REKK

EUROPEAN SECURITY OF GAS SUPPLY - THE FUTURE OF RUSSIAN GAS IN THE SUPPLY MIX IN CEE

Final report

ECF Grant: G-2304-65j858

July 2024

Outline

- Case 1: modelling the ban on Russian transshipments
- Case 2: modelling the cessation of Ukrainian gas transit
- Case 3: modelling the effect of the German storage levy
- Modelling the reference case and model validation

CASE 1:
MODELLING THE BAN ON RUSSIAN LNG TRANSSHIPMENTS

14th sanctions package of the EU on Russia

- In June 2024, the 14th sanction package forbade the

  (i) reloading and transshipment of Russian LNG in European terminals and

  (ii) delivery of Russian LNG to terminals not connected to the interconnected natural gas system.

- Only one LNG terminal, Malta Delimara FSRU is affected by this ban, as there is no pipeline in place between Malta and Italy.

- Modelling the sanctions

  - limiting the capacity of Yamal LNG exports, due to making the route to Japanese markets longer and tying up the scarce icebreaker ARC7 carriers. In 2022 and 2023 these carriers were making rounds between Yamal LNG terminal and Zeebrugge or Montoir-de Bretagne terminal, reloading their cargo to another vessels. The icebreaker ships not being available, other vessels can not reach the Yamal terminal and thus limit its utilisation.

  - Making the cost of shipping Russian LNG to Japanese markets more costly due to the higher distance.

- Transhipments of Russian LNG in European terminals accounted for ~5.1 bcm in 2023, taking place in Zeebrugge and Montoir de Bretagne. Delivering these cargoes from Yamal to the European terminals takes 7 days one way, 14 days roundtrip. LNG is reloaded in the terminals to other vessels which have no icebreaking capabilities, and these transit to Japanese ports via Suez canal or passing by the Cape of Good Hope around Africa.

- The sanctions forbid transshipment, forcing the ARC7 icebreaker LNG carriers to perform the entire voyage, as no other ports are capable for such transshipment service. Other options include reloading on the open sea or at Murmansk port, but these are dangerous and limited possibilities.

- Assuming 15 knots average speed and a roundtrip of vessels from liquefaction to regasification and back, it would take 40 days by the Cape of Good hope one way and 31 days via Suez as opposed to the 14 days roundtrip to Zeebrugge.

- This would mean that the liquefaction capacity can not be operated at full utilisation, due to the unavailability of appropriate icebreaker vessels. The 5.1 bcm reloaded in 2023 would shrink to 0.76 bcm/year directly delivered to Japan, if the ships were to make the longer route passing the Cape of Good hope and 0.94 bcm/year via Suez. Considering the total Russian LNG liquefaction capacity, this would result in a 10% capacity shrinkage and a 18% for the Yamal terminals.

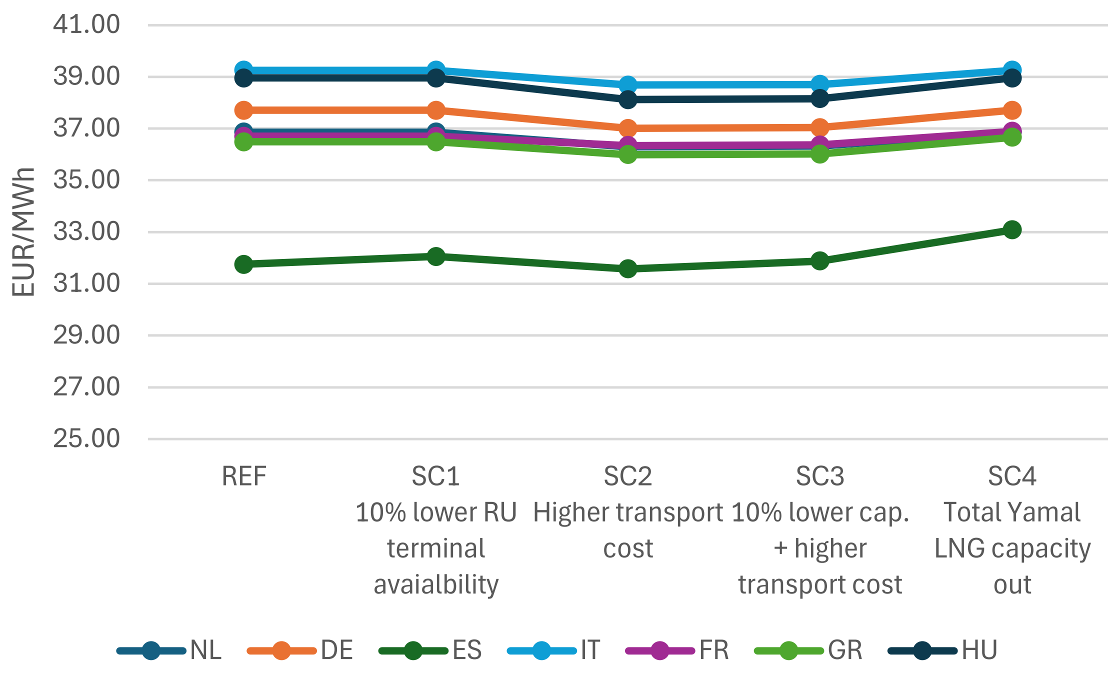
- As of 2024, Yamal LNG was operating with four liquefaction trains, a total capacity of 17.4 million tons per year (~23.7 bcm/year). Portovaya LNG (1.5 mtpa) and Vysotsk LNG (1.5 mtpa), two smaller liquefaction plants in the Baltic Sea were also delivering cargoes to European terminals. Sakhalin LNG trains (11.5 mtpa) located in the far eastern part of Russia delivers cargoes to Asian markets directly. In 2023, total Russian LNG export was 31.5 mtpa, of which 54% targeted Asian markets while 46% was reaching European markets, net of transshipments.

Modelling the transshipment ban

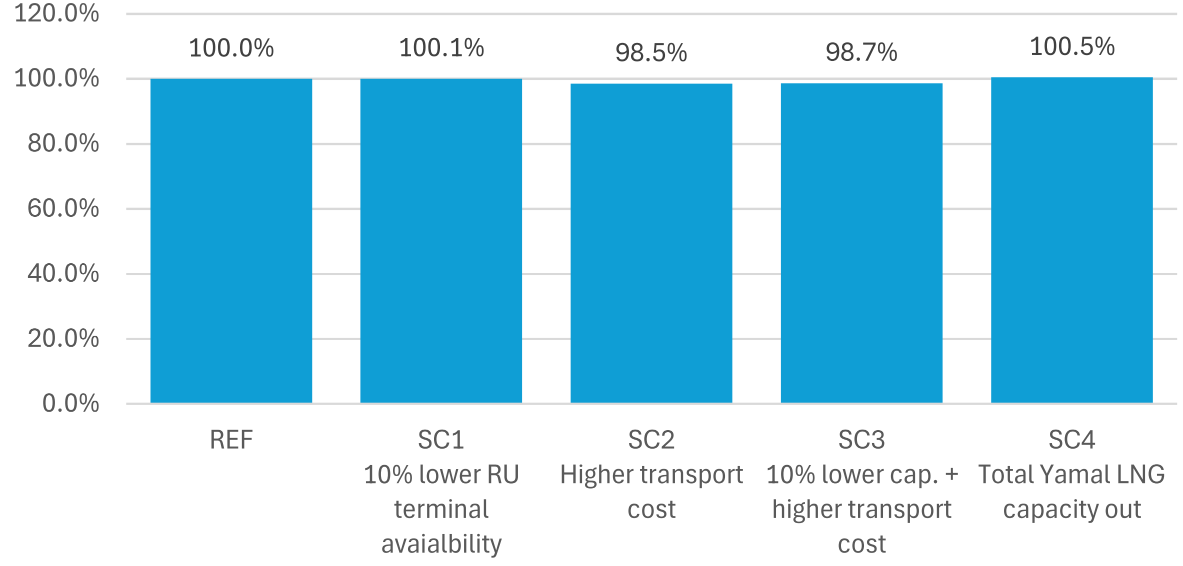
- **Reference case:** no constraint on Yamal capacity, transhipment at Rotterdam allowed
- **Scenario 1:** Yamal LNG terminal capacity related to trans-shipments is limited by 18% (~10% of RU LNG export capacity.
- **Scenario 2:** cost of shipping LNG to Japan from Russia is increased
- **Scenario 3:** the effects of scenario 1 and 2 are combined.
- **Scenario 4:** Yamal LNG goes offline due to the sanctions at all. Only Sakhalin II LNG is shipping to Japan

Effects on European markets

MODELLED EU27 PRICES, EUR/MWh

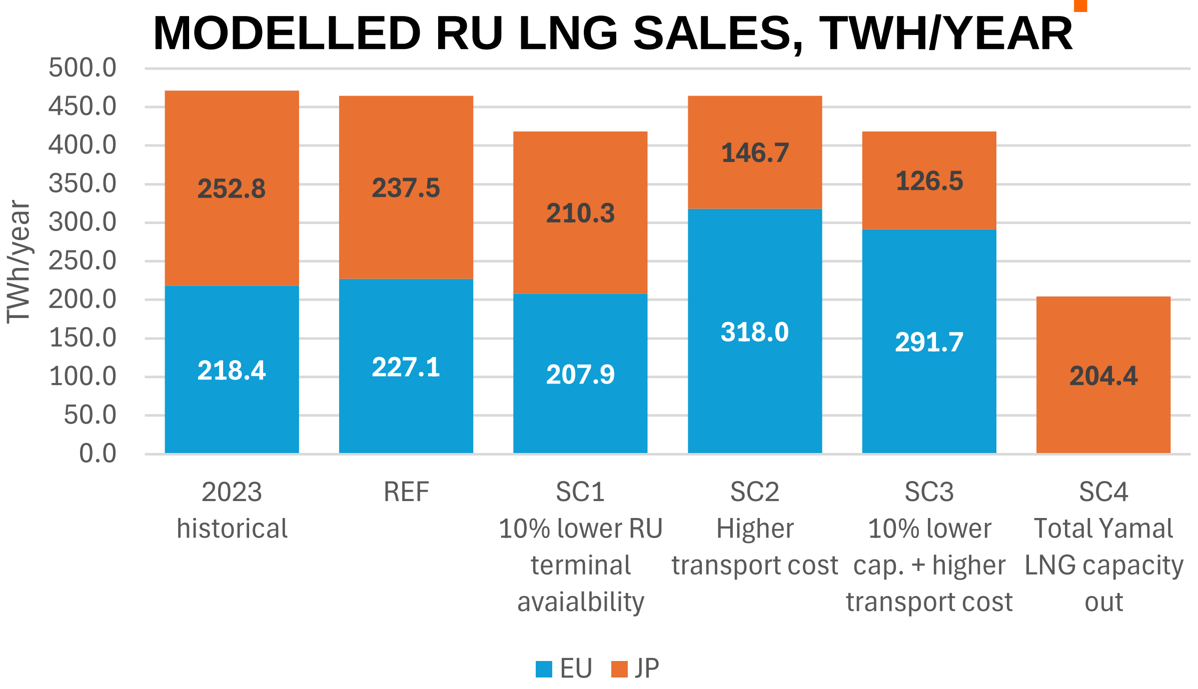


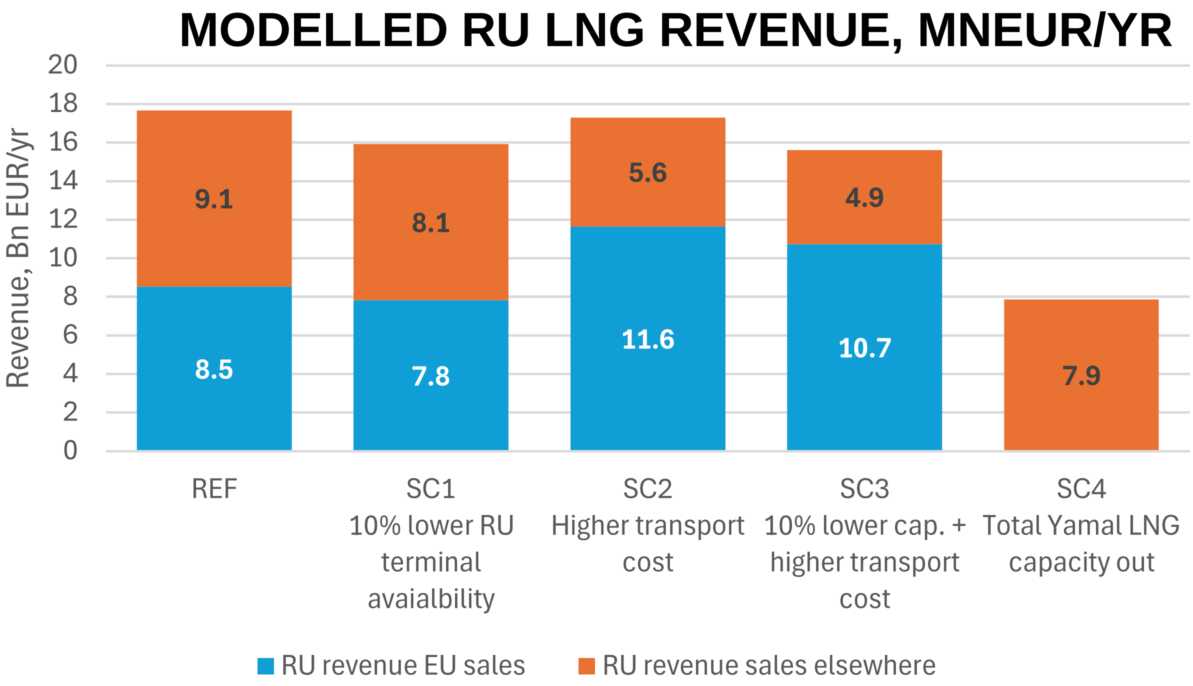
MODELLED EU27 GAS BILL CHANGE, %



- Price effects of the sanctions are **below 1%** compared to the without sanctions case.
- Consequently, the **cost of sanctions on European consumers is negligible**, as the total gas bill of the EU in the sanctions scenarios differs **less than 2%** from the reference case.

Effects on Russian LNG exports





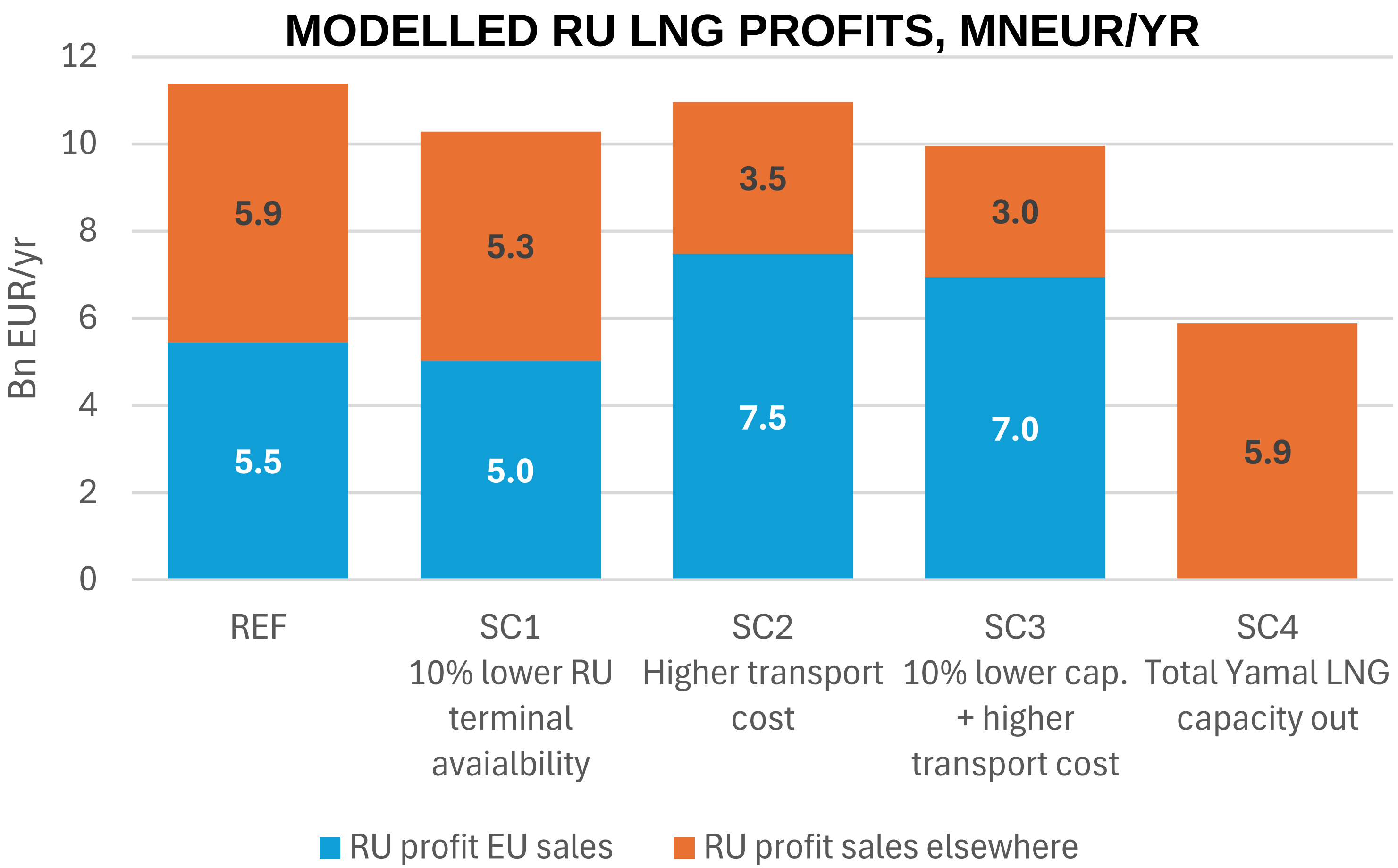
- Russian LNG deliveries are greatly affected by the sanctions
- REF: reproducing 2023 historical outcomes (good fit)

- SC1: -19 TWh/year RU LNG export, division between EU and Asia is unaffected
- SC2: higher shipping cost pushes ~+90 TWh/yr cargoes from Asia to Europe
- SC3: higher shipping cost and 10% lower availability pushes ~+65 TWh/yr cargoes from Asia to Europe
- SC4: all RU LNG goes to Asia

- Revenues: wholesale price * volumes delivered
- Modelled revenues: 17.6 Bn EUR/yr c.f CREA 2023 14.6 Bn EUR/yr

- SC1: -10% revenue
- SC2: -2% revenue
- SC3: -12% revenue
- SC4: -55% revenue

Effects on estimated Russian profits



- theoretical profits are also calculated on gas sales, assuming a **5 EUR/MWh liquefaction cost** and a **3 EUR/MWh gas production cost.**
- Banning transshipment may increase RU LNG sales to Europe
- This has negligible effect on European prices, BUT EU finances Russian budget still

CASE 2:
MODELLING THE CESSATION OF UKRAINIAN GAS TRANSIT

Are Russian contracts still important for the CEE region?

- Some CEE countries still receive pipeline gas vie Ukraine or via Turkstream pipeline system from Russia. Altogether these volumes make up ~10 bcm, targeting Hungary, Slovakia, Austria and Balkans countries (Serbia, Bosnia).
- By 2025, UA transit is expected to cease
- RU-AT, RU-SK contracts not to be delivered
- What happens if all contracts disappear?
- How would these change in different market conditions?
- How does EU gas demand affect the results?
- How does the timing affect the demand?

ACQ AND ROUTE OF RU LTCs TO EU27 STILL DELIVERED IN 2024

	ACQ (TWh/yr)	Route
RU-AT	70	RU-UA-SK-AT
RU-HU	50	RU-TR-BG-RS-HU
RU-SK	52	RU-UA-SK
RU-HR	13	RU-TR-BG-RS-HU-HR
RU-GR	33	RU-TR-GR
Total	218	-

Scenarios

	JP Low (25)			JP REF (35)			JP High (45)		
	EU Low	EU Ref	EU High	EU Low	EU Ref	EU High	EU Low	EU Ref	EU High
WITH UA TRANSIT	EU Low	EU Ref	EU High	EU Low	EU Ref	EU High	EU Low	EU Ref	EU High
NO UA TRANSIT	EU Low	EU Ref	EU High	EU Low	EU Ref	EU High	EU Low	EU Ref	EU High
NO RU GAS TO EU27	EU Low	EU Ref	EU High	EU Low	EU Ref	EU High	EU Low	EU Ref	EU High

Modelled years: From April to March

GY 2023:
to validate modelling results

GY 2025:
First year without
UA transit, current infra

GY 2027:
Additional infra in
the affected region

GY 2030:
Additional LNG
in EU27

		Month											
		1	2	3	4	5	6	7	8	9	10	11	12
Calendar year	2023				GY2023								
	2024	GY2023											
	2025				GY2025								
	2026	GY2025											
	2027				GY2027								
	2028	GY2027											
	2029												
	2030				GY2030								
	2031	GY2030											

Scenarios to be modelled

ASIAN GAS PRICES

- an oversupplied LNG market with low Asian prices **(~25 EUR/MWh**),
- a balanced LNG market reflecting current Asian price levels **(~35 EUR/MWh**) and
- a scarce LNG market with high Asian prices **(~45 EUR/MWh)**

EUROPEAN GAS DEMAND

- low demand in the EU27 (-15% REF **~3 000 TWh/year**)
- reference demand in the EU27 (**~3 600 TWh/year**) in line with the NT scenario of ENTSOG
- high demand in the EU27 (+15% REF **~4 100 TWh/year**)

CORNER YEARS

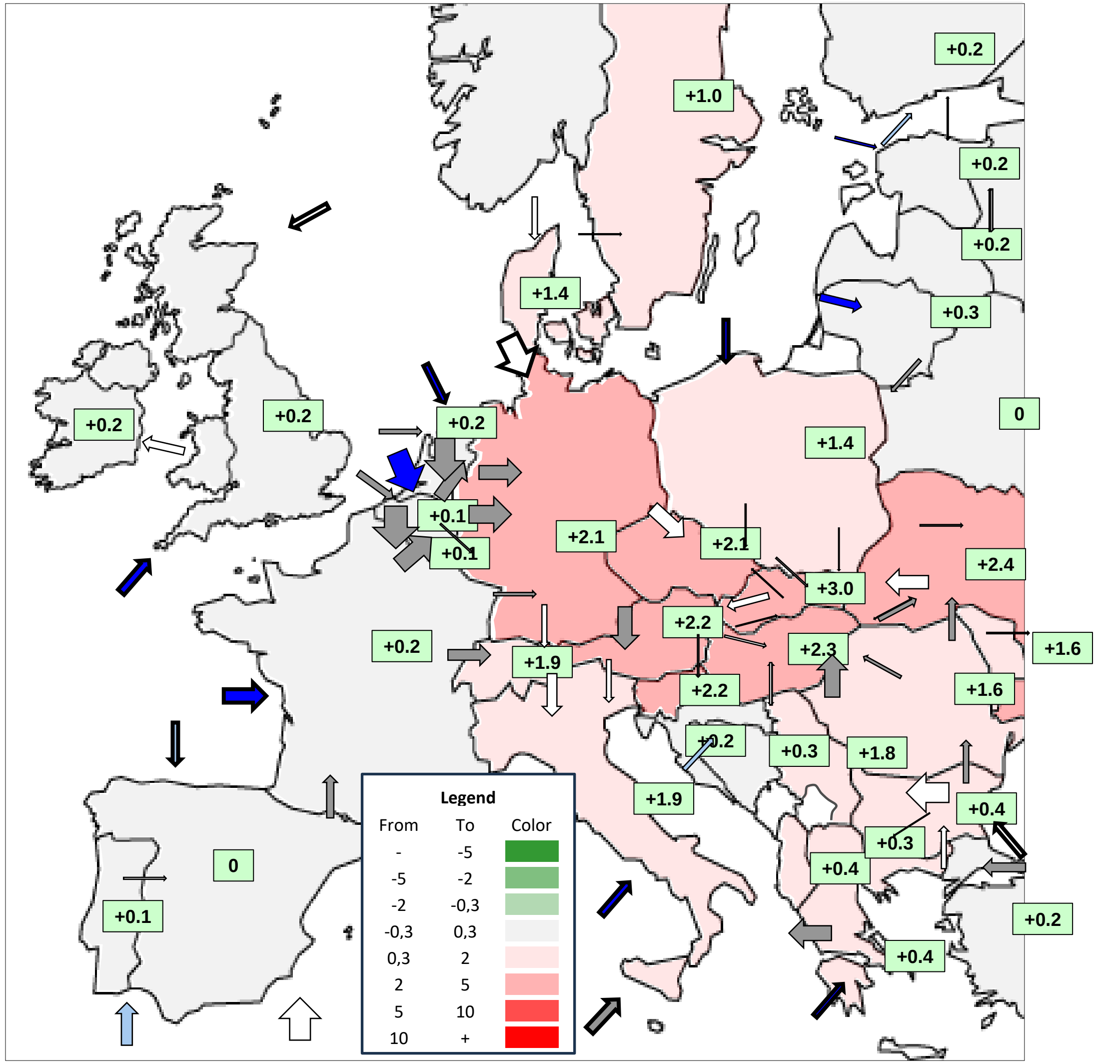
- 2025: end of contract, no new infra
- 2027: some new infra in the region
- 2030: additional LNG for EU27

TRANSIT SCENARIOS

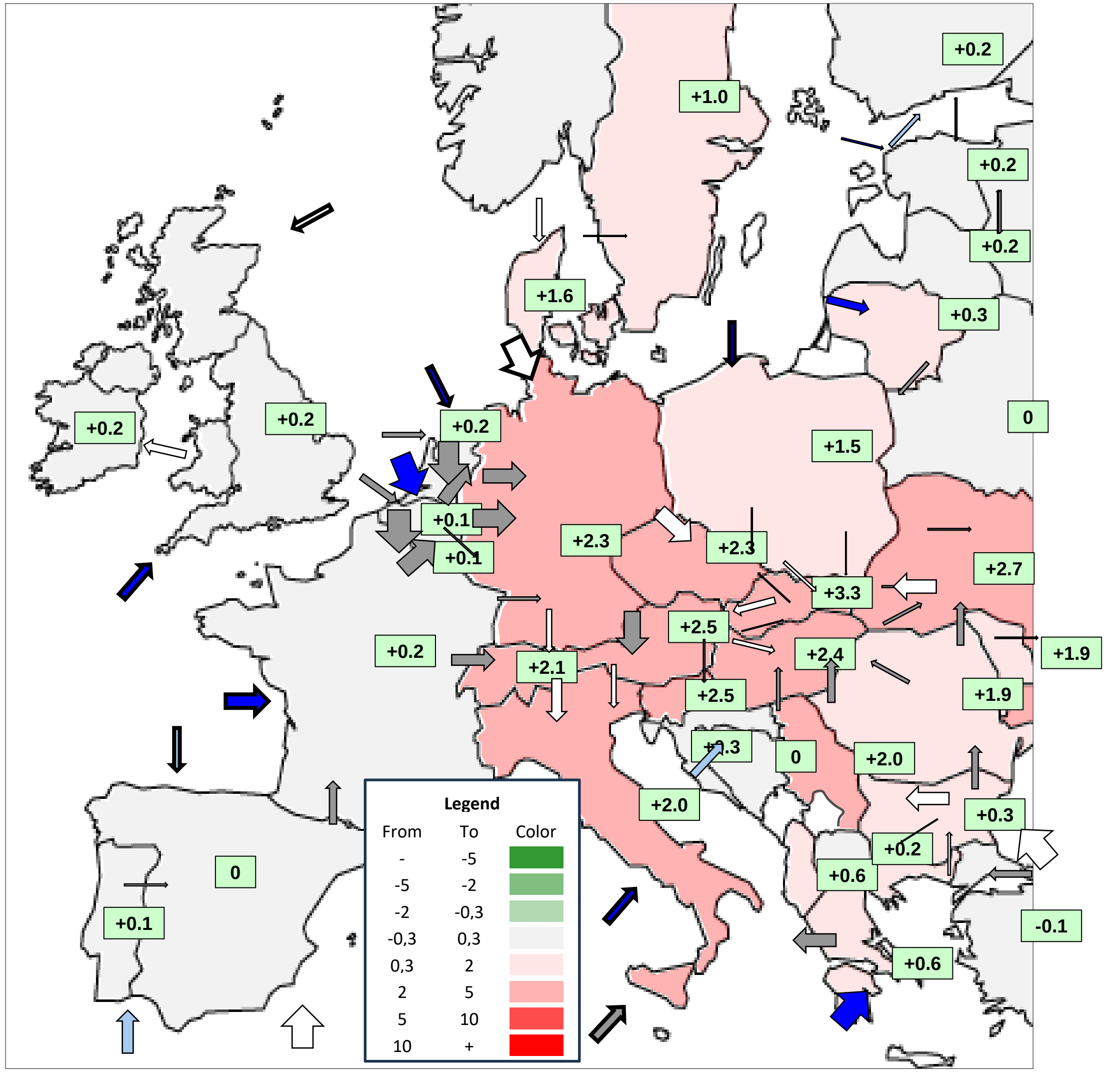
- **no UA transit:** with the expiry of the current transit contract, no agreement is reached and **RU-AT and RU-SK** contracts are stopped. Russian volumes transiting via the Turkstream 2 pipeline system are still delivered.
- **UA transit:** with the expiry of the current transit contract, a new agreement is reached and contracts going through the Ukraine are still delivered. Russian volumes transiting via the TS2 pipeline system are also delivered.
- **No RU gas:** at the same time of ending the transit contract, all Russian gas deliveries to EU27 **(AT, GR, HR, HU, SK)** countries is stopped. RU Contracts to non-EU countries such as TR, MK, BA, RS are still delivered.

Modelled gas price change due to UA and full RU gas stop

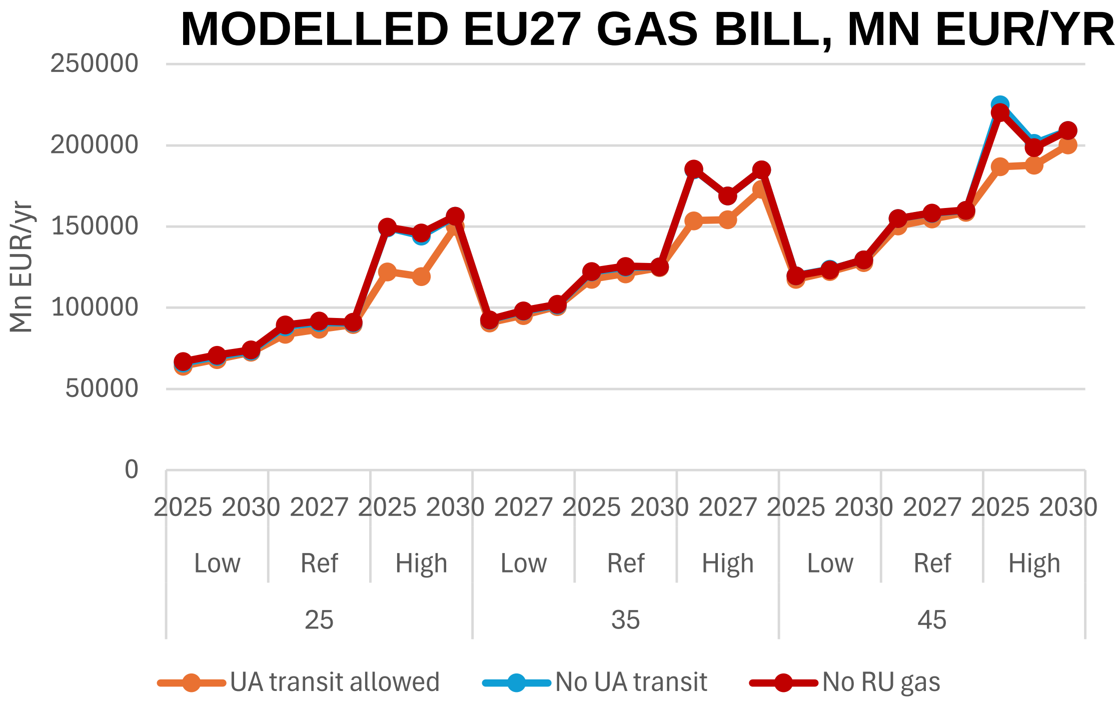
UA TRANSIT ENDS (JP=35, REF DEMAND)

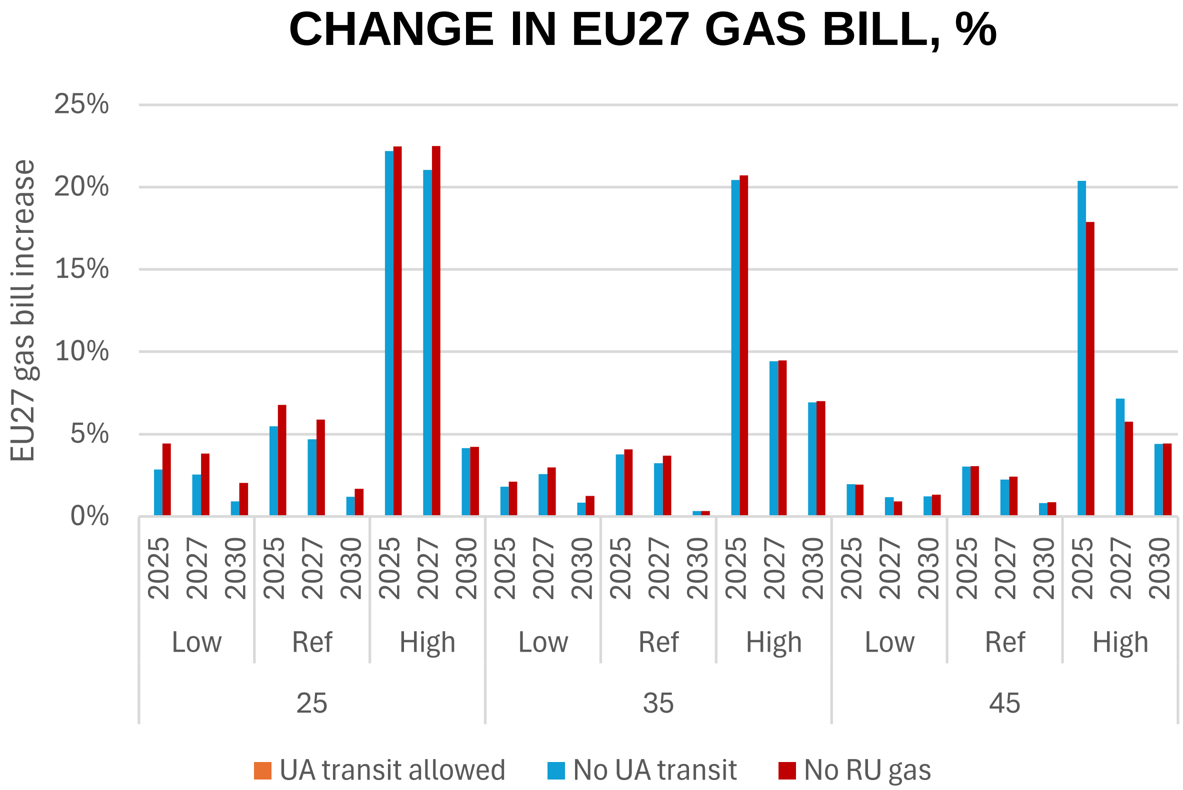


NO RU GAS TO EU27 (JP=35, REF DEMAND)



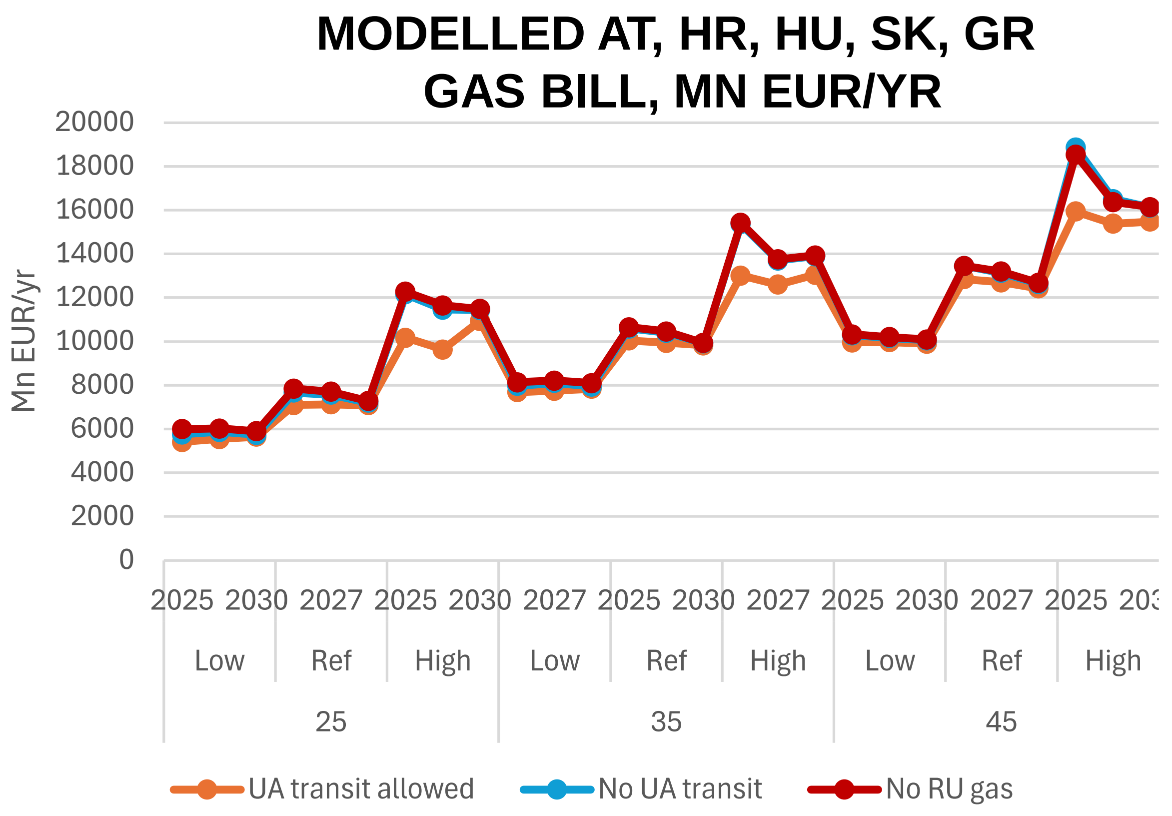
Effects on gas bill EU27

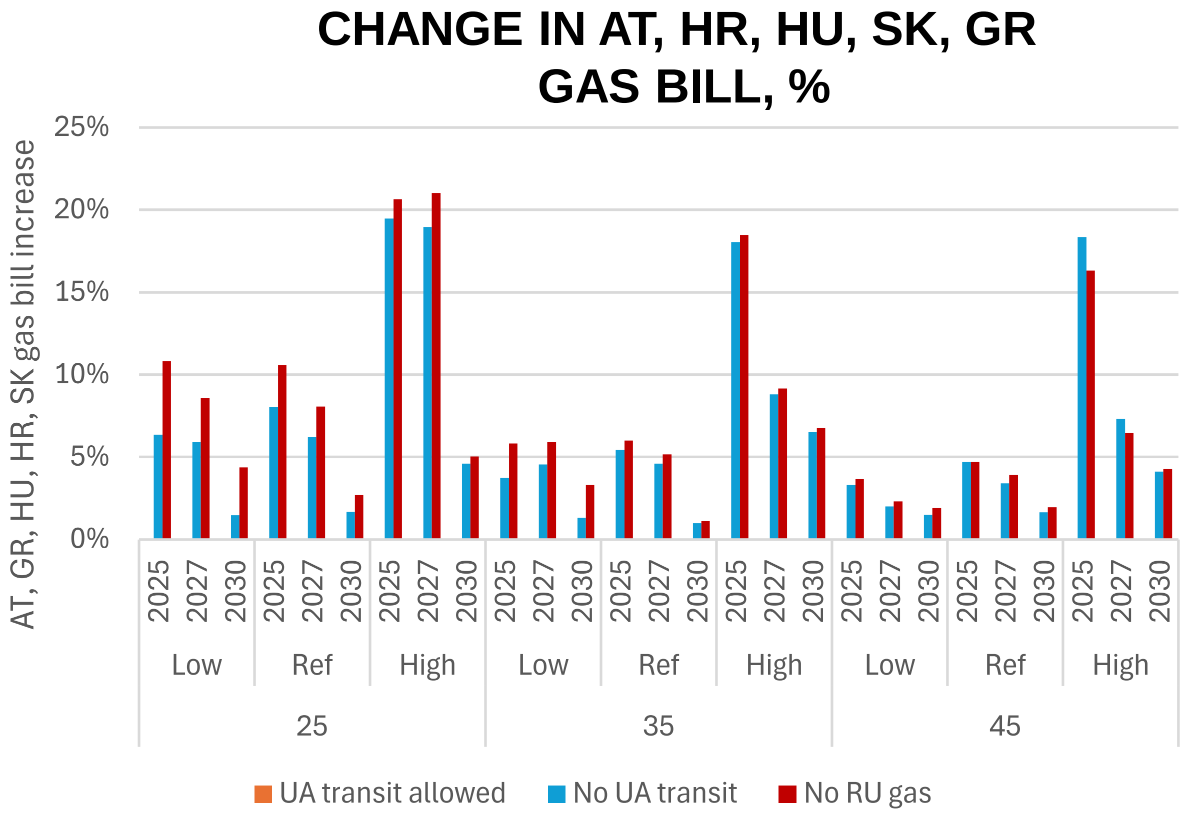




Gas bill of EU27 is not much impacted by the UA tranzit stop – nor by the full RU gas stop
In a low or reference demand environment the increase is~5% or less. Even is a tight global market and high demand environment the increase of the EU gas bill is ~20%.

Effects on gas bill AT, HR, HU, SK, GR

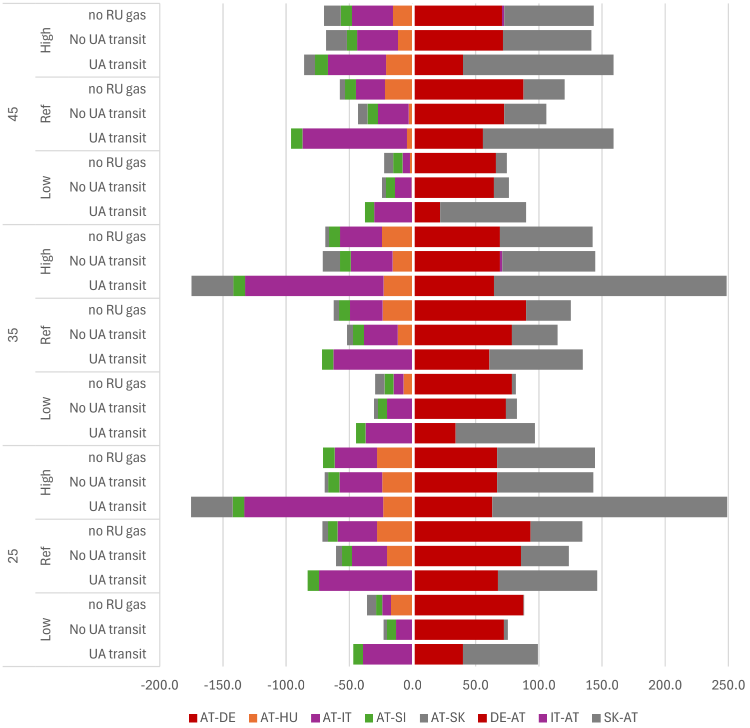




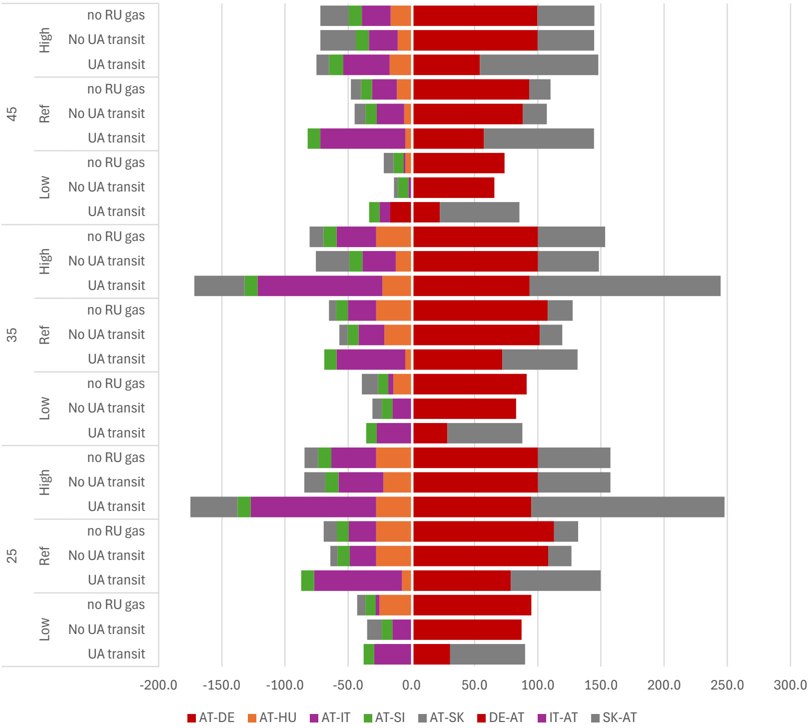
- For the most impacted CEE countries the impact on the gas bill is similar as for the EU27 for the high demand scenarios (~20%). However the price increase is higher in the low and ref demand scenarios for the next few years (~10%) even if the global LNG market has ample supplies. The bottlenecks disappear by 2030 in all price and demand scenarios.

Supply structure AT

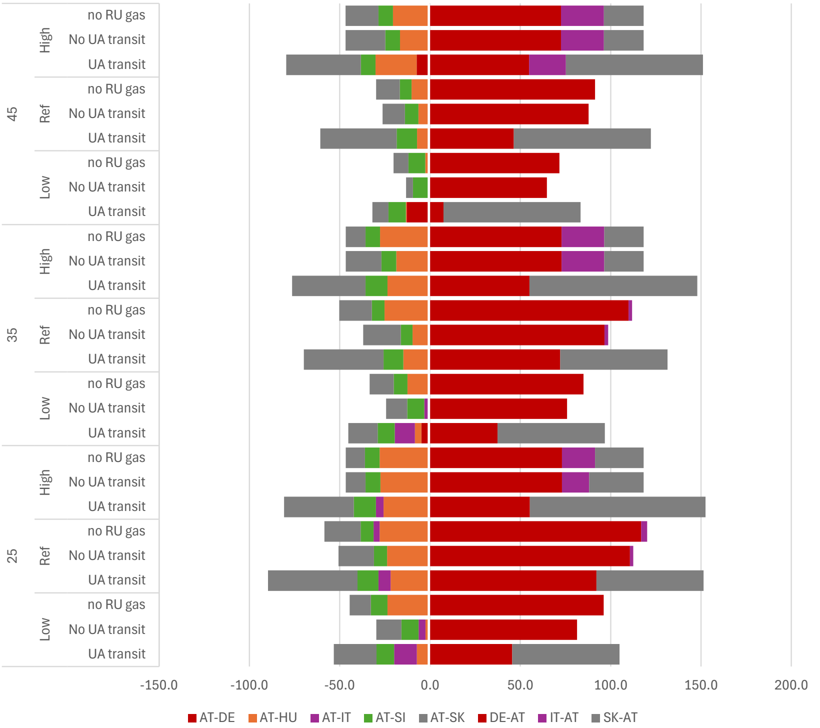
2025



2027

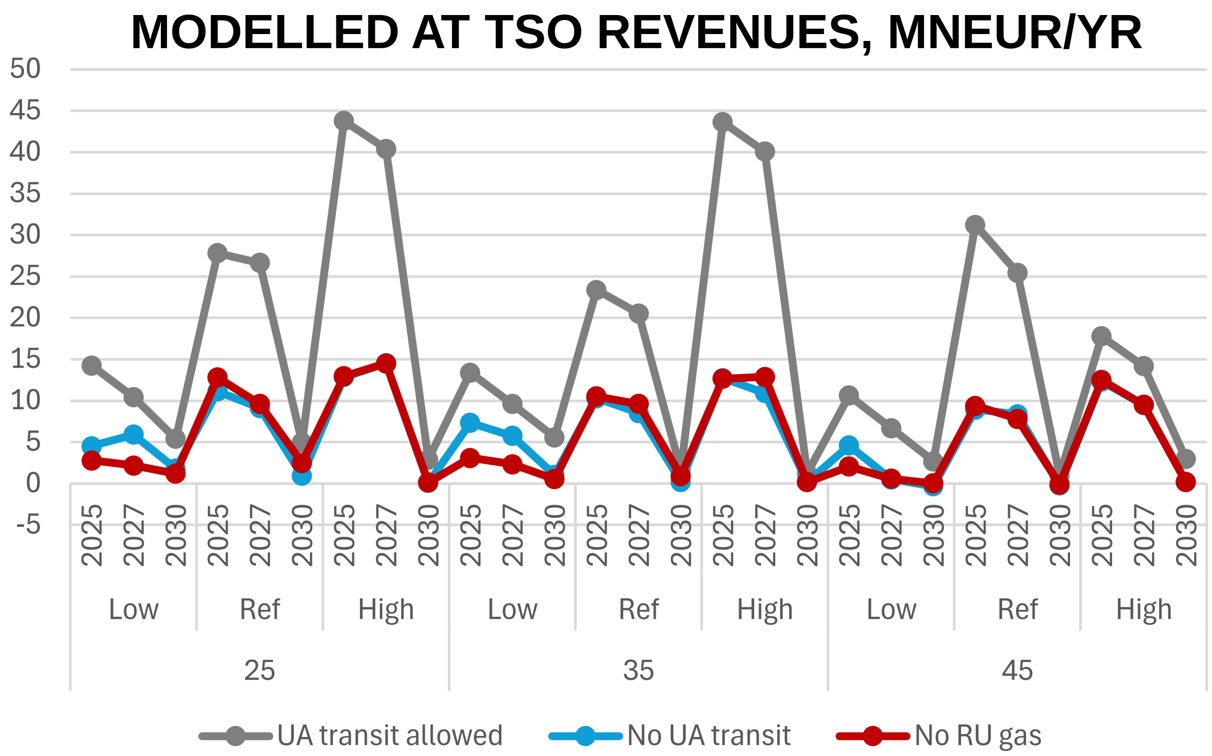


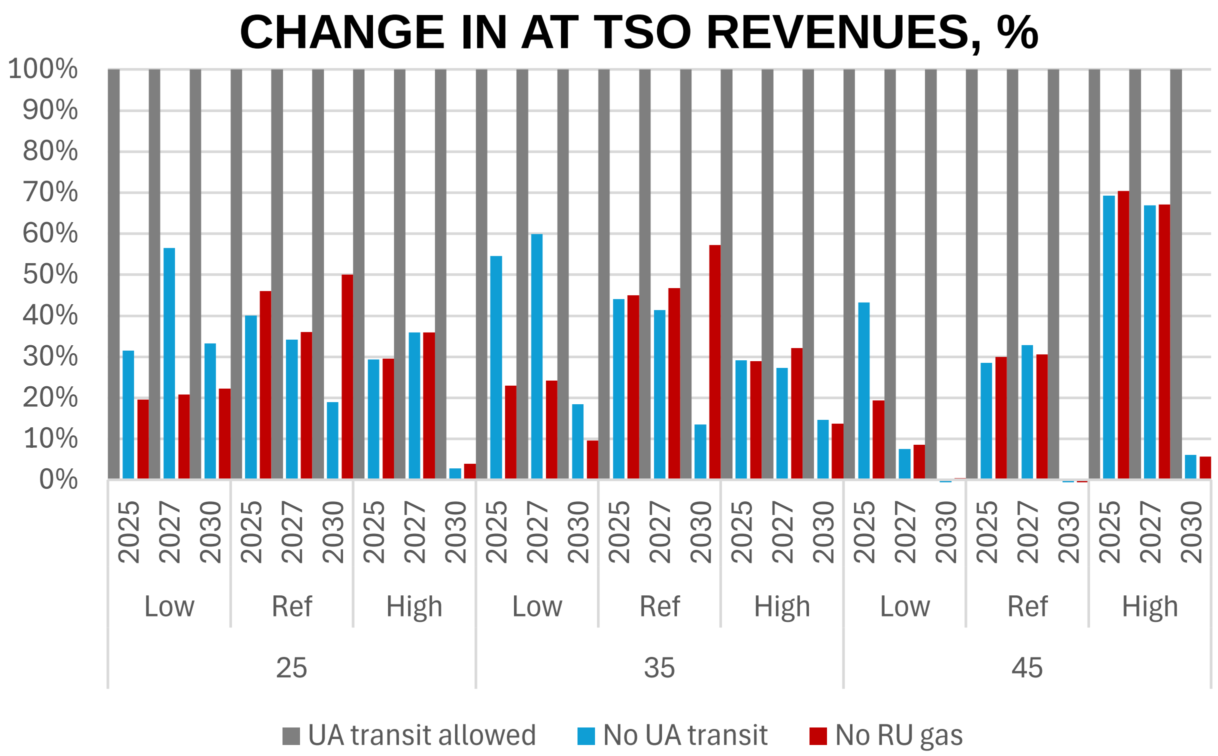
2030



- AT flows drastically reduce with the UA tranzit stop and with the RU gas stop. The Slovakian import is substituted by German flows.

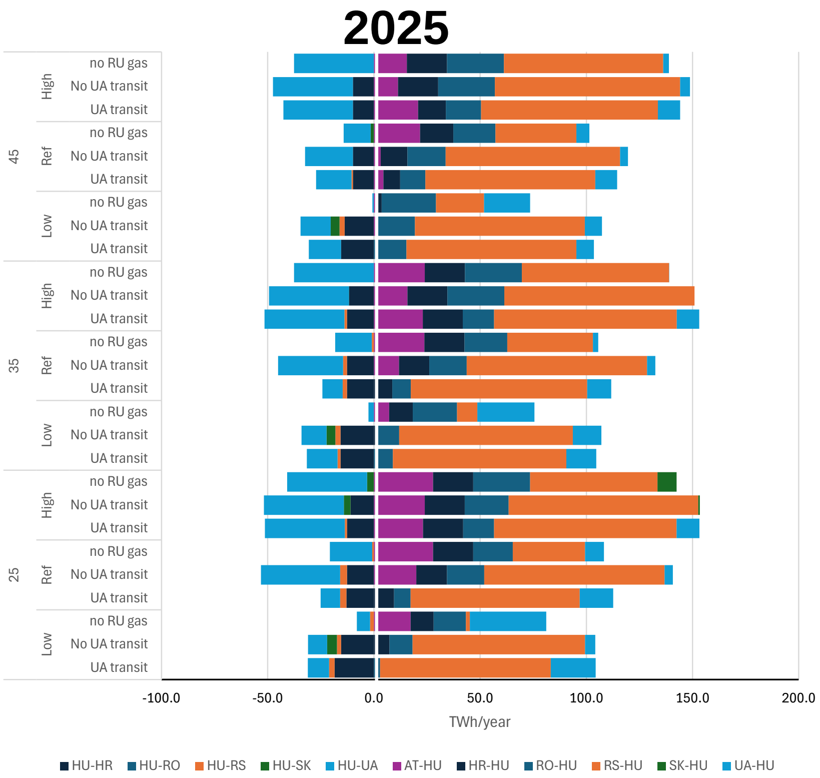
Modelled AT TSO revenues

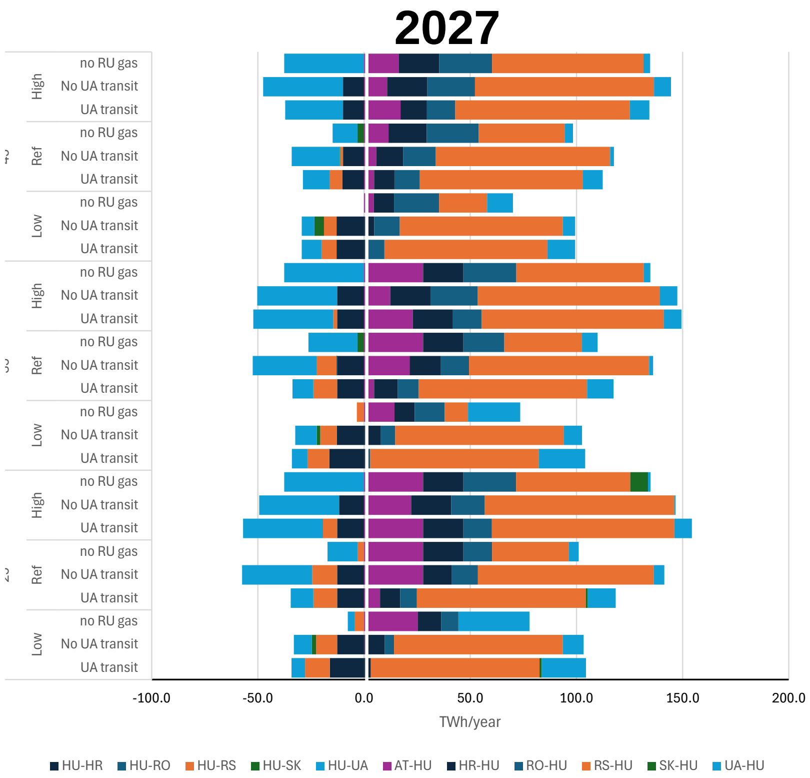


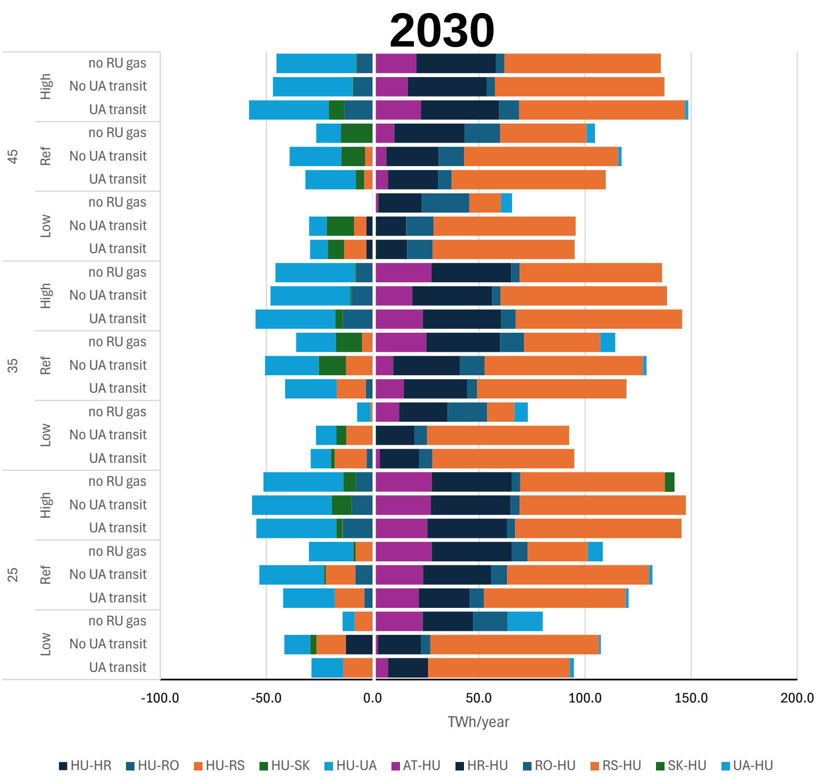


- The stop of UA tranzit volumes cuts back the AT TSO revenues by 50% or more in many of the scenarios.
- The full Russian gas stop has similar results for the AT TSO as the UA tranzit stop. However in the low demand scenarios the UA tranzit route cuts back revenues by 50% while the full RU gas stop almost deminishes the TSO revenues.

Supply structure HU



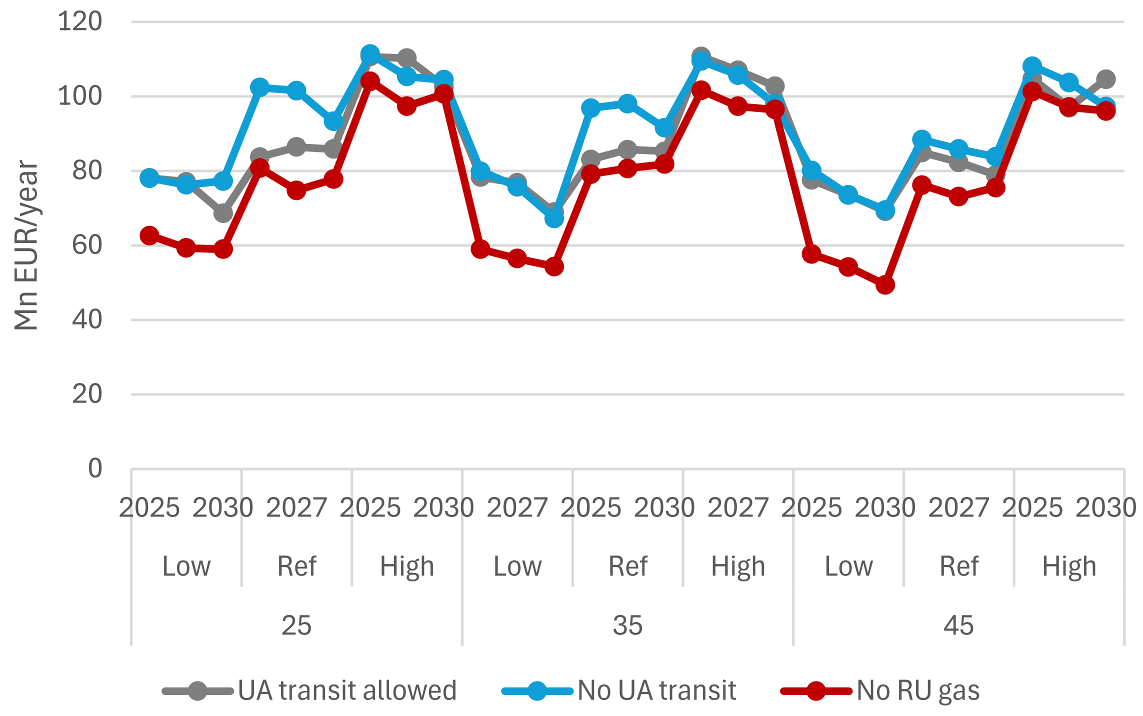




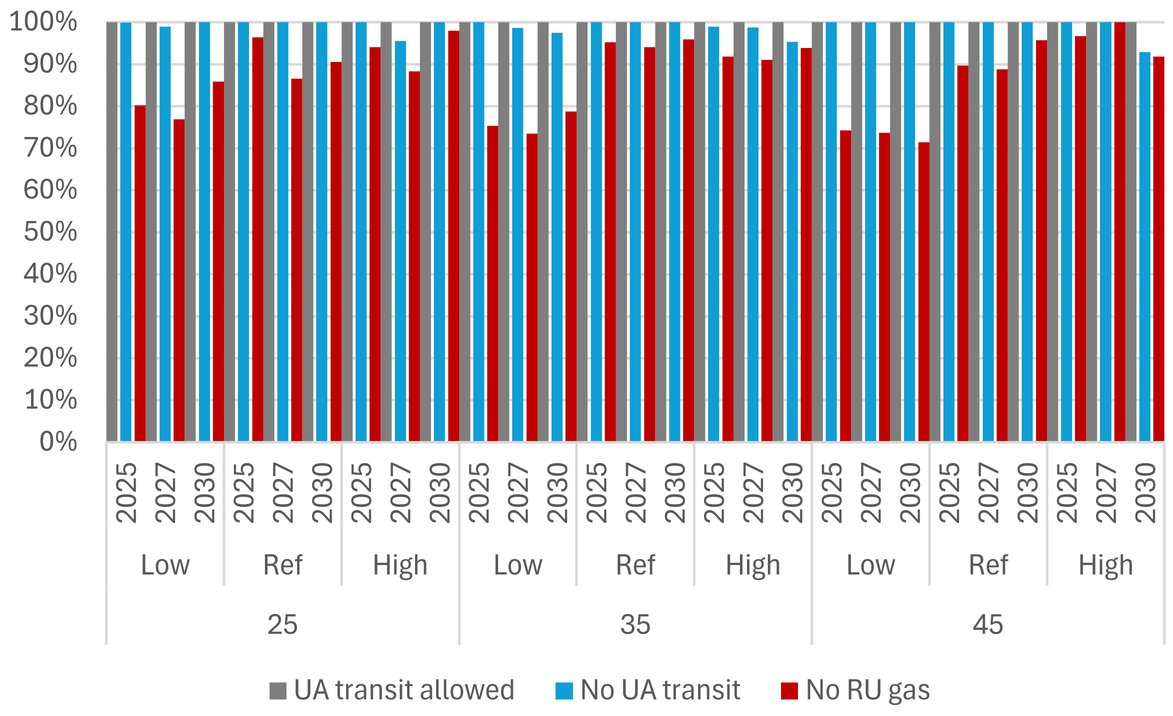
- The well developed HU gas transmission system can easily adapt to any changes in the flows. The UA tranzit stop does not impact the total imported volumes on the system, in certain scenarios it increases the flows to supply the missing volumes from other directions.

Modelled HU TSO revenues

MODELLED HU TSO REVENUES, MNEUR/YR



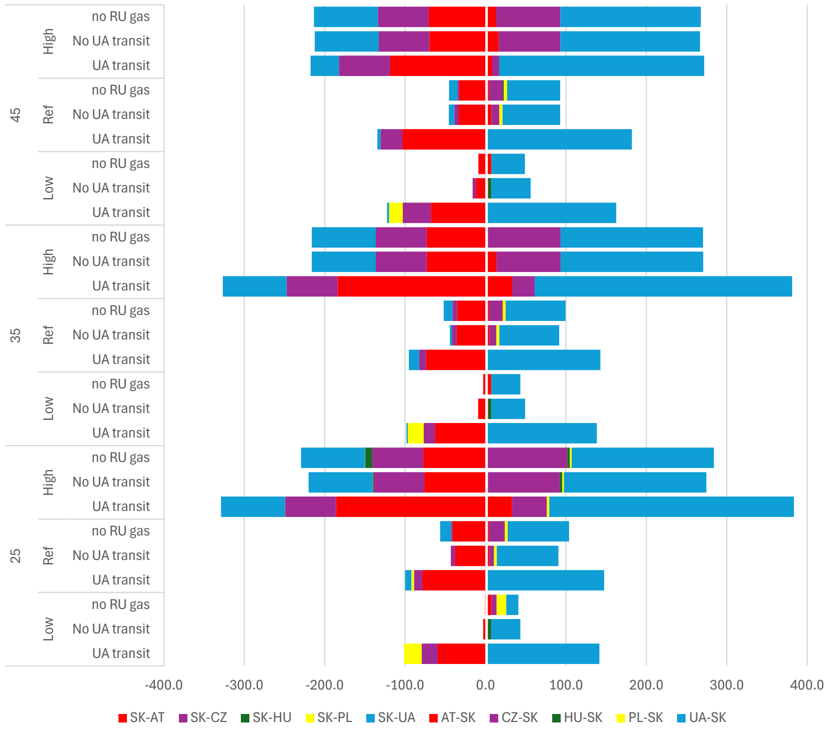
CHANGE IN HU TSO REVENUES, %



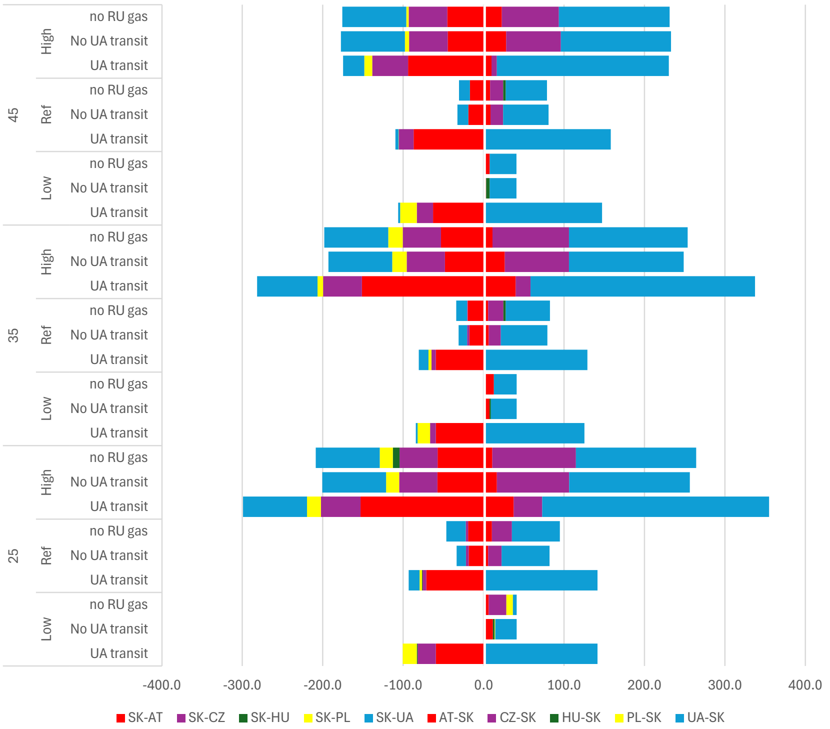
- The UA tranzit stop does not impact the HU TSO revenues
- The stop of all RU gas deliveries would cut back the HU TSO revenues up to ~30% in the low gas demand scenarios.

Supply structure SK

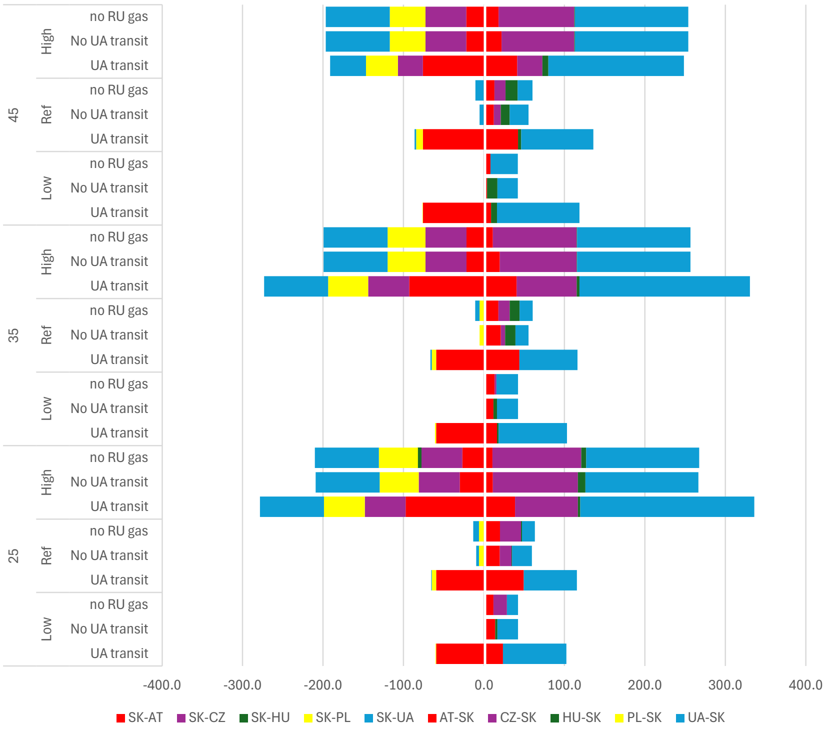
2025



2027

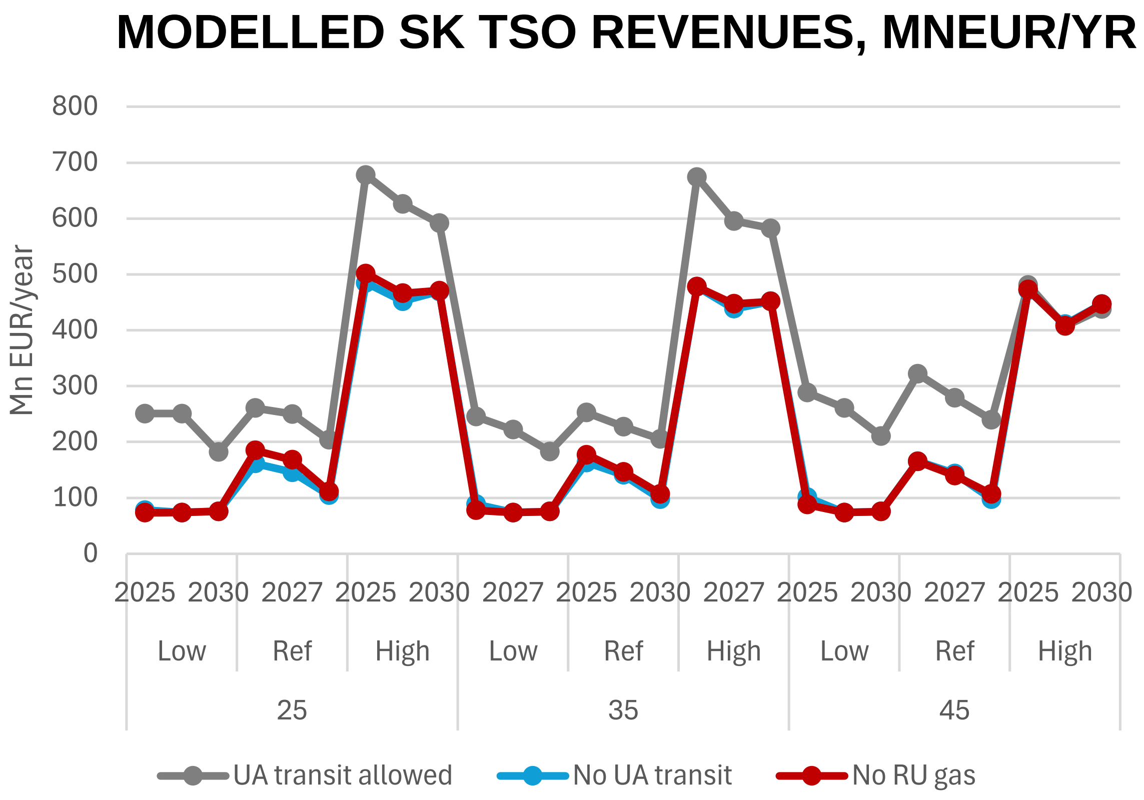


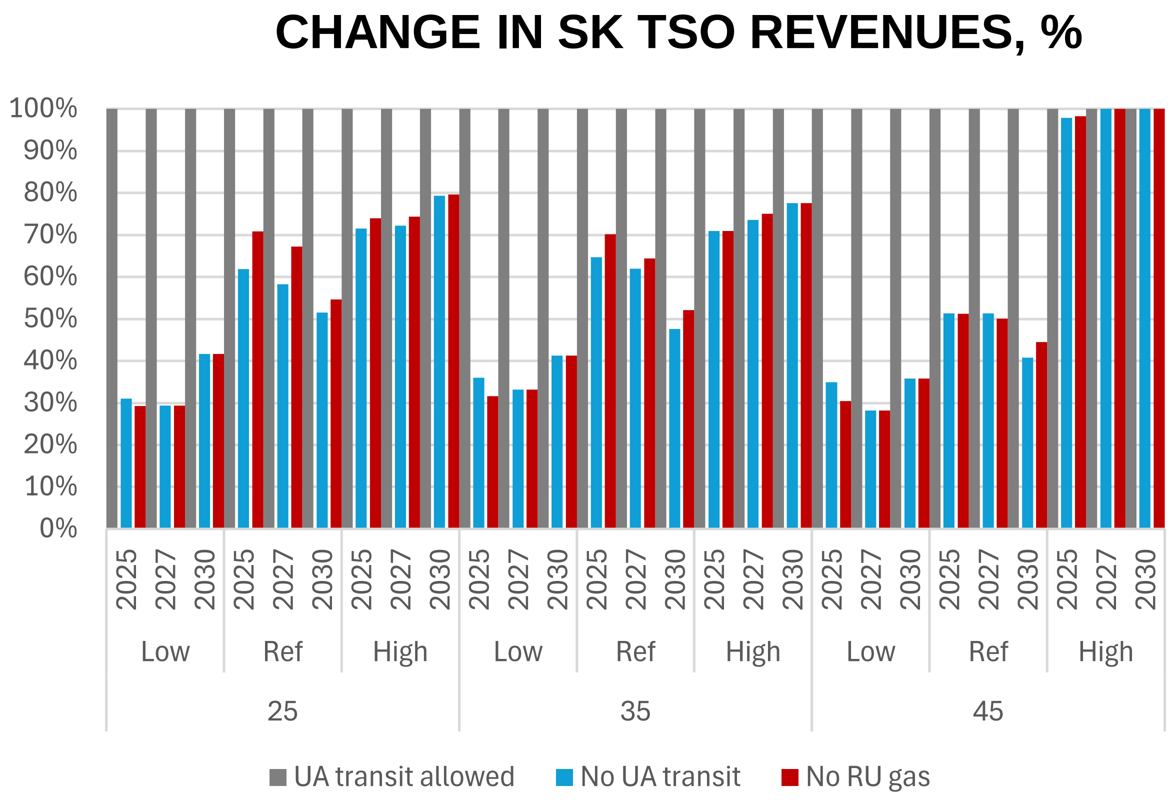
2030



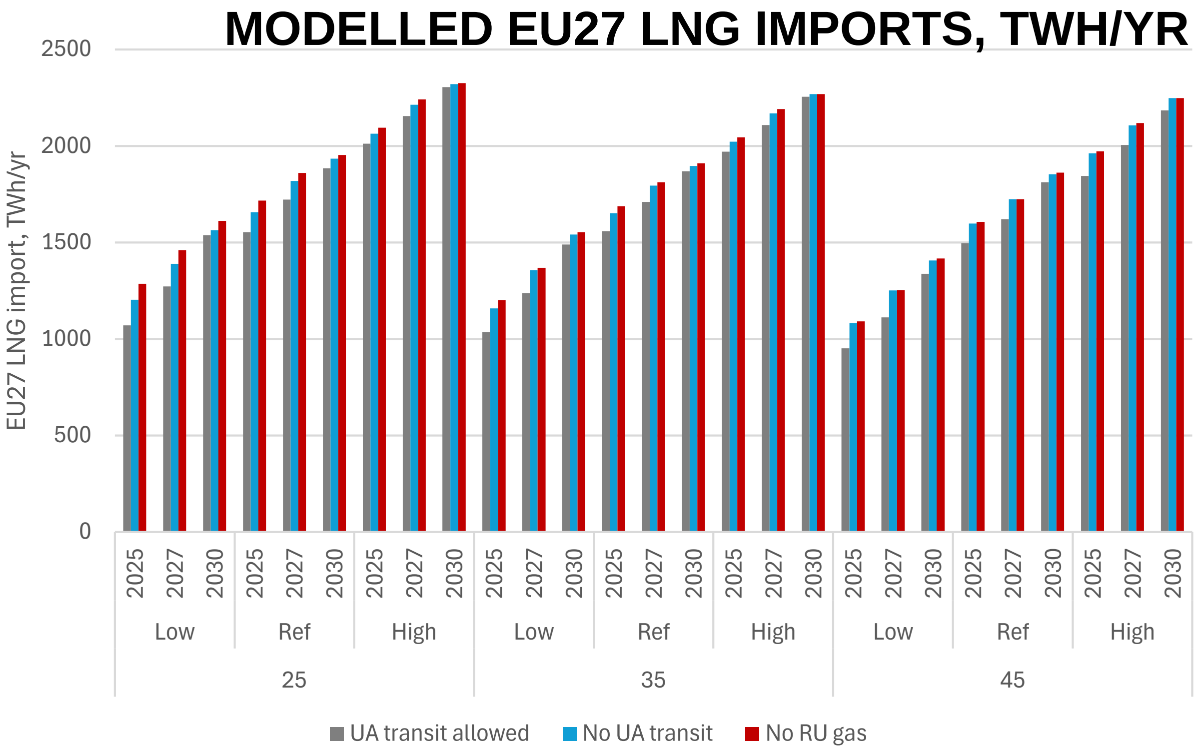
- SK is the country most exposed to the Russian gas deliveries.
- The stop of the UA route drastically impacts the transit volumes on the system, and the full RU gas supply has very similar impact pattern.

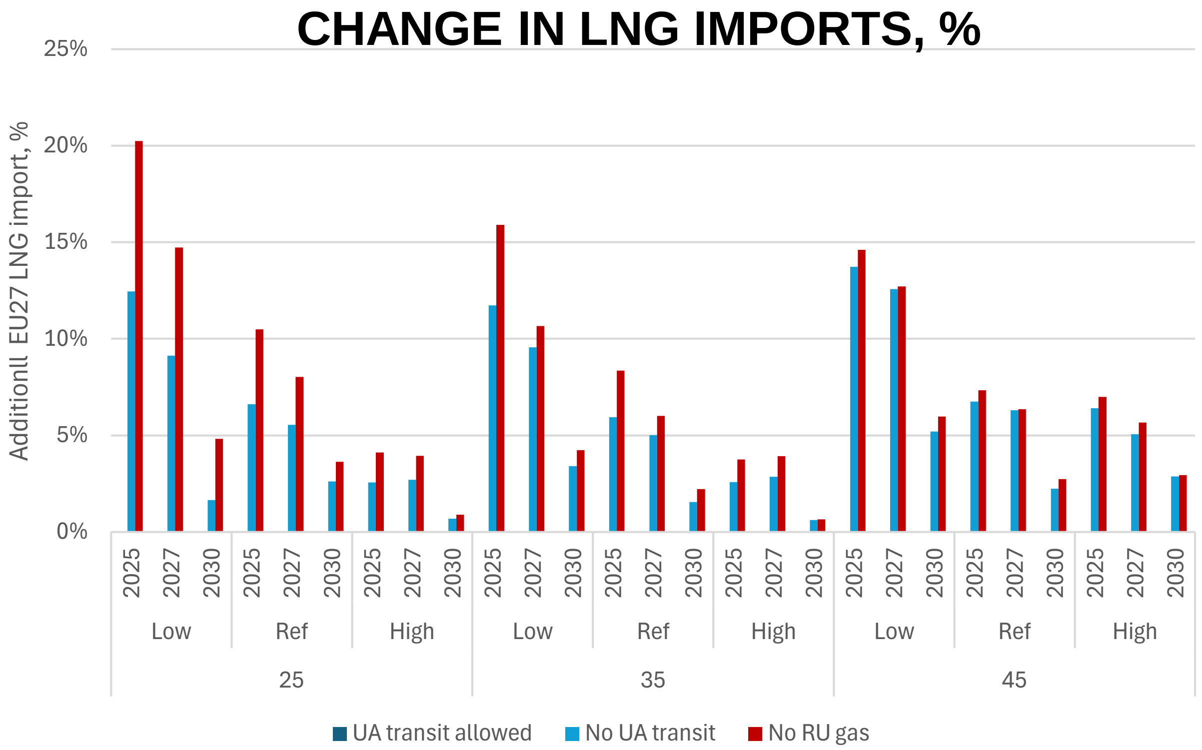
Modelled SK TSO revenues





LNG imports modelled, TWh/year





- LNG import woulmes are driven by the Eu gas demand and to a lesser extent by the Russian gas scenarios.
- LNG can flexibly substitute the missing Russian piped gas volumes
- The change of LNG volumes varies between 1-20%.

CASE 3:
MODELLING THE EFFECT OF THE GERMAN STORAGE LEVY

German storage levy

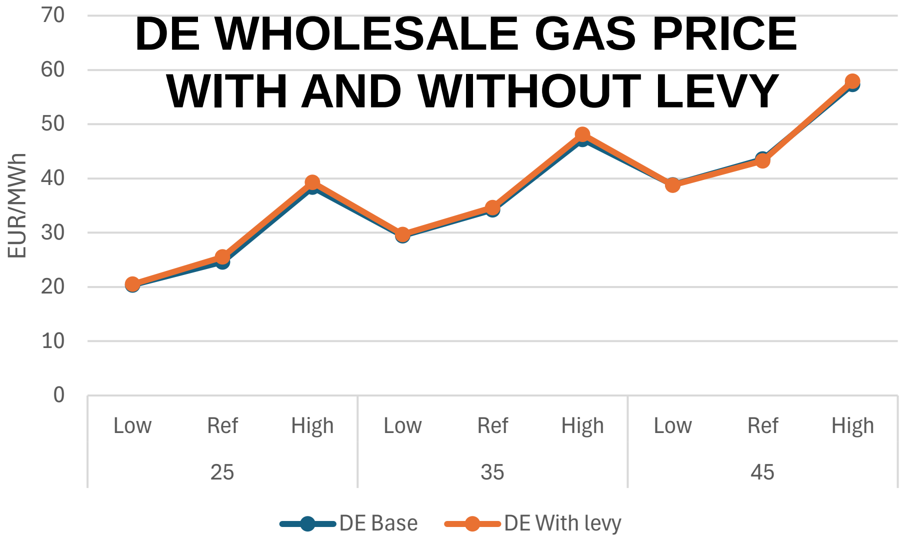
- In 2022, Germany introduced a so-called „storage levy" (*Gasspeicherumlage*) on all of its exit points to recover the high cost of 2022 storage stockbuild
- The stock was ~50 TWh, procured at the cost of ~9 Bn EUR
- 12.5 TWh of stock was already consumed and marketed at a price of 77.5 EUR/MWh , producing ~1 Bn EUR revenues
- However, the remaining ~6.5 Bn EUR needed to be recovered
- The exit points not only included domestic exits but also interconnection points
- This was strongly criticised by traders and other countires as well as the European Commission, being a market-distortive action, hampering cross-border trade and hurting the functioning of the internal gas market of the EU
- The levy was eventually scrapped for interconnection points friom 2025 but remained for domestic users
- The levy stood at
  - 2022.10-2023.06. 0.59 EUR/MWh
  - 2023.07-2023.12. 1.45 EUR/MWh
  - 2024.01-2024.06 1.84 EUR/MWh
  - 2024.07-2024.12 2.5 EUR/MWh
- In the 2024.07-2027 period, Germany expects to recover 6.5 Bn EUR additionally

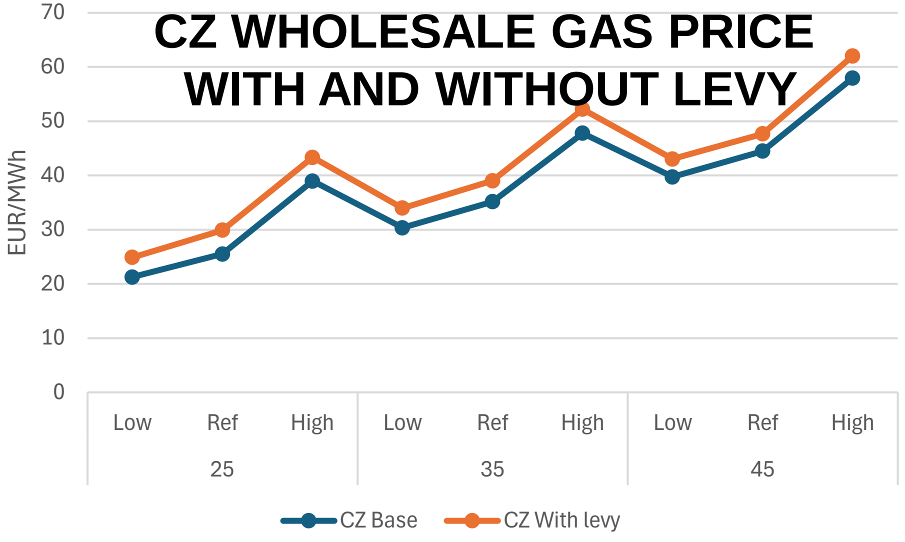
- The levy was set on domestic interconnection points, as well as on cross-border exit points
- Originally, 75% of the revenues were to be realised on domestic points, 25% on cross-border points
- After 07.2024. this mix changed to 90% on domestic exit points and 10% on cross-border points
- This means that the 6.5 Bn EUR to be recovered on the 07.2024-03.207 period would mean a revenue of **230-600 Mn EUR/year** on cross-border trade

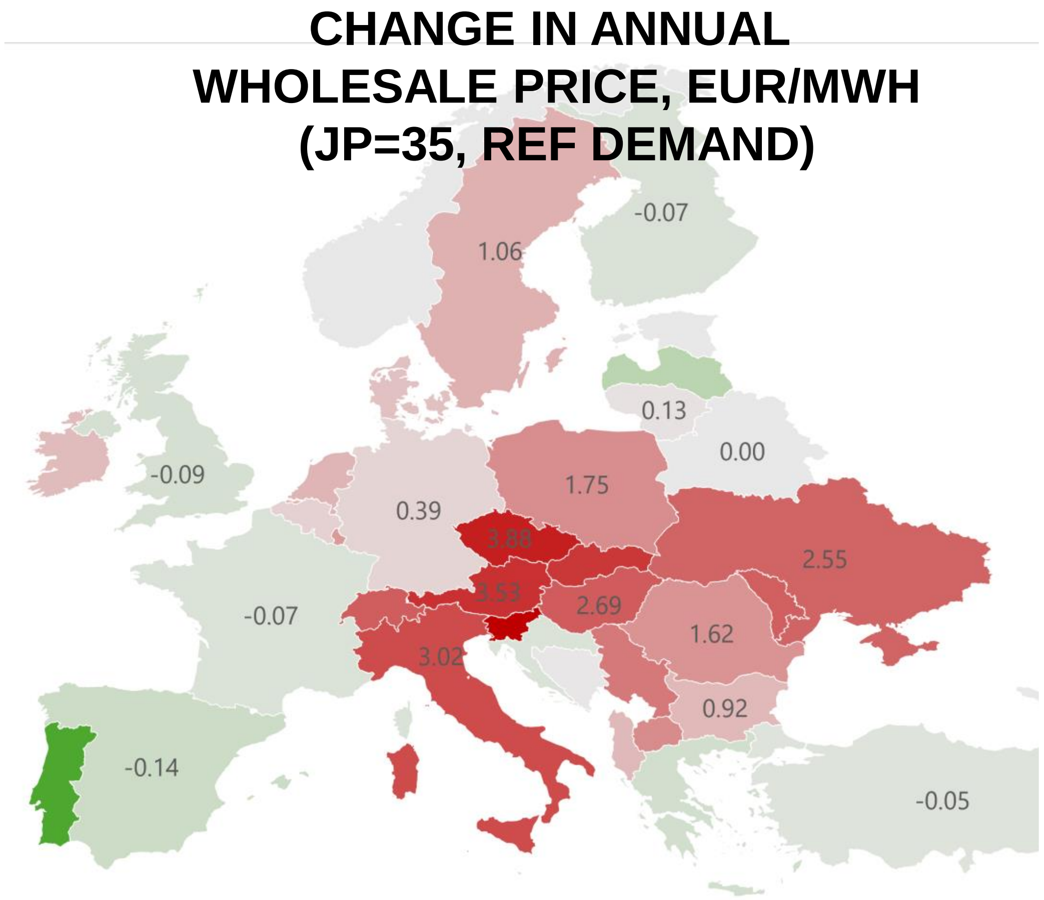
Modelling the storage levy

	JP Low (25)			JP REF (35)			JP High (45)		
Without storage levy on DE cross-border exits	EU Low	EU Ref	EU High	EU Low	EU Ref	EU High	EU Low	EU Ref	EU High
With storage levy on DE cross-border exits	EU Low	EU Ref	EU High	EU Low	EU Ref	EU High	EU Low	EU Ref	EU High

Effects of the 2.5 EUR/MWh levy on prices

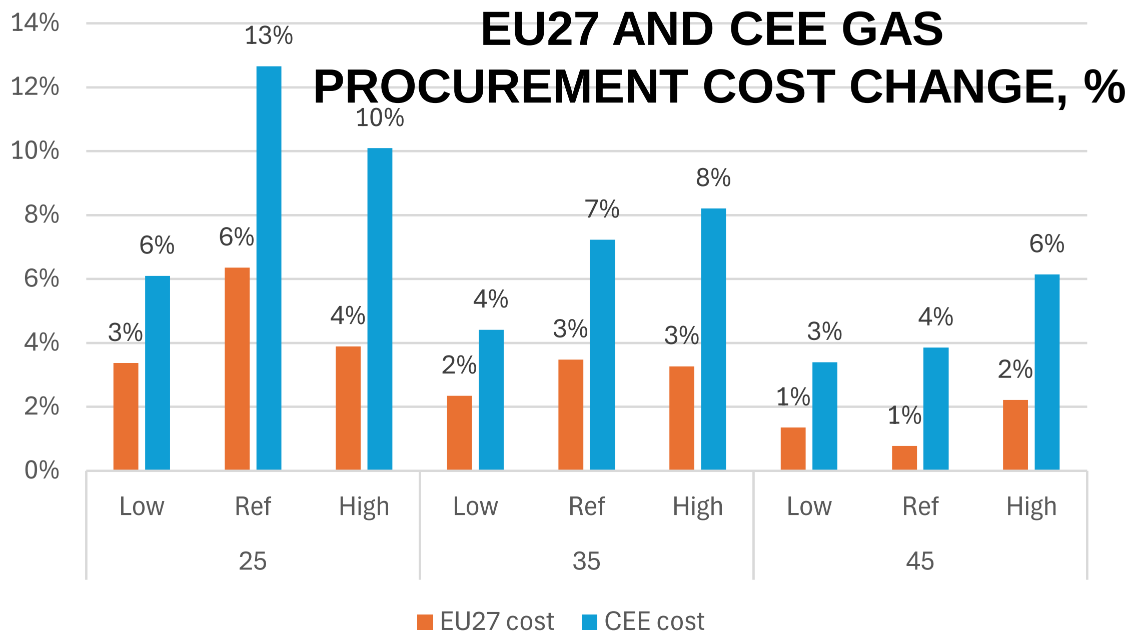


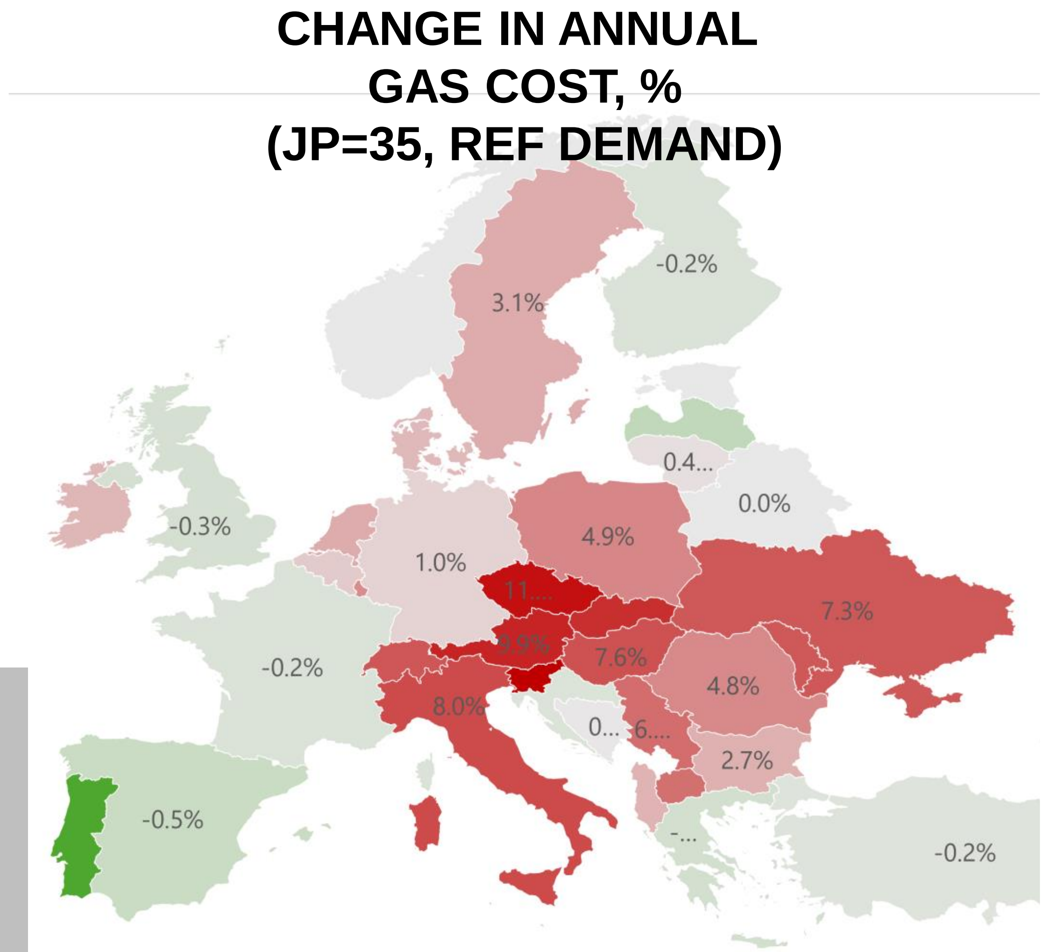




- DE storage levy has adverse effect on countries east and south of Germany, as dominant exit flows from DE are transiting mainly to these directions
- Bigger effects can be measured in neighboring countries

Effects on gas cost

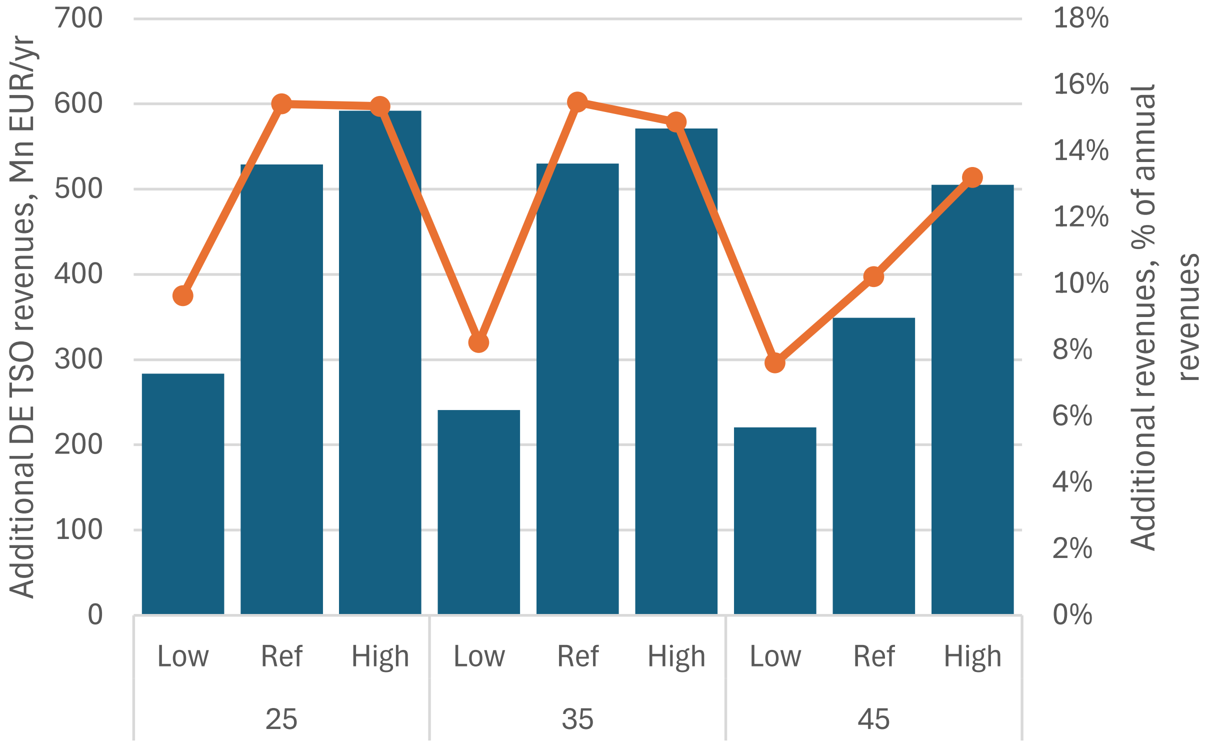




- The storage levy has a cost-increasing effect of on EU27
  - 3-6% at oversupplied LNG markets,
  - 2-3% at balanced LNG markets
  - 1-2% at tight LNG markets
- CEE (AT, CZ, HR, HU, PL, SI, SK) is affected more severely
  - 6-13% at oversupplied LNG markets
  - 4-8% at balanced LNG markets
  - 3-6% t tight LNG markets
- Countries west of Germany are not affected adversely

Effects on TSO revenue

CHANGE IN DE TSO REVENUES, MN EUR/YR AND %



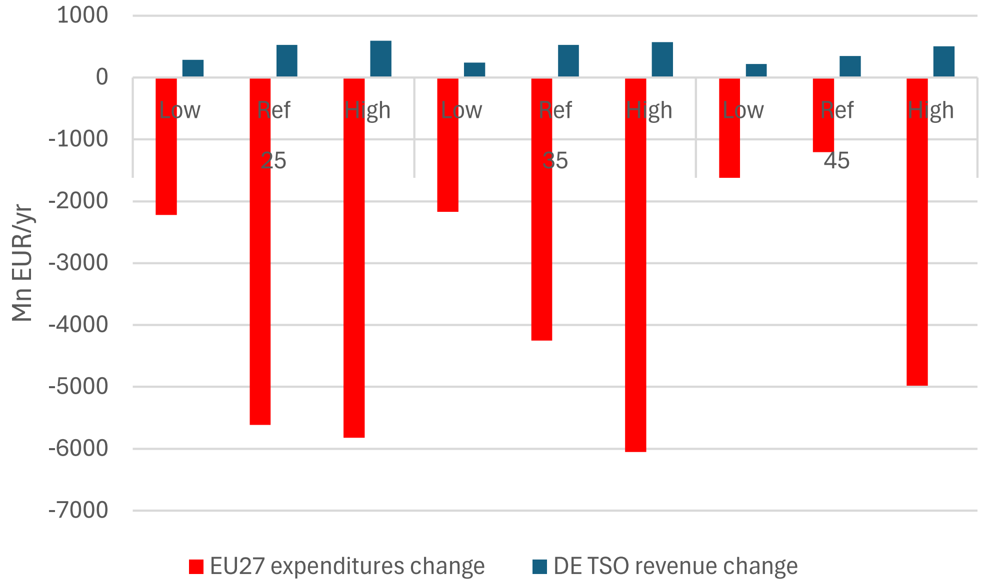
- DE TSO revenues are driven by demand scenarios
  - At low demand, 220-280 Mn EUR/year (8-10%)
  - At reference demand, 350-530 Mn EUR/yr (10-15%)
  - At high demand, 500-590 Mn EUR/yr (13-15%)
- The revenues recovered from additional cross-border storage levy are within the range of required revenue as stipulated by the THE methodology
  - Methodology: **230-600 Mn EUR/yr**
  - Modelled: **220-590 Mn EUR/yr**

Does it worth it? Change in consumer expenditures vs. Additional DE TSO revenues

GAS PROCUREMENT COST CHANGE, Mn EUR/yr (RED: HIGHER COSTS GREEN: LOWER COSTS)

		AL	AM	AT	BA	BE	BG	BY	CH	CZ	DE	DK	EE	ES	FI	FR	GE	GR	HR
	Low	0.4	0.0	171.4	1.8	-32.0	26.6	0.0	72.5	251.1	95.4	-16.2	0.1	3.0	4.1	-170.8	0.0	6.7	5.3
	Ref	0.5	0.0	294.6	0.6	125.6	44.2	0.0	109.6	357.4	751.5	34.6	0.7	-108.1	1.9	63.5	0.0	11.9	3.3
25	High	0.8	0.0	317.4	1.2	-112.6	70.4	0.0	98.4	404.9	823.5	92.0	2.6	9.2	0.7	-495.8	0.0	56.5	0.0
	Low	0.5	0.0	161.0	0.0	-21.9	36.3	0.0	65.6	249.7	166.2	-17.1	-0.9	2.1	1.5	-128.1	0.0	26.1	5.0
	Ref	0.4	0.0	244.4	0.0	81.6	33.4	0.0	88.0	314.1	322.9	17.7	0.0	-33.4	-1.3	-22.8	0.0	-7.5	-1.7
35	High	0.7	0.0	310.3	1.2	-80.9	63.1	0.0	104.5	406.9	859.5	85.5	1.6	2.5	-0.3	-428.5	0.0	52.1	-0.9
	Low	0.5	0.0	172.2	-2.1	-68.4	1.6	0.0	52.9	226.1	-35.8	-13.3	-0.6	0.6	1.6	-269.6	0.0	14.9	9.5
	Ref	0.3	0.0	199.6	-0.8	24.4	20.6	0.0	3.0	254.7	-250.6	-3.2	0.5	-11.3	-0.8	-106.4	0.0	-18.7	-1.1
45	High	0.4	0.0	284.6	-0.1	-119.4	40.2	0.0	97.2	374.4	549.6	72.9	0.7	-7.8	0.2	-495.3	0.0	-0.3	0.3

		HU	IE	IT	LT	LU	LV	MD	MK	MT	NL	PL	PT	RO	RS	SE	SI	SK	TR	UA	UK	EU27
	Low	84.1	17.1	1666.8	-0.1	5.7	0.2	8.1	0.0	0.3	-21.8	34.7	-36.4	27.4	24.0	1.4	34.3	63.1	40.0	175.4	-361.5	2221.7
	Ref	340.3	56.2	2293.6	8.6	14.5	1.3	26.7	0.9	0.1	306.3	544.8	-63.3	267.1	72.0	14.9	53.2	196.1	-3.4	630.6	46.0	5614.7
25	High	361.0	15.9	2605.7	10.6	4.0	-0.3	18.7	1.6	0.0	-25.1	1127.9	-3.5	235.0	84.0	35.5	54.8	230.7	62.2	436.9	-566.5	5820.9
	Low	98.0	19.2	1468.8	-0.6	6.3	-2.6	9.6	8.6	0.3	-50.1	21.0	-34.1	54.8	12.9	1.0	32.8	76.0	1.4	205.3	-318.0	2170.7
	Ref	252.3	45.5	1974.5	2.4	12.4	-2.2	20.3	6.8	-0.2	276.6	385.2	-38.0	177.3	63.1	9.8	46.3	161.1	-25.6	462.6	-56.8	4250.8
35	High	419.8	22.9	2691.8	6.4	5.5	-3.0	19.2	8.9	-0.1	18.4	1069.2	-9.3	242.4	78.9	33.2	54.3	231.9	24.3	479.6	-477.9	6054.5
	Low	85.6	2.4	1436.8	0.5	4.0	-1.3	7.1	-3.4	0.3	-74.8	48.8	-39.9	19.3	2.2	2.4	34.2	65.9	-426.8	161.0	-542.8	1622.8
	Ref	144.1	41.2	362.1	-5.6	9.7	-4.1	12.4	-1.5	-0.3	167.0	187.5	-31.5	63.5	41.9	5.0	39.1	121.3	-186.3	287.8	-103.6	1206.8
45	High	376.4	13.3	2428.0	3.4	3.7	-5.5	17.8	-0.2	0.1	10.9	949.4	-5.0	215.8	60.2	29.6	50.5	213.0	-19.8	454.1	-588.0	4983.6

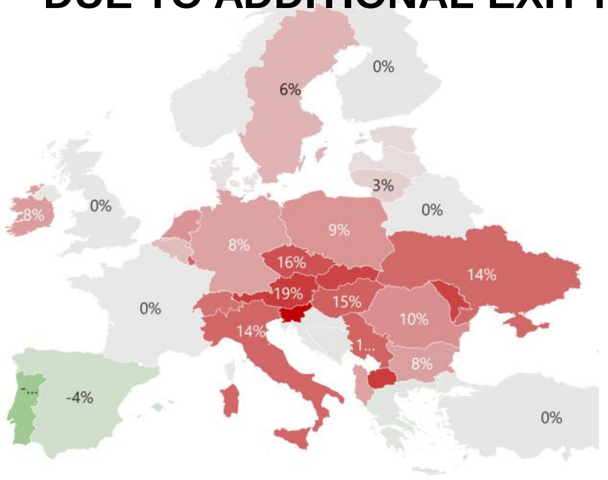


- The storage levy of 2.5 EUR/MWh on cross-border IPs creates huge additional cost on the interconnected European gas markets
- Altogether **EU27 gas procurement cost** could increase by **1.6-6 Bn EUR/year**
- **DE TSO revenues** can increase by **0.22-0.59 Bn EUR/year**

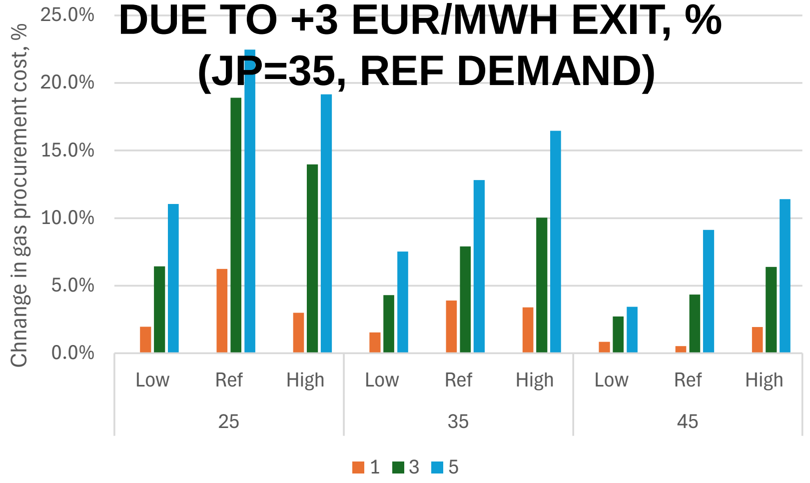
Thought experiment: non-cooperative tariff setting

- What happens if not only Germany, but other countries exercise higher exit tariffs on their borders?
- +1/+3/+5 EUR/MWh additional tariff on all cross-border exits of the EU27 and EnC CPs
- A +3 EUR/MWh exit fee would increse the cost for most continental countries, and have little effect on the periphery of the network
- If all countries increase their exit fees, the total EU27 gas procurement cost could greatly grow > non-cooperation would lead to high cost for nearly all
- Eg. If all countries add a
  - +1 EUR/MWh exit fee, expenditures can increase 1-6%
  - +3 EUR/MWh 3-19%
  - +5 EUR/MWh 3-22%

CHANGE IN EU27 GAS PROCUREMENT COST DUE TO ADDITIONAL EXIT FEE, %



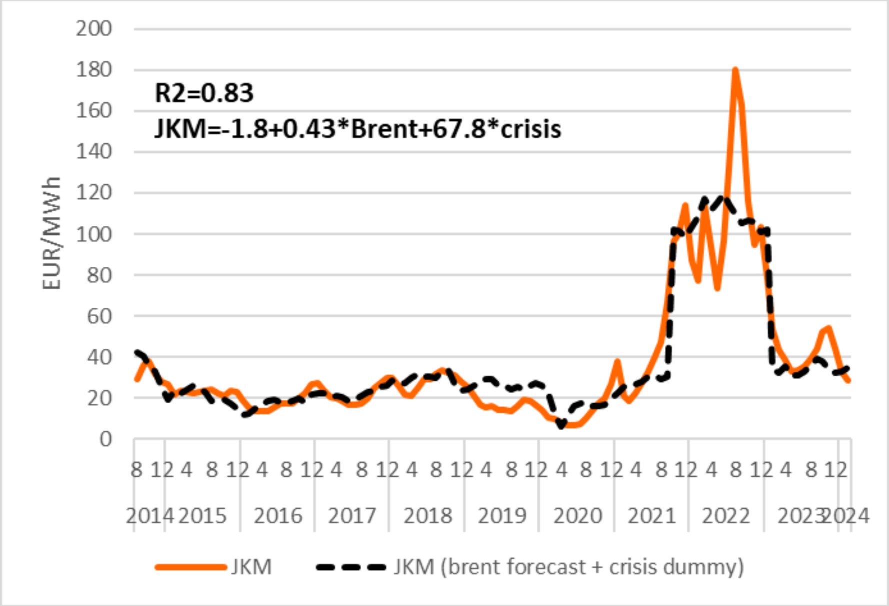
CHANGE IN GAS PROCUREMENT COST DUE TO +3 EUR/MWH EXIT, % (JP=35, REF DEMAND)



ANNEXES – ASSUMPTIONS AND MODEL VALIDATION

JKM forecast – Brent based estimate

- JKM prices can be estimated based on Brent using a simple OLS estimate
- For crisis period, dummy used
- Estimation period: 2014.08 – 2024.02.



ÖSSZESÍTŐ TÁBLA

Regressziós statisztika	
r értéke	0.91454
r-négyzet	0.83639
Korrigált r-négyzet	0.83346
Standard hiba	13.22
Megfigyelések	115

VARIANCIAANALÍZIS

	df	*SS*	*MS*	*F*	*ignifikanciája*
Regresszió	2	100062	50031.1	286.27	9.4E-45
Maradék	112	19574.1	174.769		
Összesen	114	119636			

	Koefficiens	*eandard hil*	*t érték*	*p-érték*	*Alsó 95%*	*Felső 95%*
Tengelymetszet	-1.8138	4.92004	-0.3686	0.71309	-11.562	
Brent ár t	0.43522	0.0777	5.60126	1.5E-07	0.28127	
Crisis dummy	67.7652	4.46713	15.1698	6.3E-29	58.9141	76.6162

BRENT	JKM
50	19.9
60	24.3
70	28.7
80	33.0
90	37.4
100	41.7
110	46.1
120	50.4
130	54.8
140	59.1
150	63.5
160	67.8
170	72.2
85	35.2
83	34.3

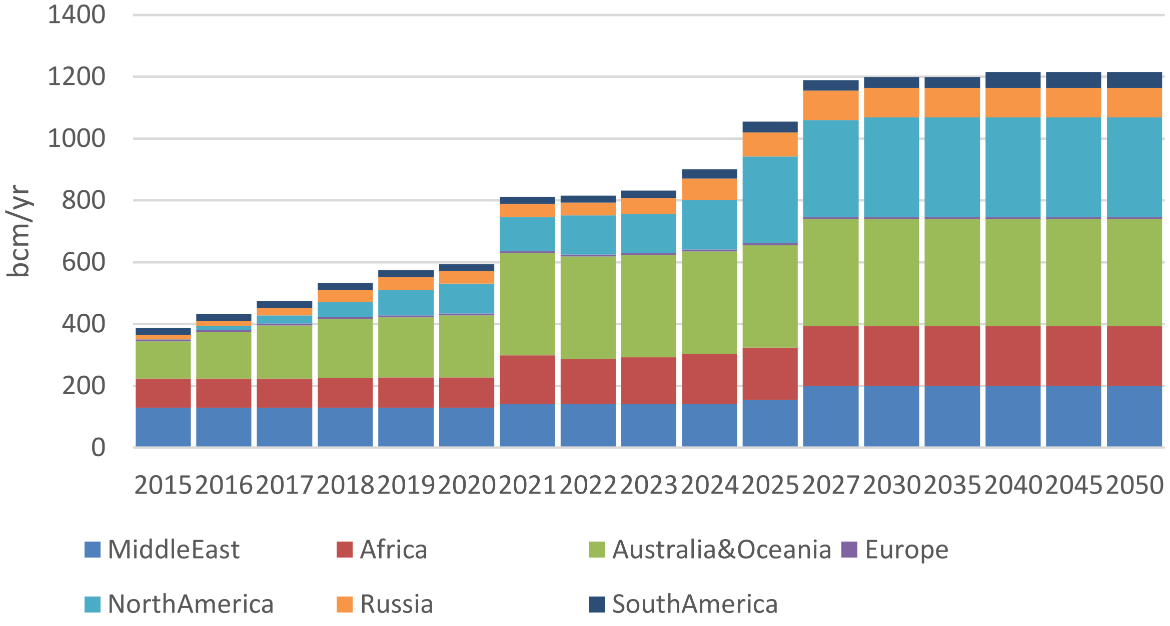
Low ~25

High ~45

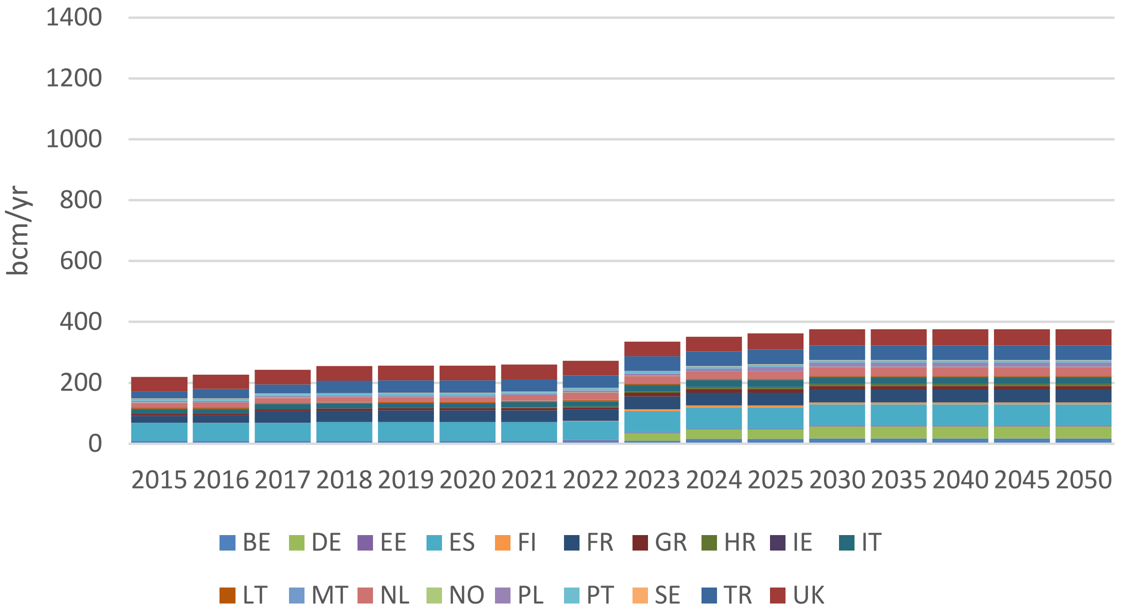
REF ~35

LNG capacities assumed

GLOBAL LIQUEFACTION CAPACITY (OPERATING+CONSTRUCTION+FID)

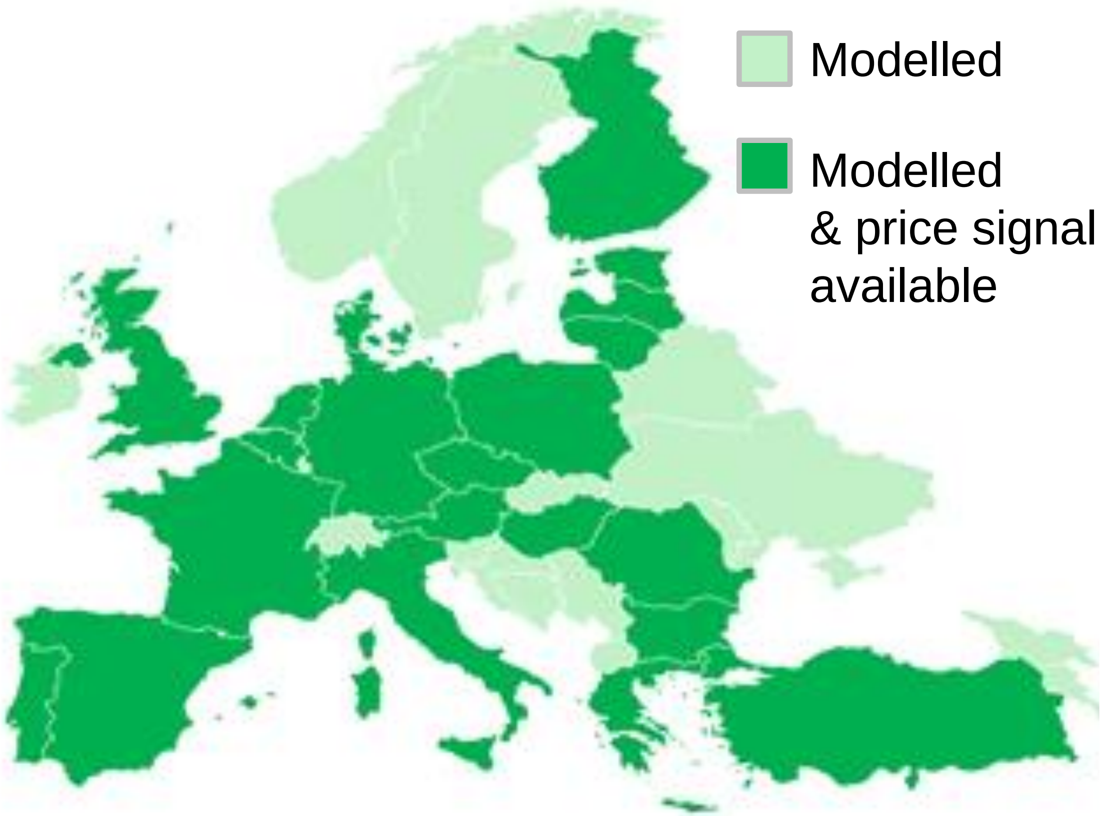


EUROPEAN REGASIFICATION CAPACITY (OPERATING+CONSTRUCTION+FID)



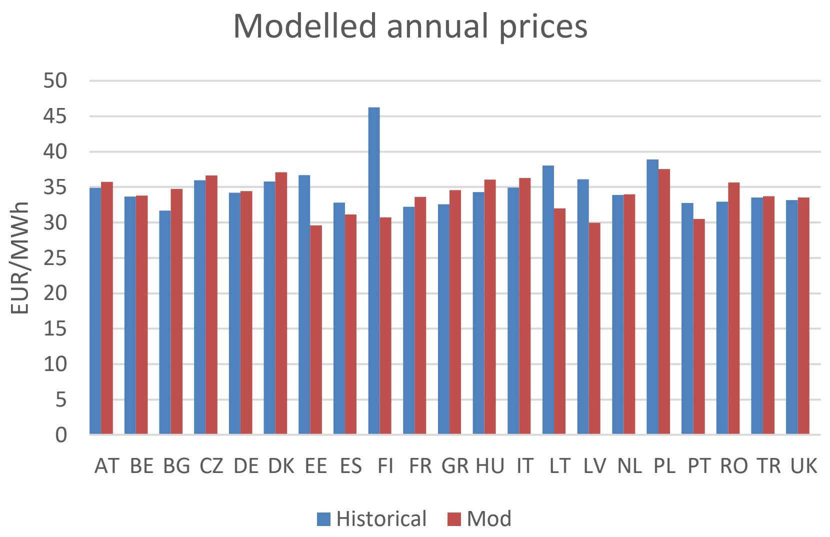
MODEL VALIDATION FOR 2023

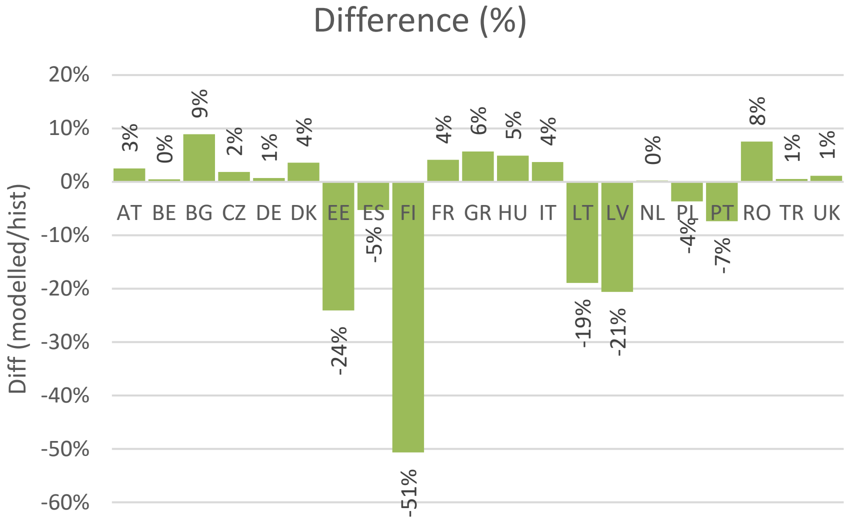
Prices



Modelled

Modelled & price signal available

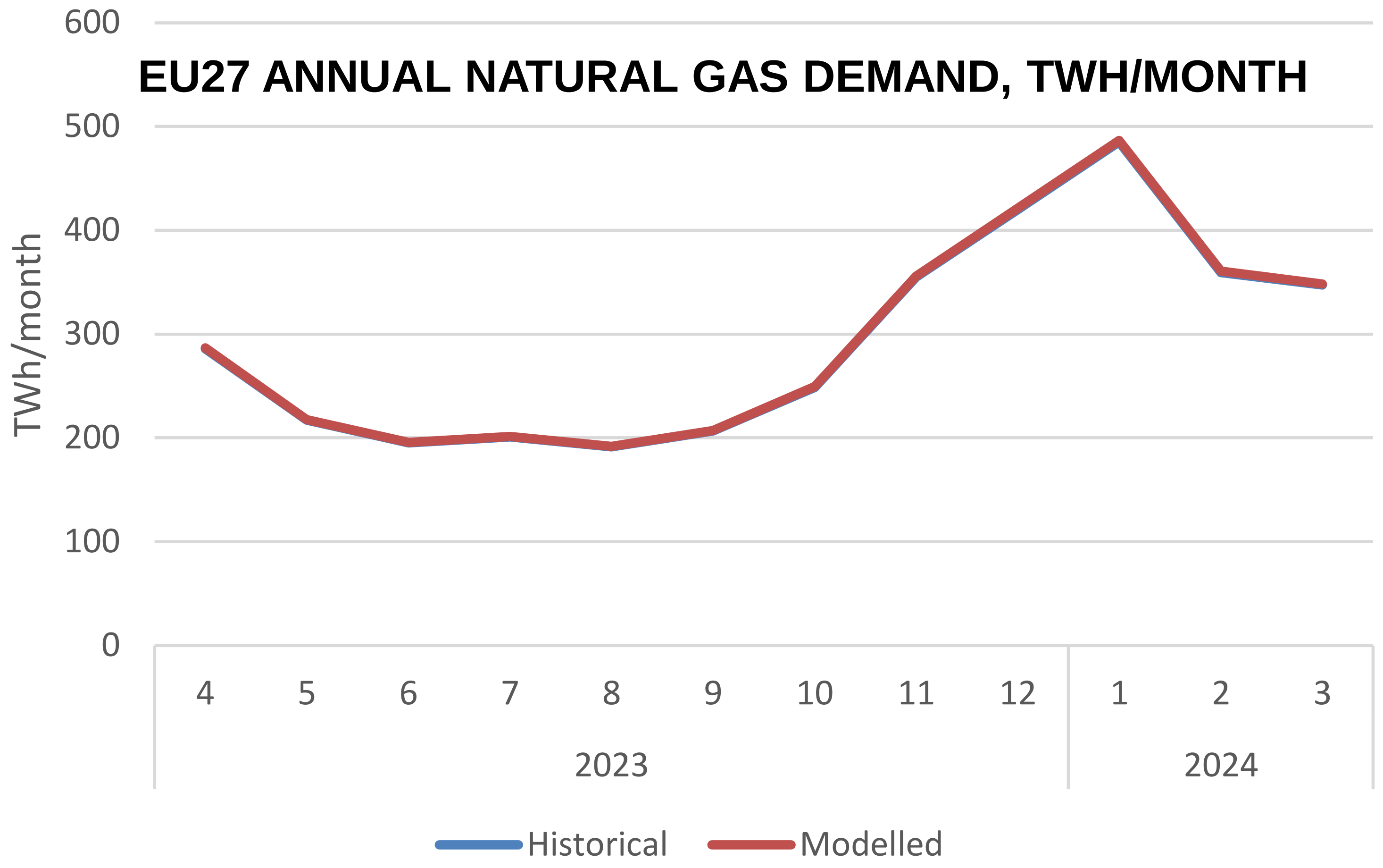




38 Modelled national markets (light green)
20 markets have published price on exchange, so these can be compared

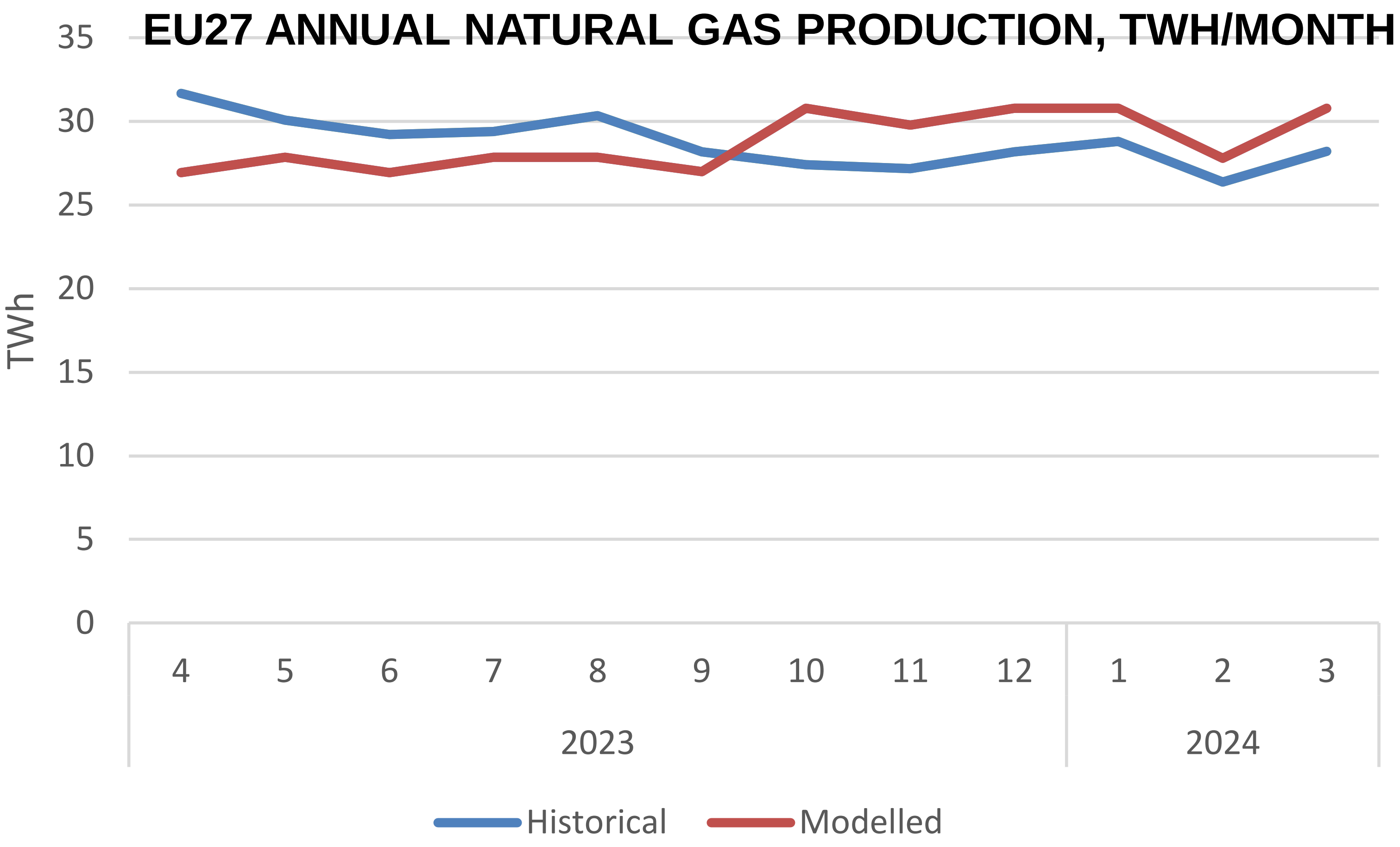
For 2023 the model estimated historical prices with a 1% difference in 4 major markets **(BE, DE, NL, TR)**, and in 17 markets **(AT, BE, BG, CZ, DE, DK, ES, FR, GR, HU, IT, NL, PL, PT, RO, TR, UK)** the difference was below 5%. In the Baltic markets **(FI, EE, LV, LT)**, the model **under-estimated** the price levels with more than 10%.

Consumption



- Country-level monthly consumption was obtained from Eurostat and Jodigas
- Below 1% difference
- Covers Final Energy Consumption (Industry, Buildings, Other sectors) and Transformation input (Power & heat generation)

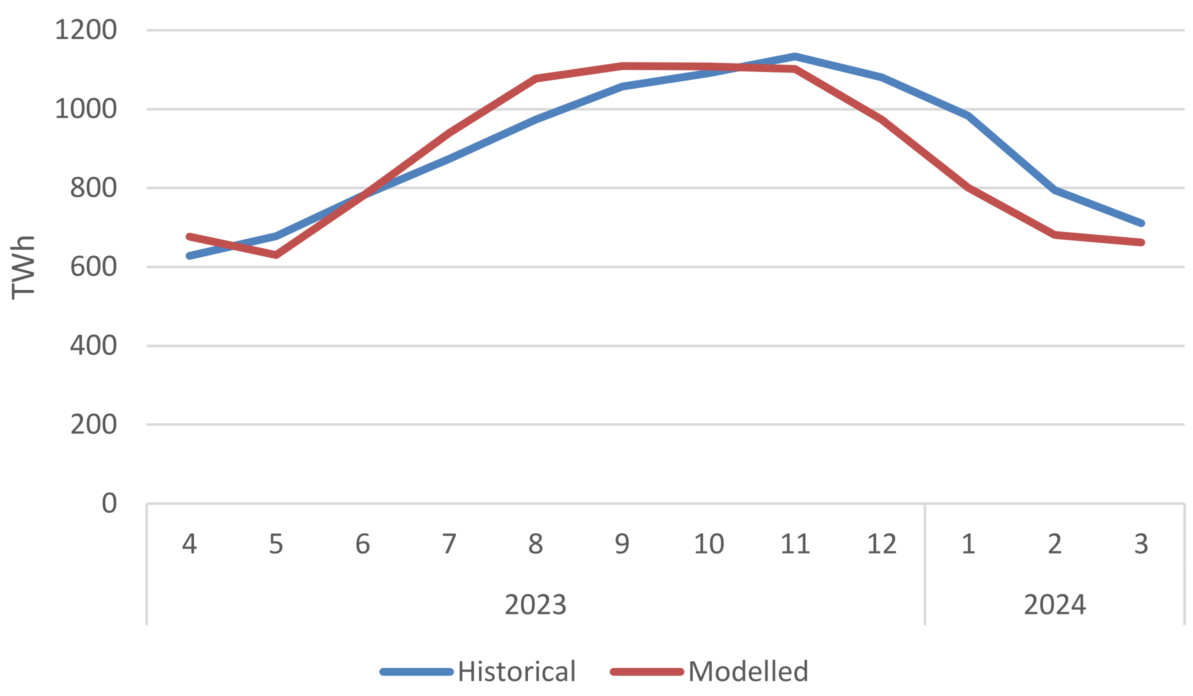
Production



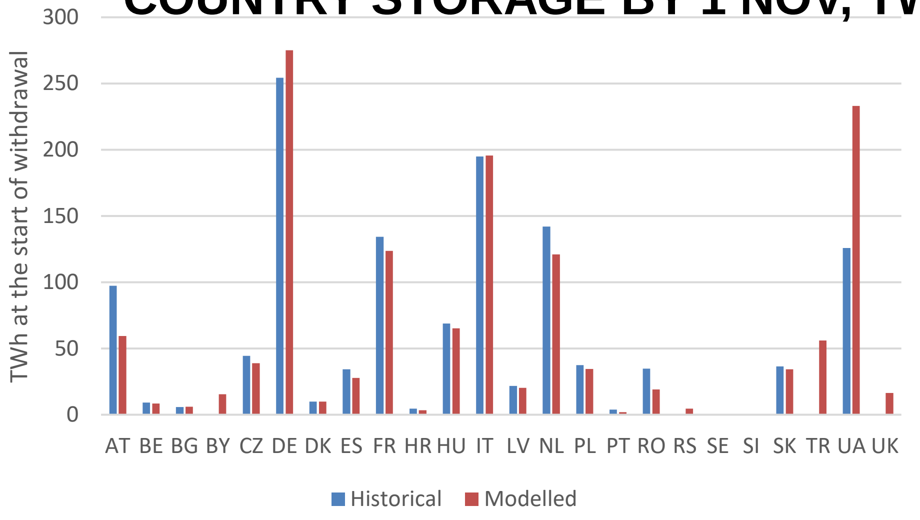
- Country-level monthly consumption was obtained from Eurostat and Jodigas
- Modelled production was at the same level annually, but monthly production differed somewhat

Storages

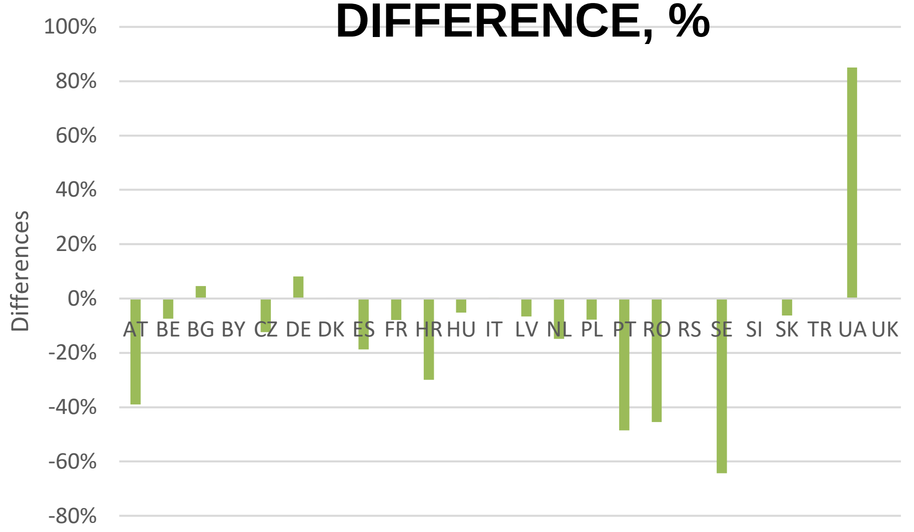
EU27 STORAGE WG LEVEL, TWH/MONTH



COUNTRY STORAGE BY 1 NOV, TWh



DIFFERENCE, %

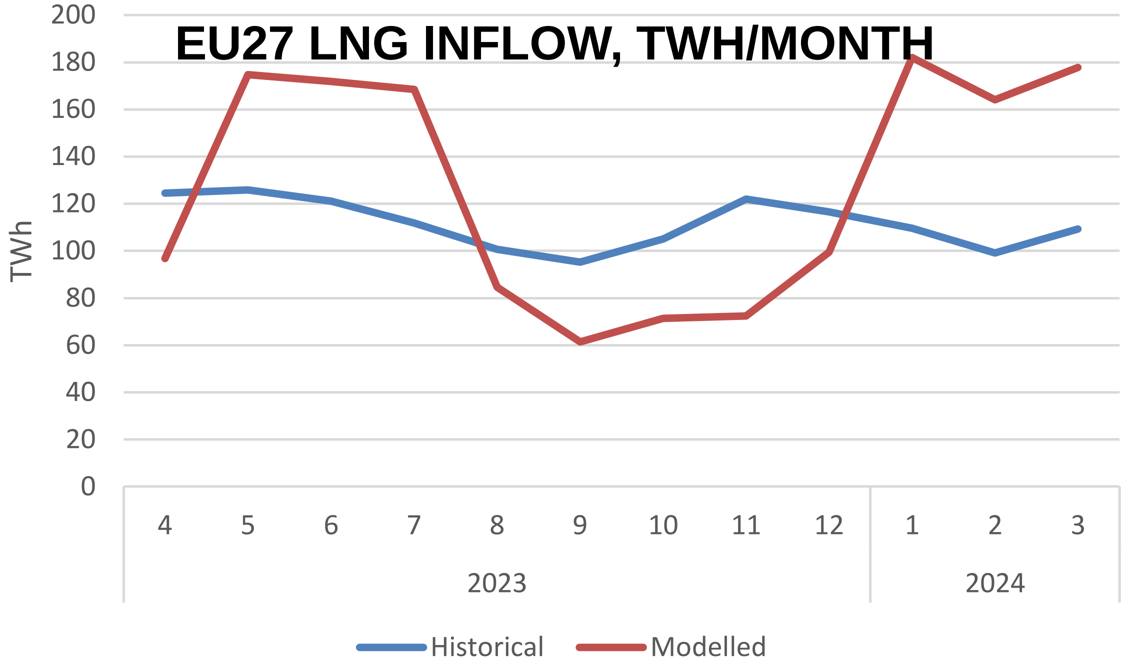


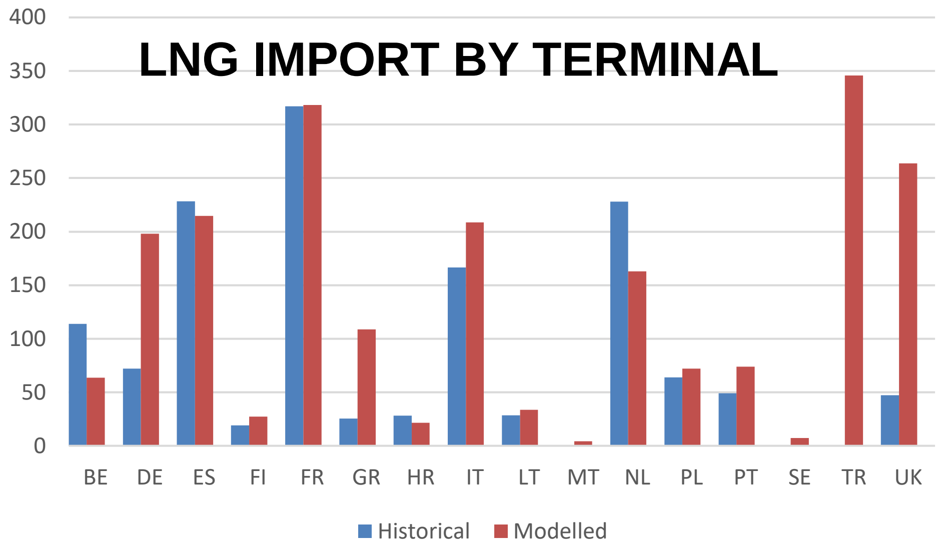
The storage targets set by the European Commission to fill up facilities to 90% by October 2023 were explicitly modelled.

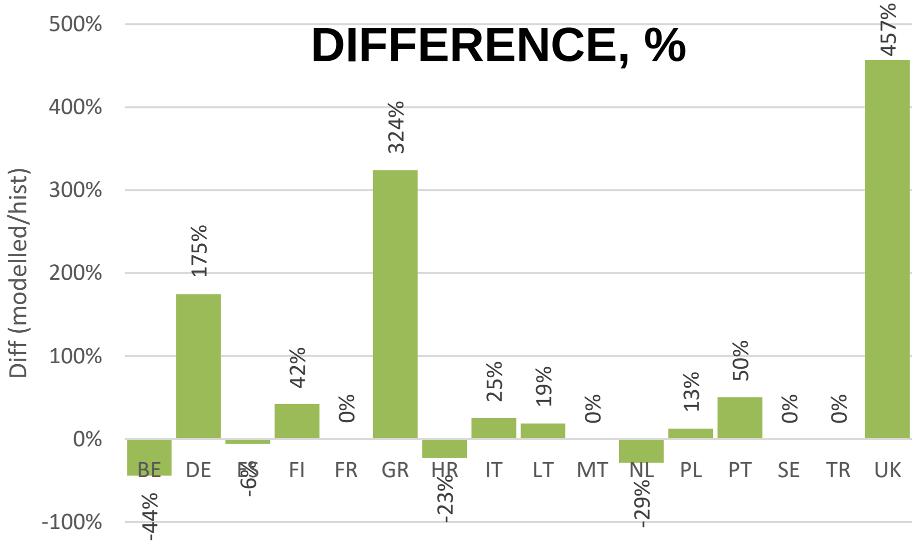
DE and UA storage are used more than data suggests

7Fields and Haidach re-located to DE from AT (being connected to DE network)

LNG







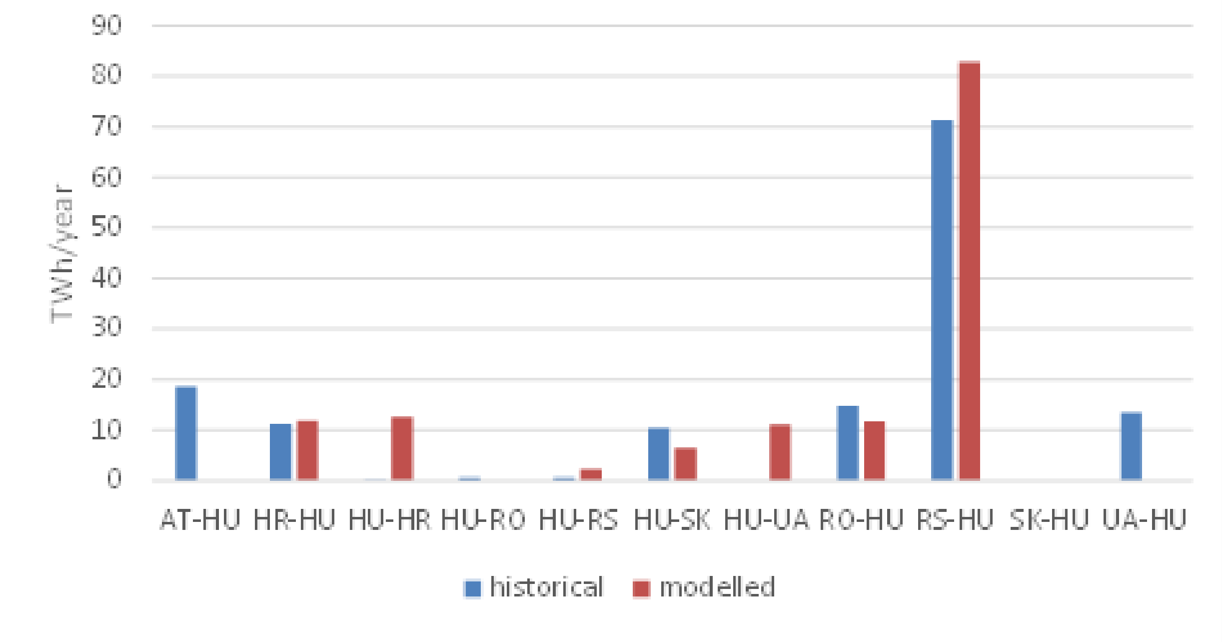
LNG data from ALSI

No data on TR and all UK terminals

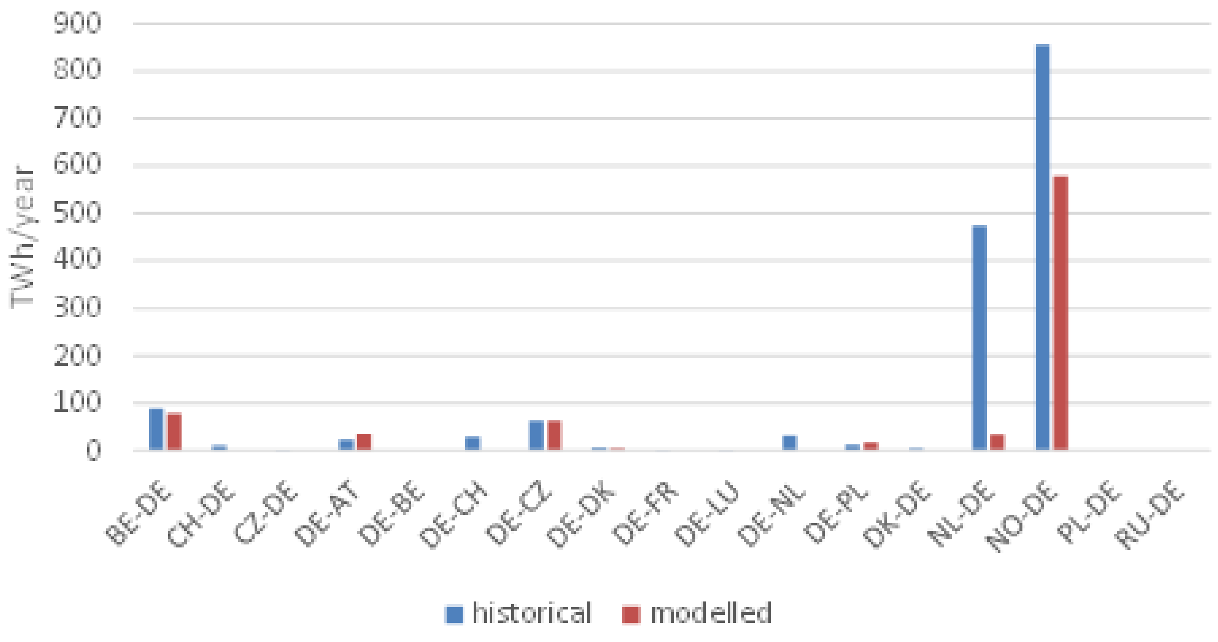
Modelled EU27 LNG inflow was 14% higher than historical data

Pipeline flows

PIPELINE FLOWS HU, TWH/MONTH

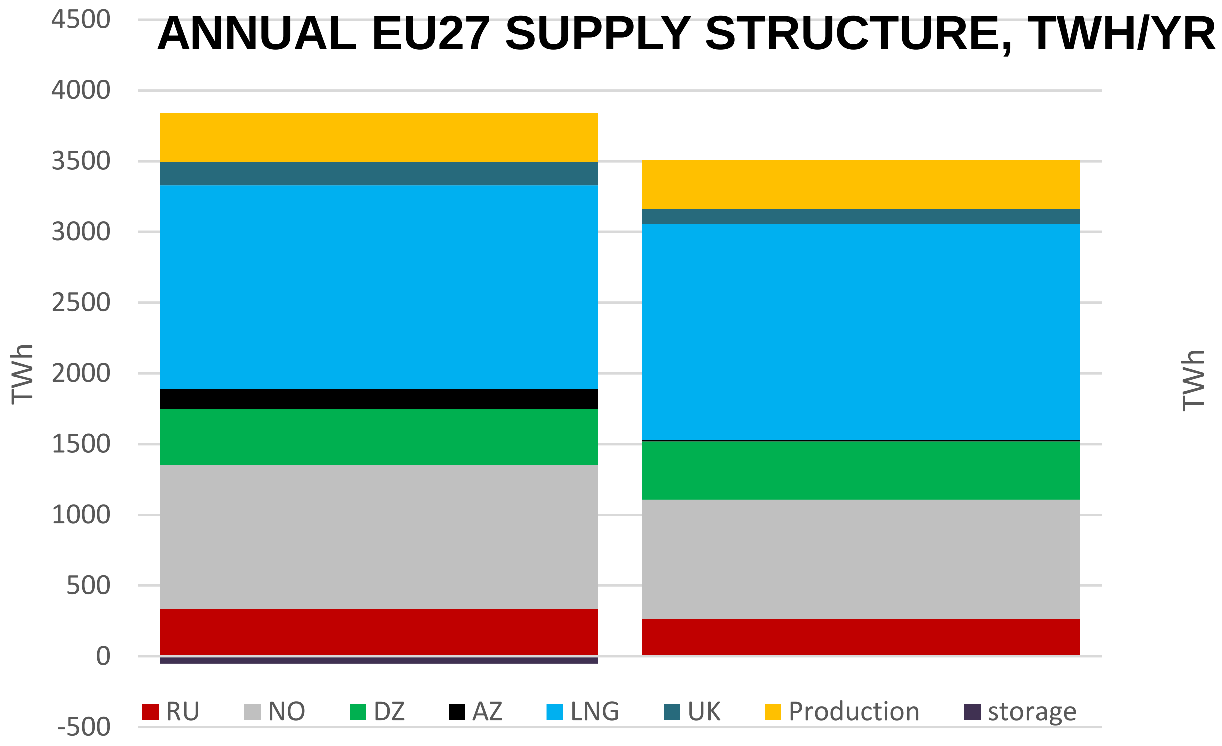


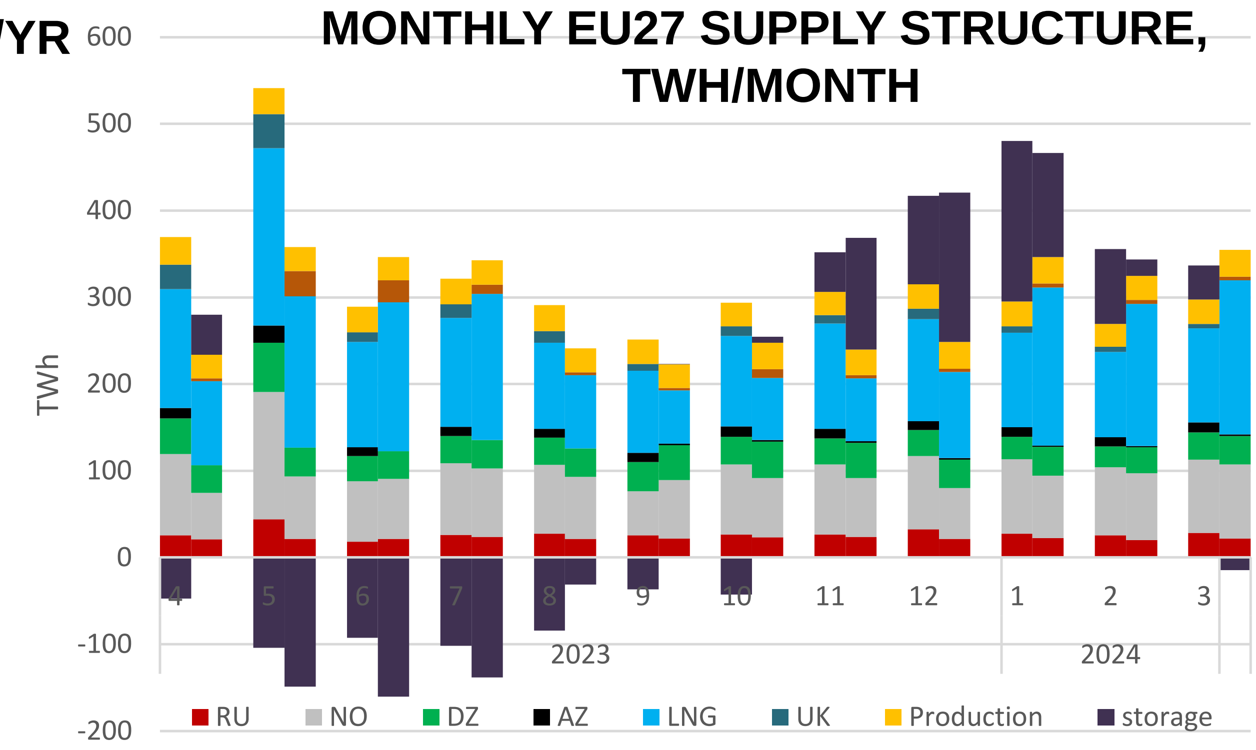
PIPELINE FLOWS DE, TWH/MONTH



- ENTSOG transparency platform pipeline flows compared to modelled results
- Country-level comparison due to high number of pipelines
- Model under-estimates pipeline use in favor of LNG

Supply structure





- Historical data from Bruegel
- Demand modelled 2% lower
- Monthly storge utilisation and supply structure fits in winter months, differs slightly in summer months

Overall model fit for 2023

MODEL DEVIATION BY ANNUAL MARKETS, AND INFRASTRUCTURE											
	Total	over -10%	-5-10%	-5-1%	-1-0%	0-1%	1-5%	5-10%	Over 10%	Within 1%	Within 5%
Price	5%	5%	0%	19%	5%	0%	67%	0%	5%	5%	90%
Consumption	0%	0%	0%	0%	0%	97%	3%	0%	0%	97%	100%
Production	0%	3%	0%	0%	41%	57%	0%	0%	0%	97%	97%
Storage	-3%	5%	0%	11%	3%	51%	27%	0%	3%	54%	92%
LNG	14%	8%	0%	3%	0%	70%	11%	0%	8%	70%	84%
Pipe	-	50%	0%	4%	21%	0%	10%	0%	16%	21%	35%
Supply Structure	-2%	-	-	-	-	-	-	-			

- **Model performs well**
- Prices estimated within 5% difference from historical data for 90% of markets
- Consumption estimated within 1% difference from historical data for 97% of markets
- Production estimated within 1% difference from historical data for 97% of markets
- Storage estimated within 5% difference from historical data for 92% of storages
- LNG flow estimated within 5% difference from historical data for 84% of LNG terminals
- Pipeline flow estimated within 5% difference from historical data for 35% of pipelines
- Supply structure est. within 2% difference from historical data