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Ukrainian coal and gas supply in Winter 2021/22

Current situation and its reasons

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Context and motivation

- At the end of 2021, coal and gas storage levels in Ukraine are much lower than in past years.
- This has raised concerns on supply security in the upcoming winter and politically sensitive dependency on Russian energy supplies.
- This presentation seeks to describe the situation and its main causes to enable a fact-based discussion.

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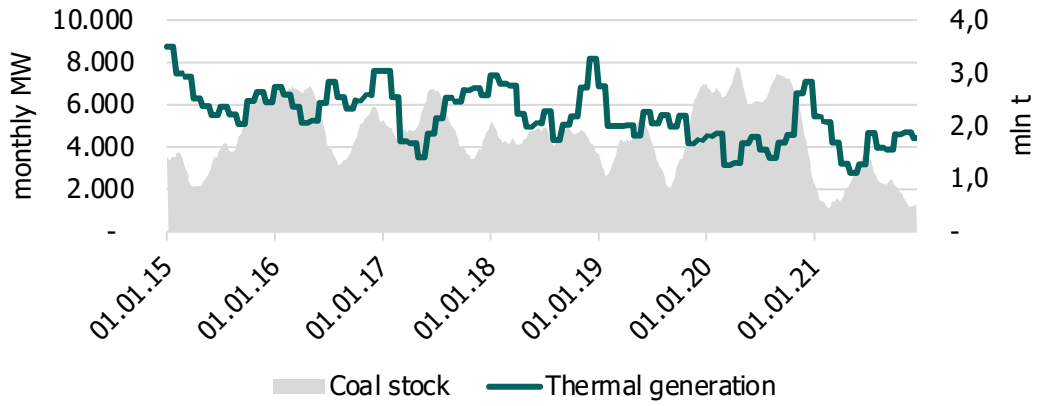
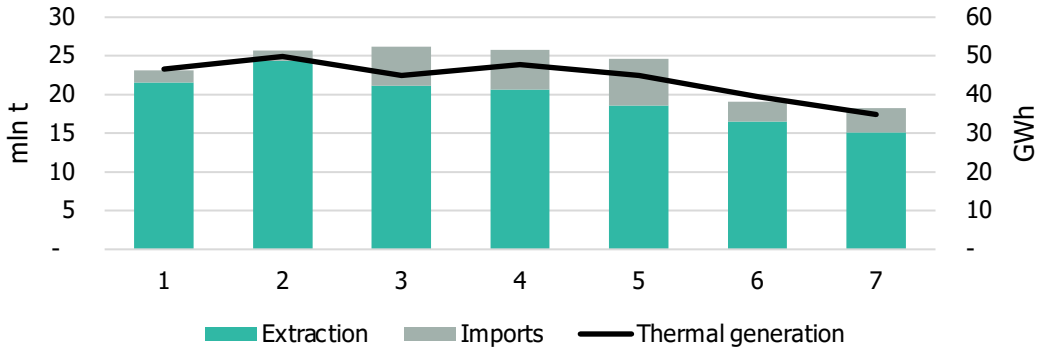
Coal stock at the Ukrainian power stations is at its historic minimum

The rapid consumption of coal during winter 2020-21 was not followed by active procurement

Coal stock at thermal power stations & average generation



Energy coal sourcing



- Coal stock in 2021 was 54% lower than 2015-19 average and 68% lower vs 2020.
- Current coal stock can cover only 10 days of generation but is not evenly distributed among power stations.
- The coal stock level is not linked to the abnormal level of thermal generation or consumption (2020-21 winter was warm and low consumption due to Covid-19).
- Share of imported coal is ~20%, with >70% coming from Russia (incl from DTEK-owned mines). Kazakhstan provided 18% of imported coal in 2021.
- Domestic coal supplies only local power stations and is not exported.
- Extraction has been decreasing faster than the drop in thermal power generation.
- Power plants operators are legally required to keep 10-20 days' coal stock. All companies failed to do so by the end of 2021.

Source: Ministry of Energy of Ukraine, Ukrenergo, own calculations

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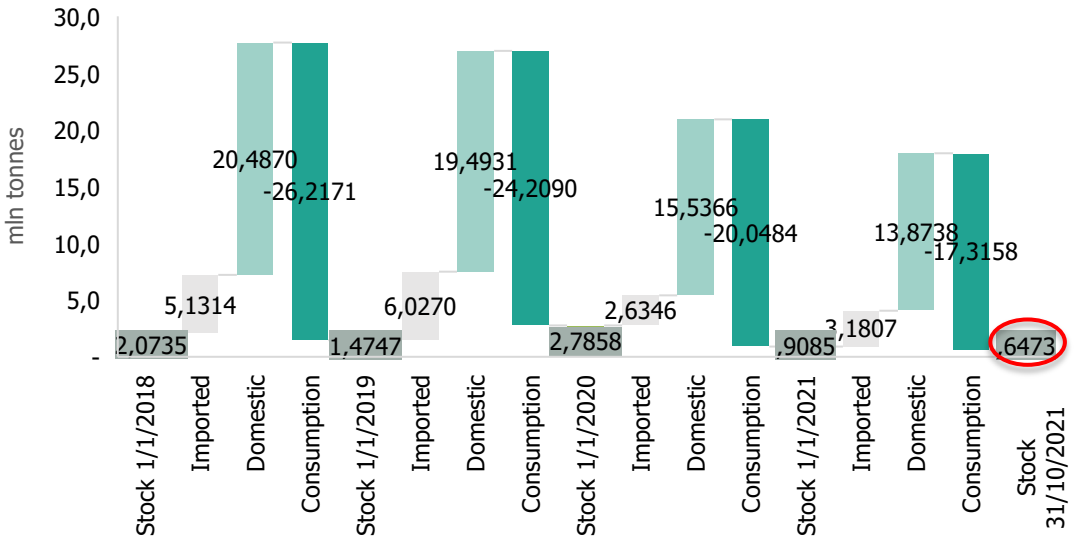
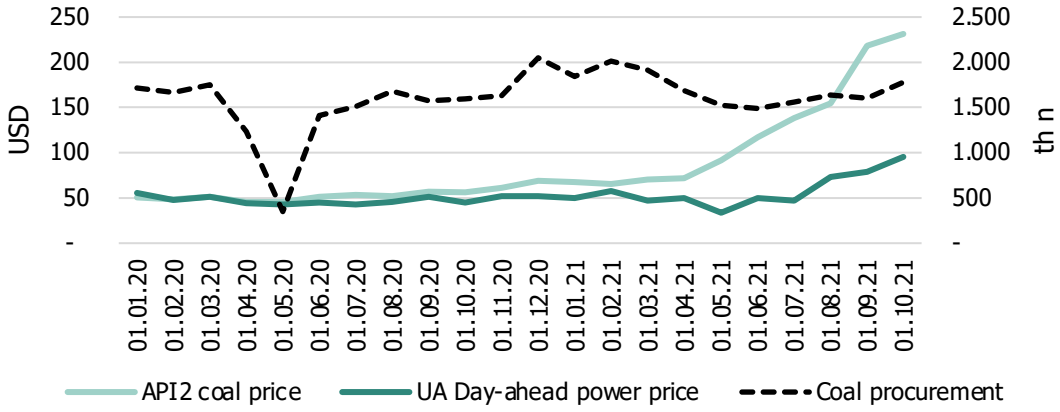
Procurement of coal in 2021 by power generators was too low

This is due to both internal mismanagement and market-wide problems

Coal balance at power stations



Coal procurement and key market prices



Source: Ministry of Energy of Ukraine, UA Market Operator, own calculations

- Previous Ministry of Energy team decreased a minimum requirement for coal stock last winter, which lead to rapid decrease in coal stock.
- Coal procurement during 2021 was not enough to reach the secure level after increase of coal consumption during previous winter. Procurement slow downed following the drop in power price.
- As domestic coal prices are not linked to international market fluctuations, changes in coal prices did not affect procurement much.
- DTEK Energy controls 70% of thermal fleet, 80% of domestic energy coal extraction and imports most of anthracite coal from their own mines in Russian. Worldwide price fluctuations hardly affected the internal cost of coal extracted.
- UA power market has regulatory constraints that have led to cash-flow gaps for power generators:
  - Wholesale market is under tight price caps which were increased in Aug'21.
  - State-owned coal mines and water supply companies have increasing arrears to their power suppliers – implying that power plants have no money to procure coal-
- Accumulated debts (€ 100-150 mln to coal-fired generation) and time gap in increasing price caps might have delayed the coal procurement but are not the decisive factors.

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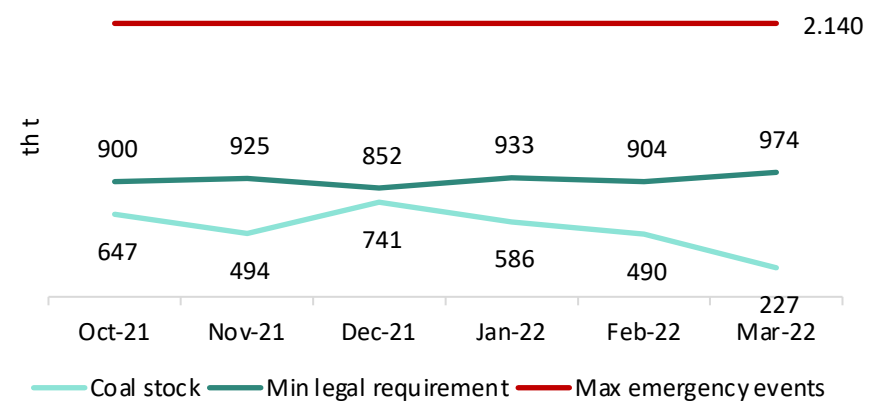
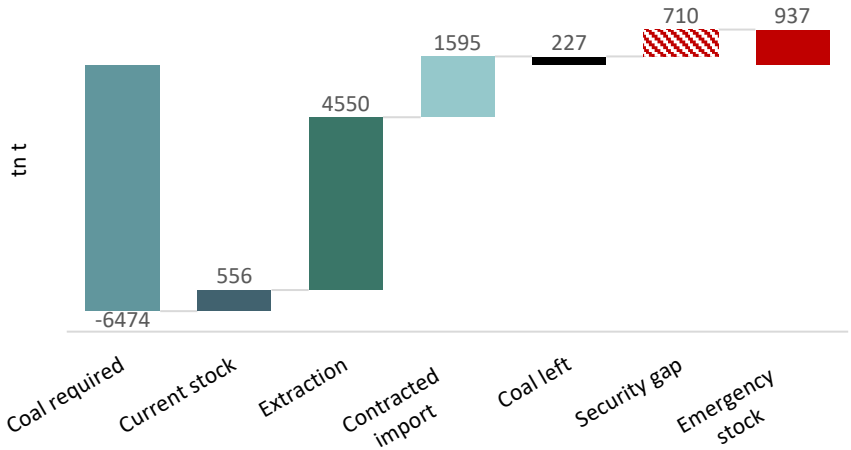
Security of power supply is under risk for winter 2021-22

Lack of coal may spill over into the already strained gas sector

Monthly coal stock estimation



Estimated coal required by Mar'22



Source: Ministry of Energy of Ukraine, Ukrenergo, own calculations

- Power companies have already started diversifying the coal supply, procuring up to 300 th t per month from the US, Columbia and Poland as well as 100-110 th t of anthracite from DTEK-owned mines in Russia.
- Russian Federation has blocked railway transit of Kazakh coal. It may also block shipments of coal from their territory and any sea route shipments via the Black sea, including re-routing of shipments from Kazakhstan. This puts 75% of the currently contracted import of coal under jeopardy.
- Nevertheless, the coal stock is on a thin margin and other events may contribute to increased demand:
  - Low water levels and no snow so far limit hydro generation;
  - Potential power imports blockade from Belarus and Russia;
  - Nuclear power plants are now operating at historic maximum (14 out of 15 blocks, total >12GW). Failure of 1 block (1 GW) or 1 biggest power station (6 GW) can only be replaced by domestic coal generation;
  - Colder winter (2C in our analysis) would add up to coal demand.
- Power system remains susceptible to a range or risks, which would lead to increased load on thermal power plants and additional demand for coal that cannot be met.
- Ukrainian power plants can burn natural gas instead of coal, but this would lead to other problems:
  - Power market price caps are below marginal costs of burning natural gas – additional financial mechanism would need to be established (already under consideration by authorities);
  - Additional demand for natural gas may break the fragile gas balance.

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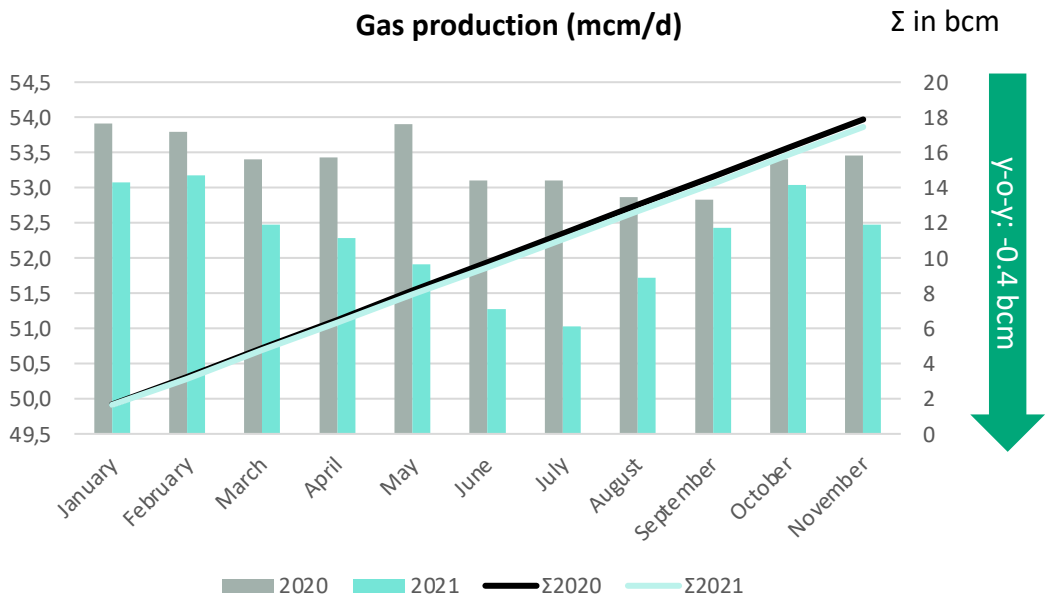
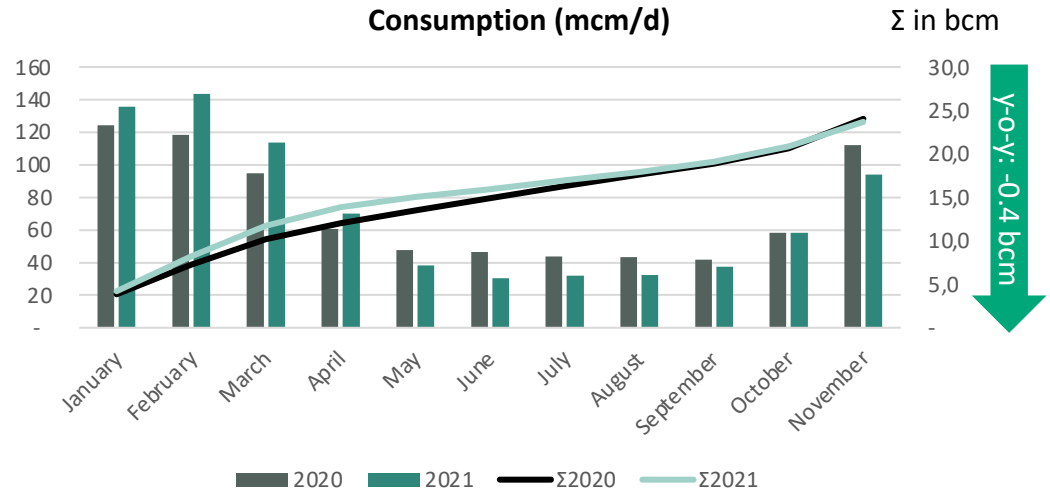
The Ukrainian natural gas production and consumption remained stable

But Ukraine continues to rely on imports





Source: Gas TSO of Ukraine, own calculations

- Ukrainian gas production until November 2021 was 2% lower than in 2020. The drop was due to state-owned Naftogaz' subsidiary UGV extracting less gas. This resulted in 0.4 billion cubic meters (bcm) less being available to the market.
- While cold weather implied higher gas consumption in the first half of 2021, this was off-set by lower consumption in the second half. Overall, Jan-Nov gas consumption is 1% lower than last year.
- Hence, the Jan-Nov domestic gas balance remains unchanged compared to 2020 at -6.2 bcm.

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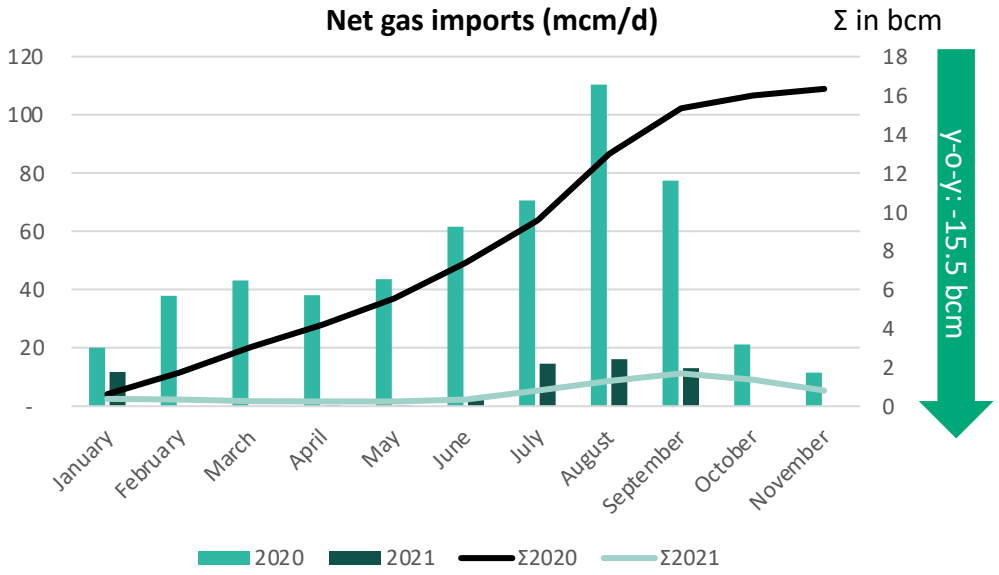
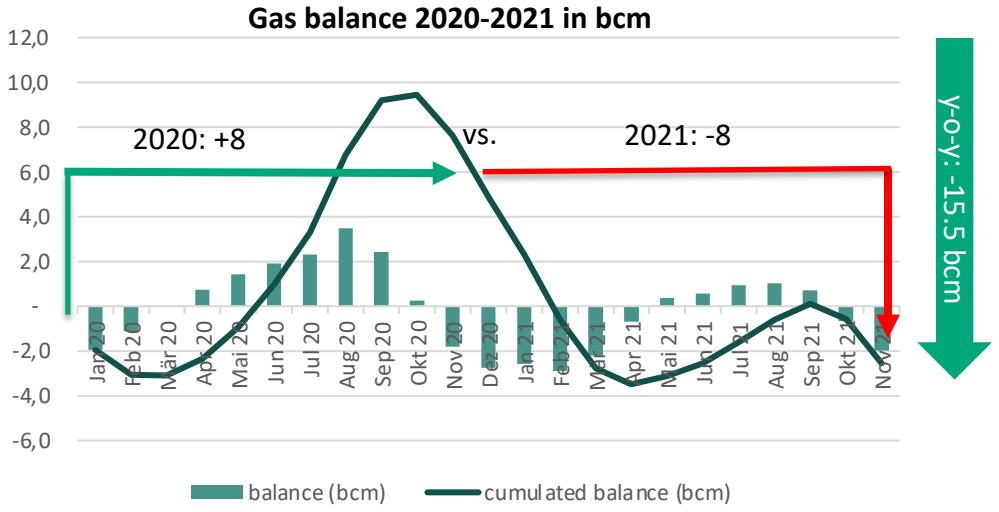
Massive reduction in net-imports causes storages to deplete quickly

Substantial storage built in 2020 was followed by record withdrawals in 2021



- In Jan-Nov, net gas imports (i.e., inflows minus outflows) were 90% lower than last year – summing up to a deficit of 15.5 bcm.



- Until Oct 2020, Ukraine accumulated gas.
- Until May 2021, there was a substantial reduction in the balance.
- Until Sep 2021, followed a modest re-accumulation.
- Oct and Nov 2021 again saw a reduction.

Source: Gas TSO of Ukraine, own calculations

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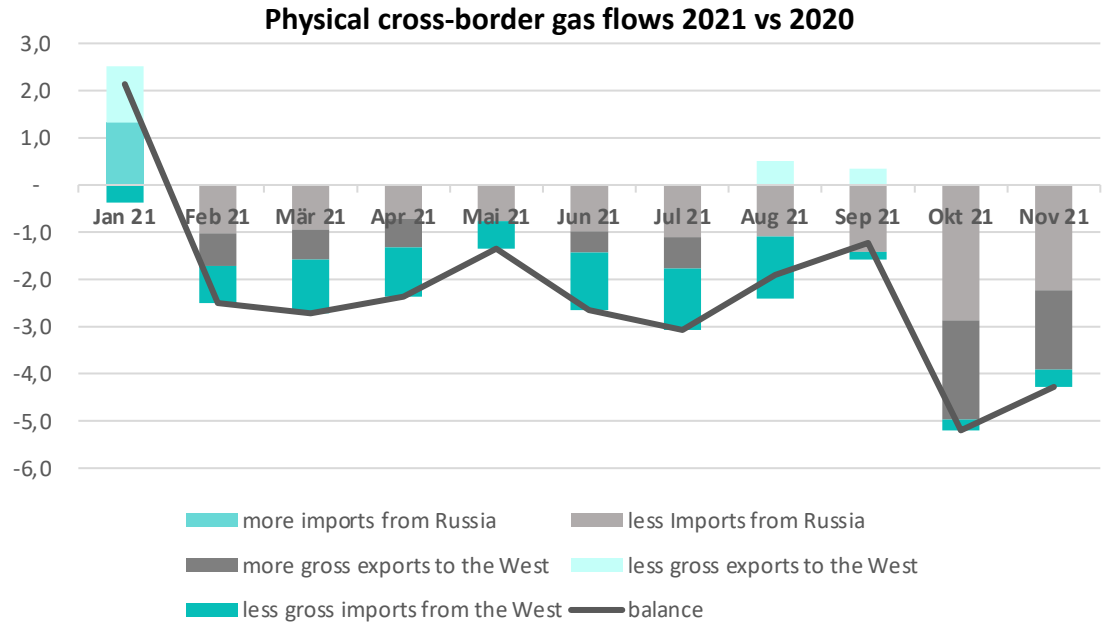
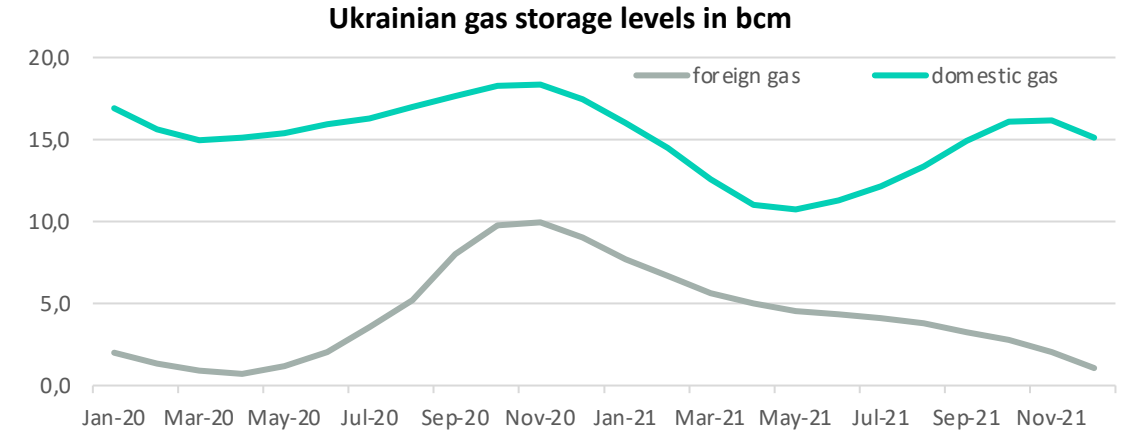
Storage withdrawals 2021 due to two reasons: less imports, more exports

Foreign gas stored in Ukraine was sent back to the EU, while Ukraine also accumulated less for the winter





Source: Naftogaz; Gas TSO of Ukraine
Note: Domestic gas includes about 5 bcm of "cushion" gas that cannot be used

Note: We only look into physical flows, as we do not observe the commercial contracts behind them

- Substantial reduction in inflows from Russia as transit was re-routed and reduced.
- Transit dropped from more than 80 bcm in 2019, to a contracted 65 bcm in 2020, and 40 bcm in 2021. Daily volumes often were occasionally at only 80 mcm/d while Gazprom had to pay for 110 mcm/d.
- This lack of carrying flows made (virtual) reverse flows from the EU to Ukraine much more difficult.
- Substantial reduction in in-flows from the West and increasing out-flows to the West as traders were reducing the substantial amount of gas they accumulated during the phase of low European gas prices in 2020.
- In November 2020, more than one third of the gas in Ukrainian storages was "foreign-owned".
- By the end of 2021, the volume of foreign-owned gas in Ukrainian storages dropped from 10 bcm to 1 bcm.
- Ukrainians (likely Naftogaz) managed to store 15 bcm by end of Nov 2021.

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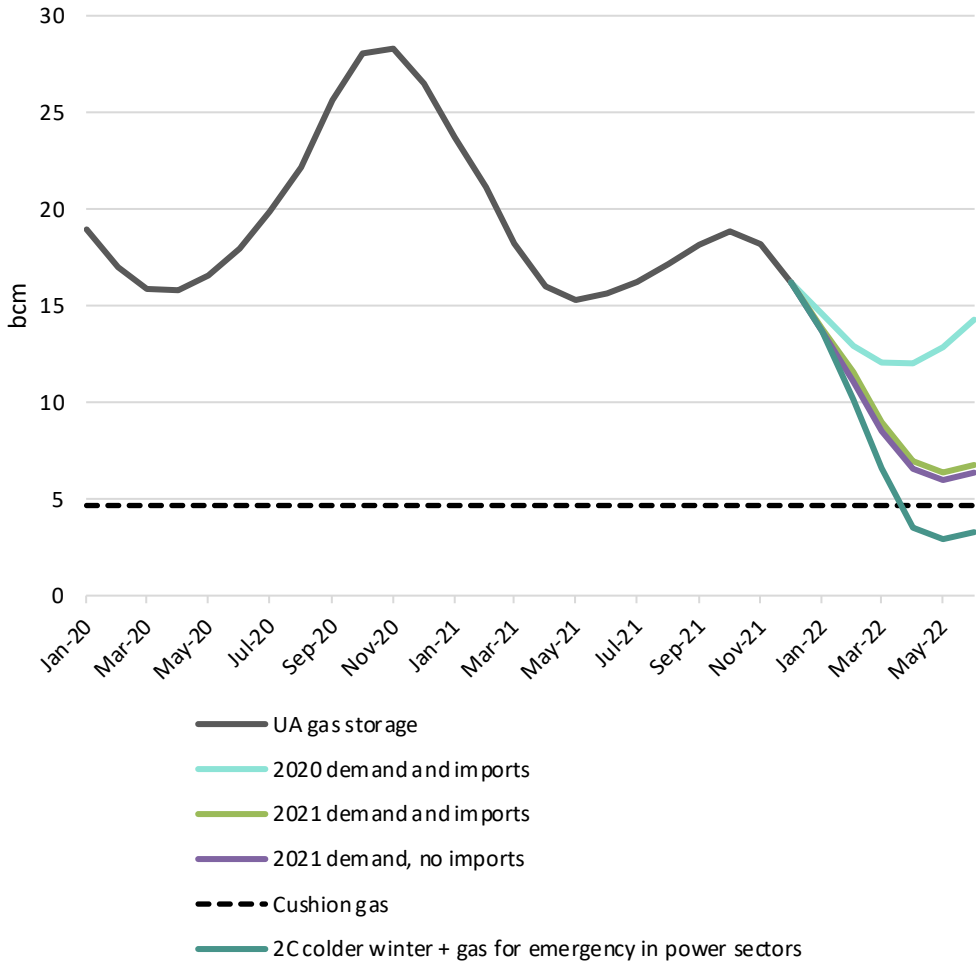
Projection: In most scenarios there should be enough gas for this winter

However, it would be hard to accumulate enough gas for the next season if bottlenecks remain

Simplistic scenarios for storage levels



Source: Naftogaz, own calculations

- If there will be a relatively cold winter (like 2020/21) and production remains flat, net imports could drop from current low levels to zero without depleting Ukrainian storages.
- Only if demand is 10% higher than in last winter (e.g., because of issues in the power sector), storages would not be able to cope.
- If emergency events occur in the power sector, additional gas demand will likely deplete the storage levels below allowed “cushion” level.
- The real test will be refilling almost empty Ukrainian storages after the winter 2021/22, should Russia stop transit (as it can re-route through NS2) and thereby also make reverse flows from the West much more challenging.
- Another challenge is financials of the Naftogaz group. Subsidization of residential supply and district heating companies, combined with high tax on subsoil use and current high gas price might affect the replenishment of gas storages.

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Conclusion: Structural measures need to be prepared for the next winter

EU/DE should support framework to enable/encourage market actors to contribute to supply security

- **It can all go well this winter – but risks remain.**
- Ukraine's energy system runs on a very tight margin.
- Small accidental or forced problems might unbalance the system:
  - No buffer to replace eventual shortfall in nuclear generation;
  - Planned electricity system decoupling from RU/BY in February might make the system very vulnerable;
  - Blockade of coal imports through the Black Sea would have disproportionate effect;
  - Open question: vulnerability of oil/products imports.
- **Current crisis is partly of Ukraine's own making.**
- Ukraine has enough storage space and generation capacity for secure winter operation, but:
  - Corporate governance issues in Naftogaz and Ukrenergo may undermine access to foreign finance;
  - Financial architecture of Ukraine's energy system does not provide enough funds and incentives for storing coal and gas;
  - Uncertainty over property rights deters foreign gas traders.
- **After the winter is before the next winter.**
  - Ukraine's coal and electricity stocks will be very low in April;
  - Squeezed nuclear will have to go into maintenance;
  - Reverse flows of gas might become structurally more difficult (especially if full rerouting through Nord Stream 2 is permitted);
  - Still no cash for storing up coal and gas for the next season. Heavy subsidisation of residential energy supply combined with record-high energy prices has pushed the financial balance to the brink.

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