (2022-2023) and long-term modelling (2030)
- b) CO₂ price: 90 €/t in the whole modelled period**
- c) Consumption in 2030:**
 - REF: 3000 TWh in EU27
 - REPower: 3200 TWh in EU27
- d) RES capacities in 2030:**
 - REF: 460 GW Solar, 294 GW Wind
 - REPower: 590 GW Solar, 477 GW wind

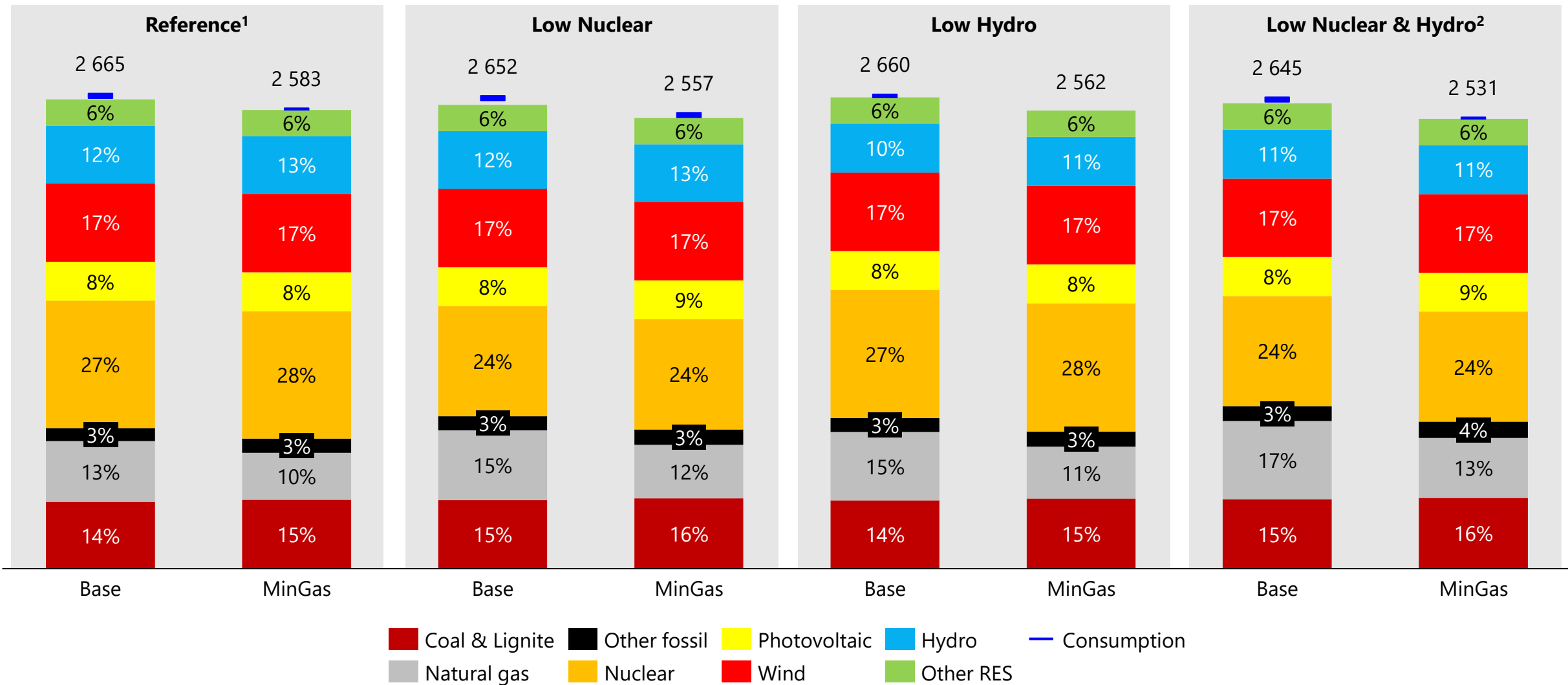
EU27 power production mix outlook (TWh, %)



Best and worst scenarios for the next 12 months

EU27 power production mix and consumption outlook

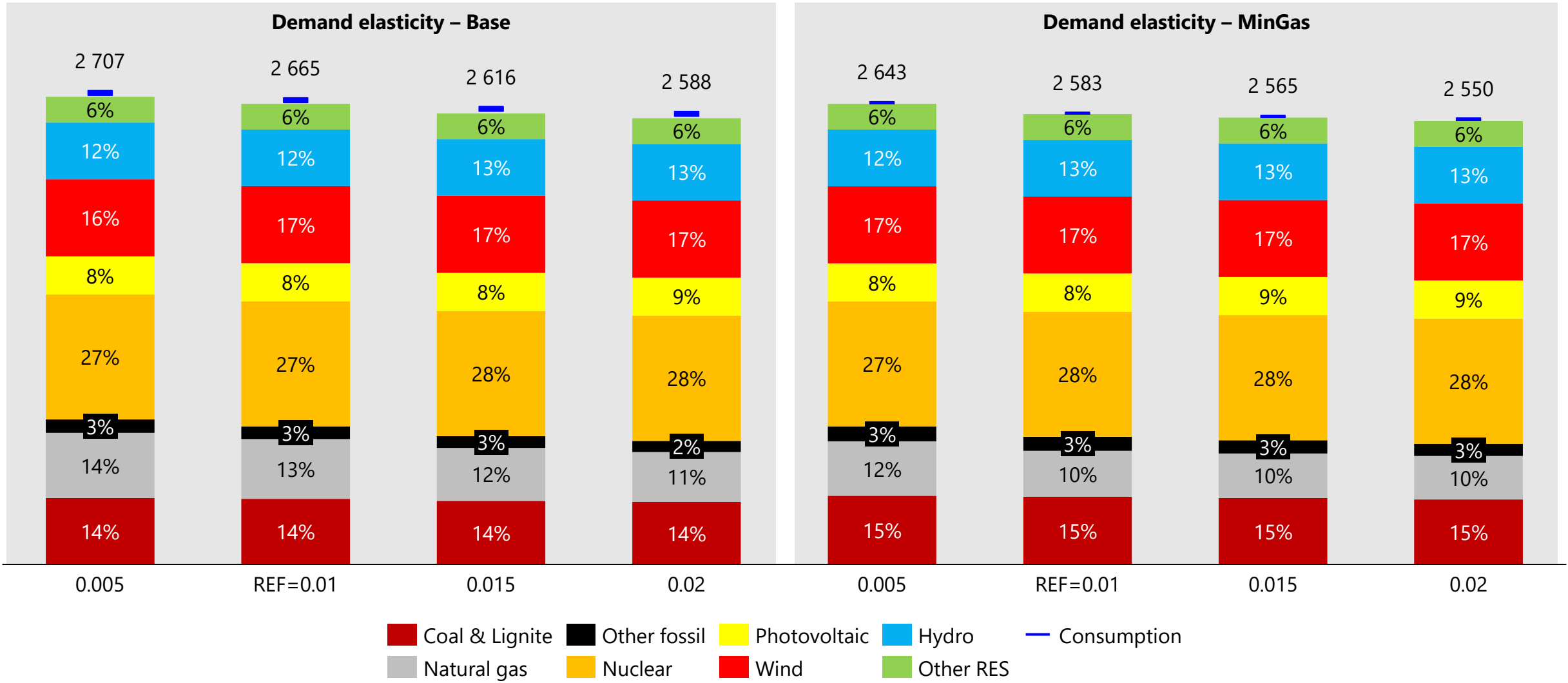
Sep 2022-Aug 2023 (TWh, %)



1: Nuclear and hydro utilised at 2021 level; 2: Pessimistic – low nuclear and hydro utilisation as in 2022

Effects of demand elasticity (REF nuclear, REF hydro)

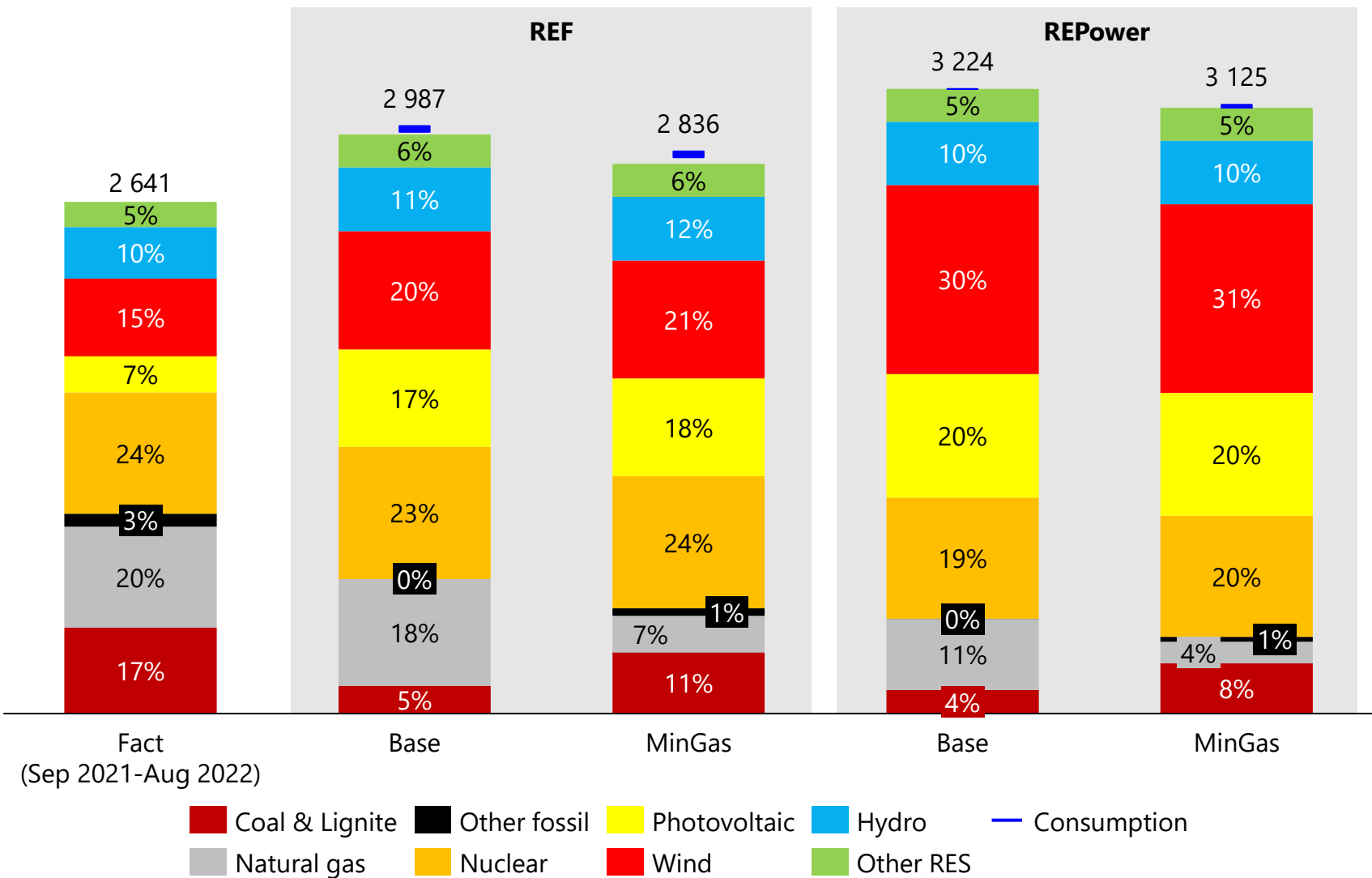
EU27 power production mix and consumption outlook – Demand elasticity
(TWh, %)



1: Nuclear and hydro utilised at 2021 level; 2: Pessimistic – low nuclear and hydro utilisation as in 2022

EU27 power production mix and consumption outlook

2030 (TWh, %)





Short-term measures

- In short-term the gas-based production can be decreased by 80-260 TWh, depending on the
 - a) French and German nuclear availability
 - b) hydro conditions
 - c) gas prices



Long-term measures

- In the long-run increasing RES generation can substitute the gas-based electricity production, and also the fossil-based generation could be significantly decreased:
 - Last year (Sep 2021-Aug 2022) the total fossil-based generation in the EU27 was 1030 TWh
 - This figure could be decreased below 500 TWh, or in very high gas price environment (if gas is only used as a last resort option) below 400 TWh

Contacting the authors

András Mezősi

andras.mezosi@rekk.hu

Enikő Kácsor

eniko.kacsor@rekk.hu