



German
Economic
Team

02 | MAR 2024

POLICY BRIEFING
MOLDOVA

Energy Monitor Moldova

Pavel Bilek, Henriette Weser, Anubha Bhatia, Julian Grinschgl

Executive summary

- » The Moldovan energy system is characterised by a high degree of supply dependency for natural gas, petroleum products and electricity, posing significant risks:
 - Supply dependence is high on energy supplies from RUS and left-bank MDA
 - Recent efforts to increase regional integration, market unbundling and energy supply diversification have yielded some results, but much work remains to be done
 - Despite diversifying gas imports away from RUS, future imports from TUR may include RUS gas
- » During the winter 2022/2023, MDA underwent the biggest energy crisis in its history as RUS reduced gas supplies and electricity flows from left-bank MDA stopped:
 - Crisis highlighted vulnerabilities, but ROU was able to fulfil MDA's electricity demand, albeit with significant electricity demand reductions and at a higher price
 - Rising prices for gas and electricity increased the already high levels of energy poverty
- » Pathways forward focus on installing additional capacity (especially renewables but also possibly a smaller gas plant) and improving energy efficiency (EE) in both residential and public buildings:
 - RES auctions finally expected in Q2-24 after long delays
 - Significant attention paid by government and donor community to funding EE projects
- » Nonetheless, any disruption of the effectively free Russian natural gas that flows to left-bank MDA would have a significant effect on electricity prices in both right- and left-bank MDA, requiring an extension of social compensation mechanisms and additional international support

Structure

1. Introduction
2. Primary energy mix and imports
3. Final energy consumption
4. Sector organisation
5. Electricity sector
6. Gas sector
7. Recent crises and energy security
8. Economic effect of potential gas supply disruptions to left-bank MDA
9. Conclusions and necessary measures

1. Introduction

Background

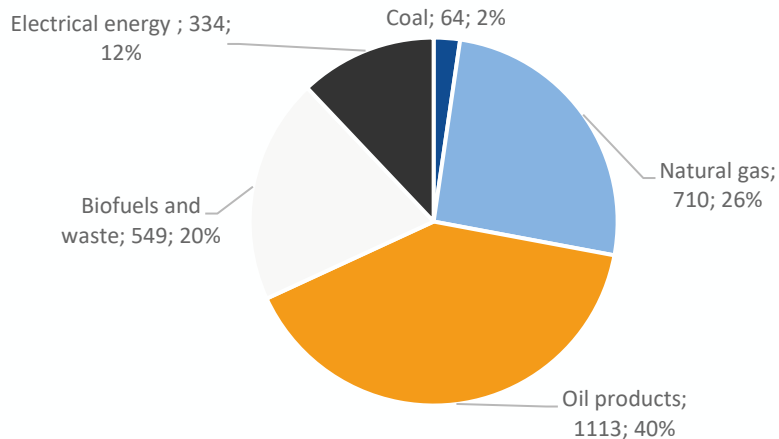
1. MDA suffers from very high energy insecurity due to import dependence for almost all of its energy needs, including the majority of electricity which is produced in the Transnistrian region
2. The country has experienced a series of energy crises in the past few years driven by disruptions of energy supplies, necessitating significant international financial support
3. While improvements have been registered in terms of regional integration, import source diversification, a renewed focus on adding generating capacity and improving energy efficiency, much work remains to be done
4. Any potential disruption to the flow of the effectively free Russian natural gas to left-bank MDA would have significant impacts on electricity prices in the whole of MDA, highlighting existing vulnerabilities and potential impact on population and industry

Purpose of this Policy Briefing

- » Overview and update on the status of the Moldovan energy system
- » Scenario analysis and country-wide economic impacts of potential disruption of natural gas flows to left-bank MDA

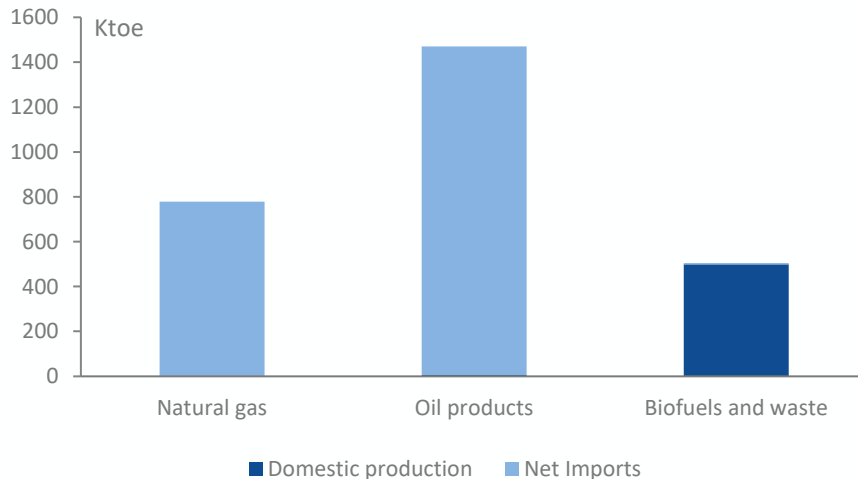
2. Primary energy mix and imports

Total energy supply 2022 (2770 Ktoe)



Source: Statistical Databank, Moldova

Import dependence, 2022



Source: Statistical Databank, Moldova

Energy supply in 2022

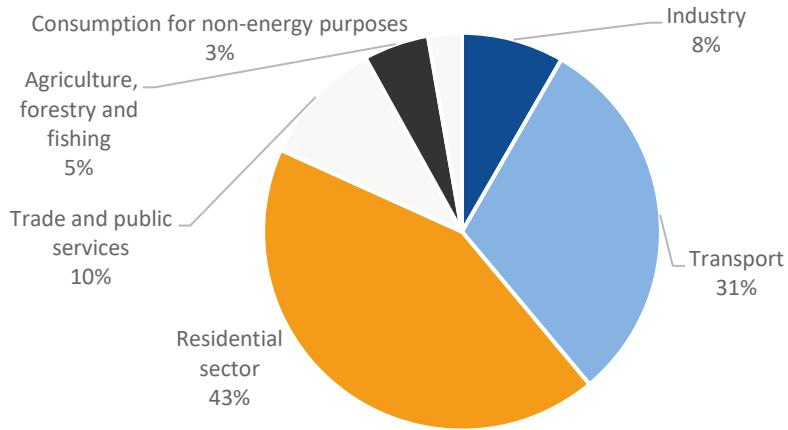
- » MDA's energy mix consisted mainly of natural gas (26%), oil products (40%), and biofuels and waste products (20%)
- » Natural gas was mostly supplied from RUS (approx. 95%); Oil product imports were more diversified, with ROU as key supplier
- » The majority of electricity (68%) was supplied by the Moldavskaya GRES (MGRES) power station located in TN region which even increased to 78% in 2023
- » No domestic oil or gas production: MDA can only cover approx. 20% of its primary energy consumption with domestic energy sources in the form of solid biofuels from agricultural residues

After energy crisis

- » Right-bank MDA stopped importing natural gas from RUS, but is still heavily dependent on electricity generated from Russian gas by MGRES
- MDA faces dual energy security issues, with heavy reliance on fossil fuels and indirect energy imports from RUS

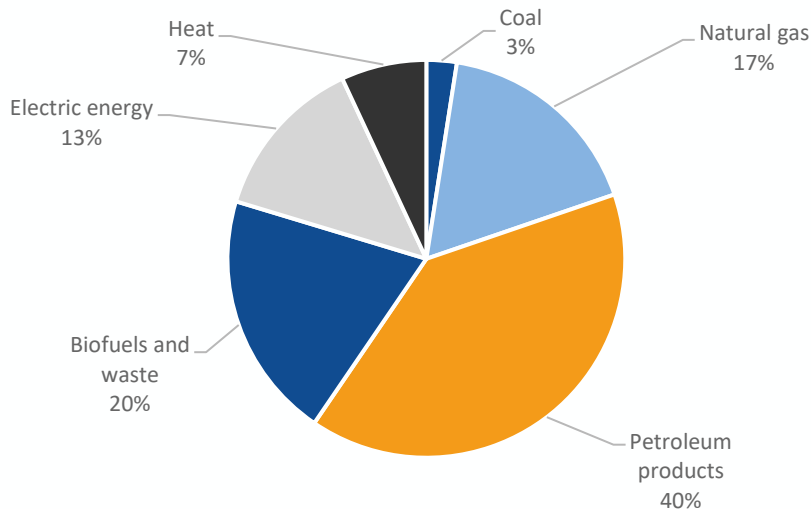
3. Final energy consumption

Final energy consumption by sector 2022 (2592 Ktoe)



Source: Statistical Databank, Moldova

Final energy consumption by source 2022 (2592 Ktoe)



Source: Statistical Databank, Moldova

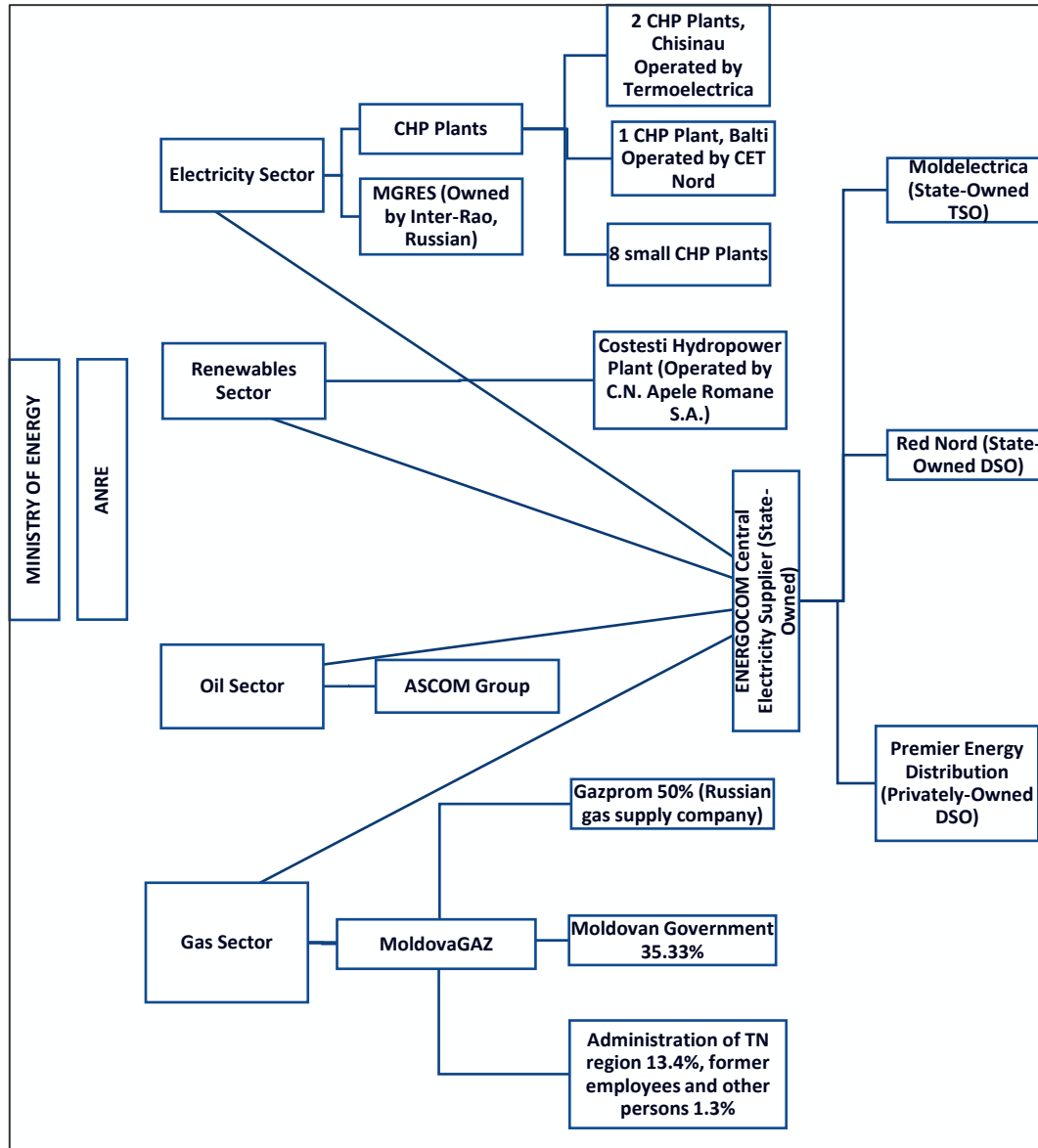
Sectoral consumption

- » The residential sector is the largest energy consumer using mostly biofuels and natural gas and Transport the 2nd largest consumer, mainly fueled by petroleum products such as diesel and gasoline
- » Industrial demand is small given the lack of large-scale manufacturing
- » Energy efficiency of the housing stock and district heat are low, with significant activities planned to improve efficiency

Final consumption

- » The entirely imported petroleum products compose the largest share of energy consumption, with a **37% increase in demand from 2010 to 2022**
- » Biofuels account for 20% of final consumption and their use **grew from 2010 to 2022 by 4.4%**
- MDA's economy, heating, electricity and transport services depend heavily on fossil fuels

4. Sector organisation



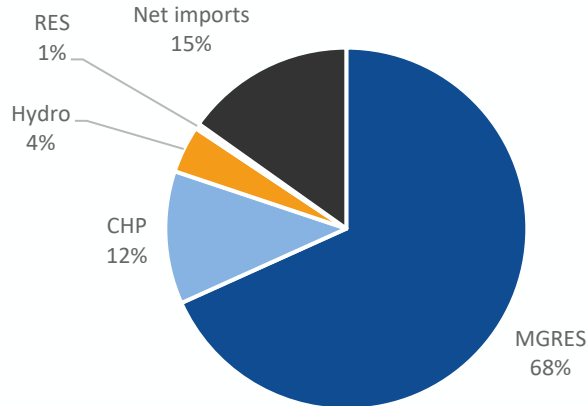
Source: Adapted based on IEA, 2022

Governance and legal structure

- » The **Ministry of Energy** is the central public authority for the energy sector overseeing the development of the energy market and management of state energy property
- » The **National Agency For Energy Regulation (ANRE)** is responsible for implementing the state policies, setting tariffs and monitoring the energy market while maintaining fair competition and transparency
- » The **National Centre for Sustainable Energy** (formerly Energy Efficiency Agency) is the administrative authority supporting the implementation of policies in the areas of energy efficiency (EE) and renewable energy sources (RES), e. g. through the Residential Energy Efficiency Fund (REEF)
- » The Moldovan energy sector is unbundled

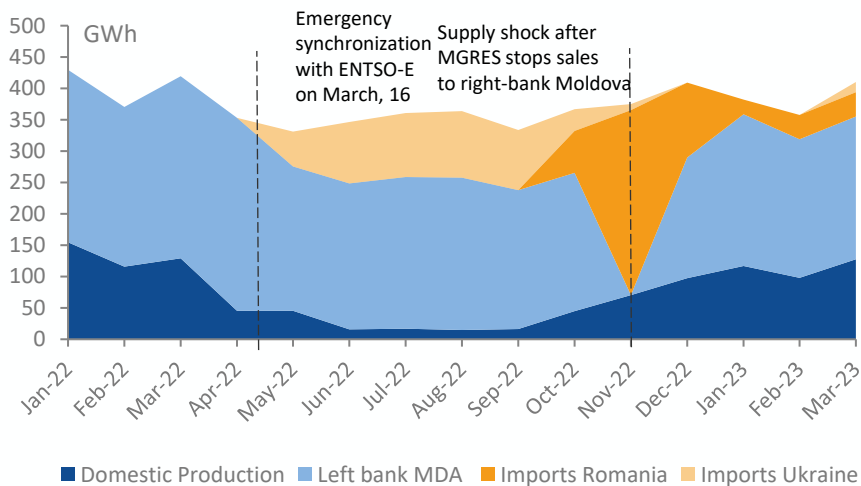
5. Electricity – supply

Electricity supply by technology (6.04 TWh), 2022



Source: Moldelectrica; sum of left- and right-bank Moldova electricity supply

Monthly electricity supply by origin

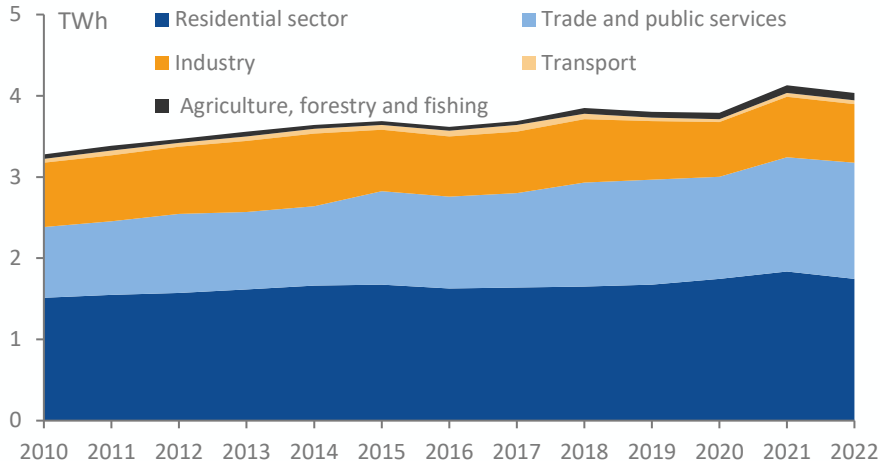


Source: Moldelectrica

- » Total installed capacity in 2024 of electricity generation in right-bank MDA is 599 MW (361 MW CHPs, 16 MW hydro, and 222 MW RES) excluding sugar factories
- » In left-bank MDA total installed capacity equals 2,568 MW with MGRES accounting for 98%, while the Dubăsari hydroelectric power plant contributes the remaining 2%
- » Electricity is mainly generated at the MGRES power station in left-bank MDA, primarily fueled by effectively free gas from RUS
- » The large dependence on MGRES decreases slightly during winters when right-bank MDA powers up its CHPs, increasing the share of domestic electricity production
- » Electricity imports from ROU (and UKR) grew after ENTSO-E emergency synchronization, increasing supply diversification and improving energy security
- Electricity supply is overwhelmingly dependent on left-bank MDA generation, which depends on gas from RUS at below market price

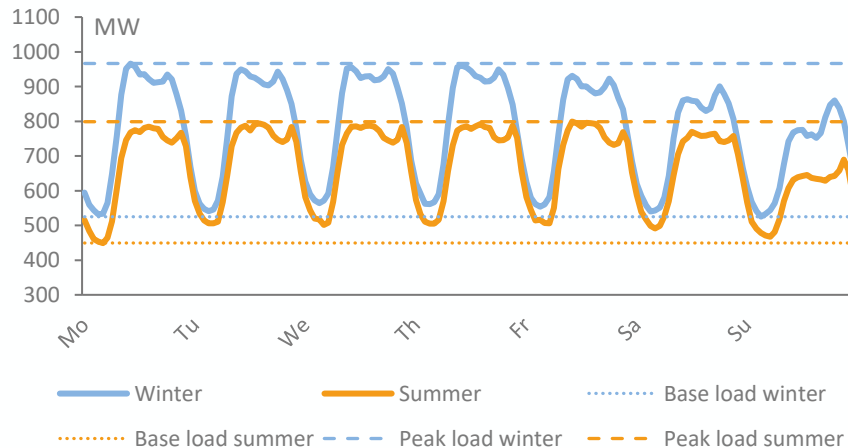
5. Electricity – demand

Final electricity consumption by sector



Source: Statistical Databank, Moldova

Average hourly load per weekday 2022



Source: Moldelectrica

Note: load curve covers RB MDA and TN region. Meteorological definition of seasons (Winter: 21.12. – 20.03., Summer: 21.06. – 23.09) excludes Energy crisis in November 2022 from load data.

Consumption

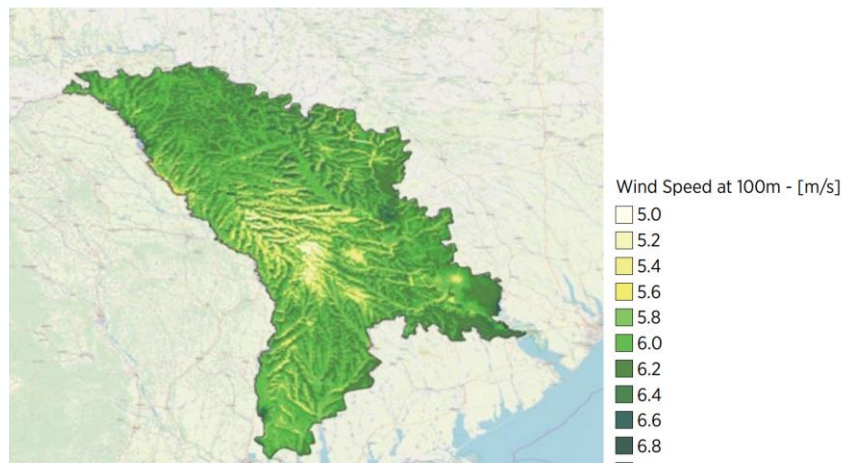
- » Since 2010 electricity consumption increased only modestly reaching 4 TWh in 2022
- » The residential sector consumed the largest electricity share (43%) in 2022, with only 18% consumed by the industrial sector
- » Energy intensity of MDA is above the EU average, with significant improvements in energy efficiency needed

Load

- » Large difference in load profile between summer and winter due to increased use of artificial lighting and electric heating
- » Peak load in summer (799 MW) as well as in winter (967 MW) exceeded installed capacity
- While demand is growing only slowly, MDA can't serve its peak load without plant capacity located in left-bank MDA

5. Electricity – RES potential and other aspects

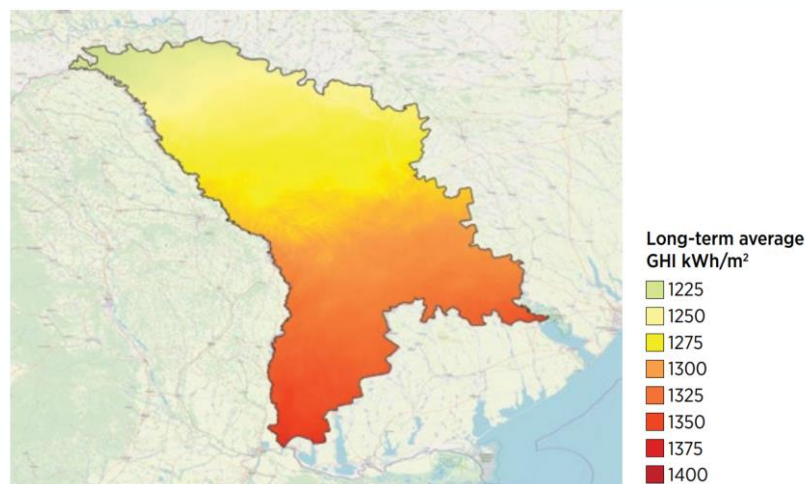
Annual wind speed



Source: IRENA Renewables Readiness Assessment for Moldova 2019

Disclaimer: Boundaries and names shown on the maps do not imply any official endorsement or acceptance by Berlin Economics.

Global horizontal irradiation



Source: IRENA Renewables Readiness Assessment for Moldova 2019

Disclaimer: Boundaries and names shown on the maps do not imply any official endorsement or acceptance by Berlin Economics.

Wind

- » Suitable locations for wind exist across the entire country with an estimated technical potential measured to be up to 21 GW

Solar

- » Technical potential of up to 4.5 GW. In 2016, 20% of the potential was already considered cost-competitive with levelized cost of electricity below 90 EUR/MWh

Hydropower

- » Estimated hydropower potential is 0.8 GW across the Danube, Prut, Dniester basins

Biomass

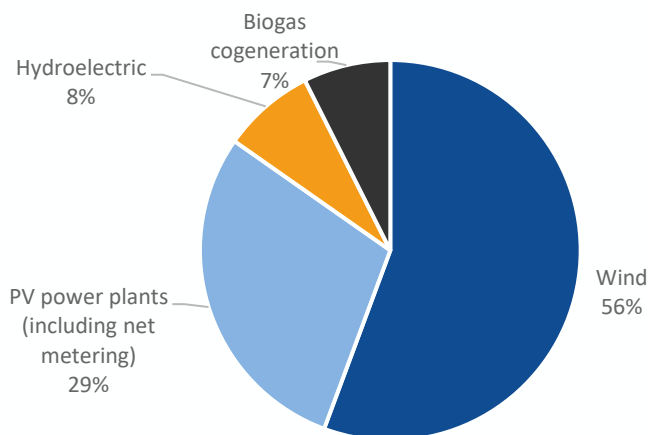
- » 20% of final energy consumption in MDA is served by biofuels and waste (mainly heating)

Balancing

- » The system is balanced notably using unplanned energy exchanges with neighboring countries at high costs
- Overall, MDA possesses significant RES potential, especially in wind. An increase in low-cost balancing capacities is vital, e. g. through intelligent consumption dispatching

5. Electricity – RES plans

Renewable energy capacity by source (207 MW), 2023



Source: Ministry of Energy Moldova

Renewable support schemes and RES policies

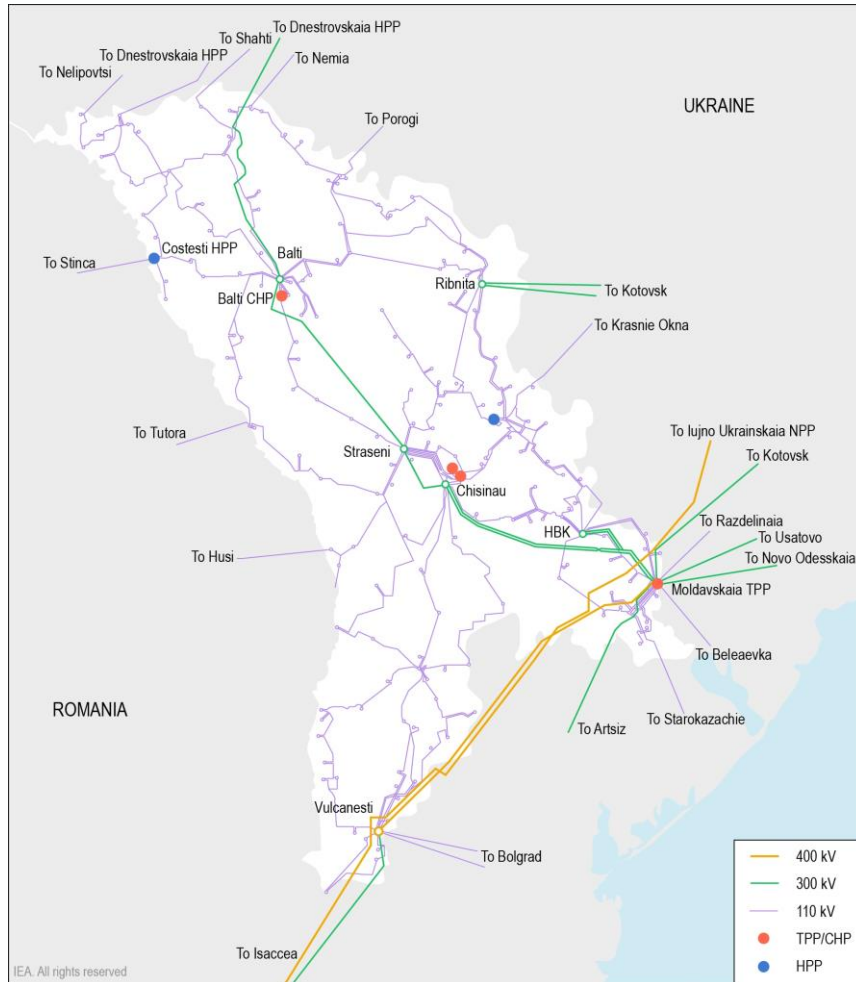
SUPPORT SCHEME	DESCRIPTION
Feed-in tariff	<p>Capacity limit: Above 10 kW and below 1 MW (4 MW for wind)</p> <p>Capacity allocation: 356 MW</p> <p>Responsible entity: ANRE</p> <p>Eligible technology: Technology neutral; Capacity limits only defined for Wind, Solar, Hydro, Biomass, Biogas</p>
Tender auction	<p>Capacity limit: Above 1 MW (4 MW for wind)</p> <p>Capacity allocation: 165 MW</p> <p>Responsible entity: Tendering commission</p> <p>Eligible technology: Technology neutral; Tenders announced for Wind, Solar, Hydro, Biomass, Biogas</p>
Net-metering	<p>Capacity limit: Up to 200 kW</p> <p>Responsible entity: ANRE</p> <p>Eligible technology: Technology neutral</p> <p>→ Will be transformed to net-billing on January, 01. 2024</p>

Source: Ministry of Energy Moldova (2023), [Law No. 10/2016](#), Energy Community (2022)

- » Wind is the most installed RES source, followed by solar, hydro and biogas, but RES generated only **5% of electricity** in 2022
- » RES capacity nearly quadrupled from **62 MW in 2018** to **222 MW in Q1-24**, but utilization has been low. The energy strategy for 2030 plans to increase RES capacity to 630 MW
- » MDA faces difficulties increasing RES due to balancing capacity dependence on MGRES
- » To increase renewable electricity deployment, a **renewable support scheme was implemented in 2018** (Law No. 10/2016)
 - Proposed amendment to the law in 2023 to clarify balancing responsibilities and the distribution of balancing costs
 - Other methods: improving the electricity network and supporting investments in RES although **large-scale auctions delayed**
- Investments in additional capacity not seen as highly attractive to investors due to electricity provided by MGRES at very low cost

5. Electricity – potential of regional integration

Cross-country transmission lines of Moldova

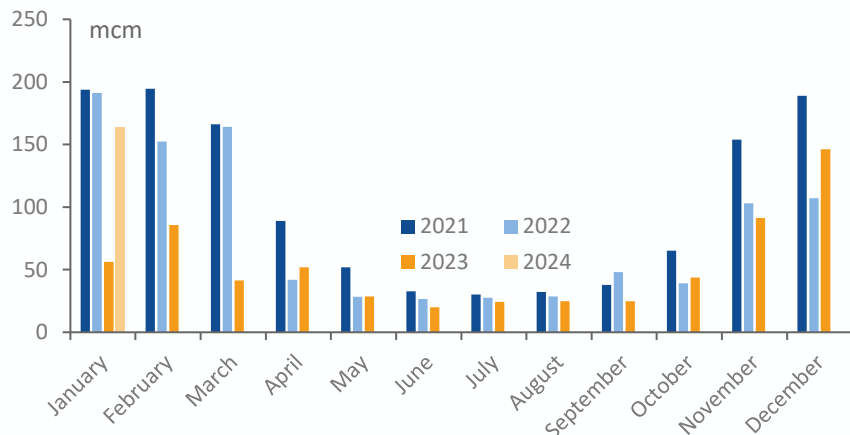


Source: IEA, 2022

- » In Mar-22, MDA and UKR carried out an emergency synchronization with ENTSO-E and disconnected from the Russian UPS/IPS
- » In Jun-22, new wholesale electricity market rules were adopted to boost cross-border trade and diversification of supply
- » EBRD, together with the EIB and the EU Neighborhood Investment Platform, are co-financing the EUR 80 m "**Moldova Romania Power Interconnection Phase II**" project in 2023
 - Construction of a 400 kV high-voltage transmission line between the city of Balti in MDA and the Romanian border
 - Transmission capacity currently leads through left-bank MDA, with new transmission capacity directly connecting ROU with right-bank MDA
- **Regional integration is viewed as the most expedient and quickest path to enhance energy security**

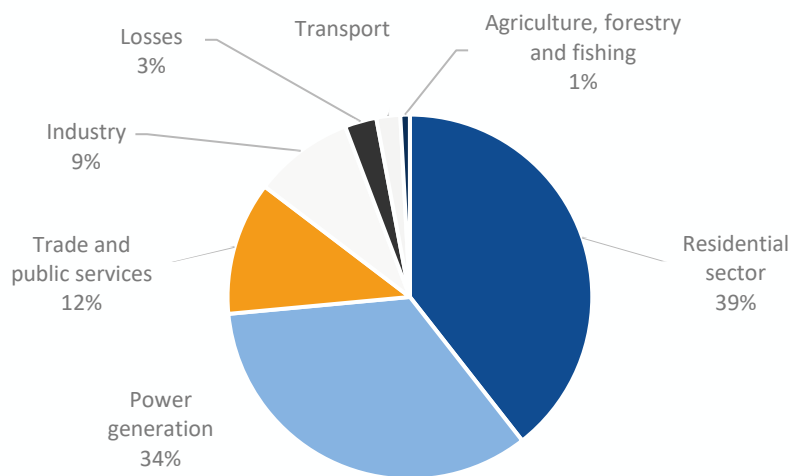
6. Gas sector issues – imports and consumption

Monthly natural gas imports



Source: Statistical Databank, Moldova

Natural gas gross consumption by sector 2022 (710 Ktoe)



Source: Statistical Databank, Moldova

Import and consumption changes

- » Following the 2022 energy crisis MDA increased import diversification and additionally sources gas from ROU, GRC, HUN, POL, CHE and AUT. In addition, contracts with TUR were concluded. But TUR could use gas from RUS for export
- » Gas saving measures and less demand due to warm temperatures lead to a **non-persisting import decrease by 50% from 2022 to 2023**
- » Gas is largely used for heat supply to the residential sector and is **main fuel** for CHPs

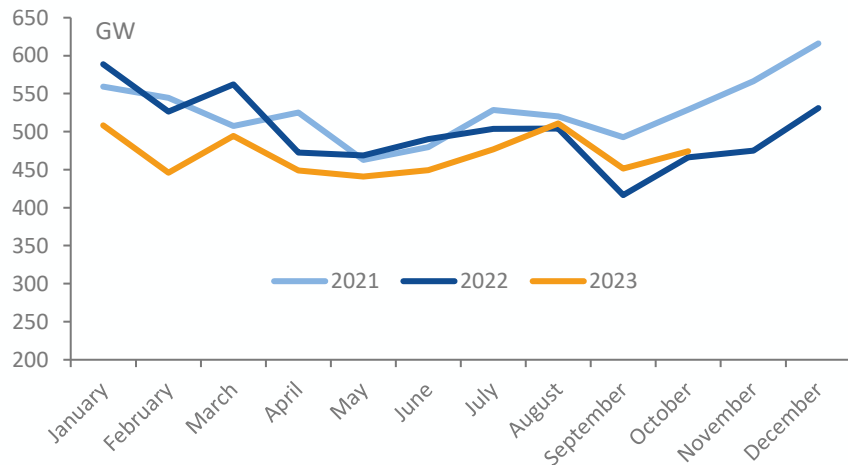
Gas sector concentration

Since September 2023 Vestmoldtransgaz acts as ISO for gas transmission in MDA

- » Below cost tariffs decrease attractiveness for investors and hamper further efforts for supply diversification efforts from Europe
- » Gazprom claims USD 700 m debt by Moldovagaz refuted by an independent audit
- MDA cut direct gas import dependency from RUS, but energy security risks remain

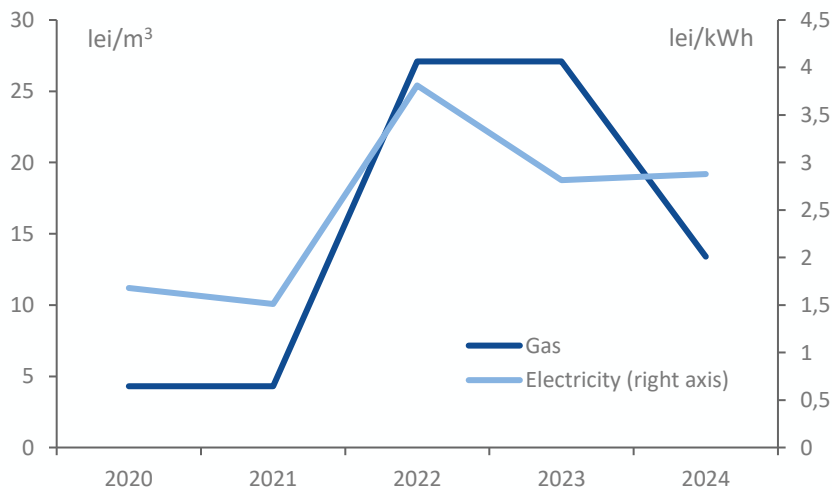
7. Recent crises and energy security

Monthly electricity load



Source: Moldelectrica

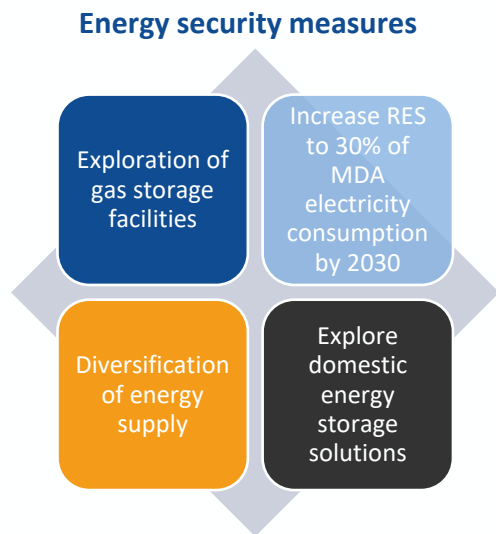
Gas and electricity prices (HH consumers) excl. taxes



Source: ANRE

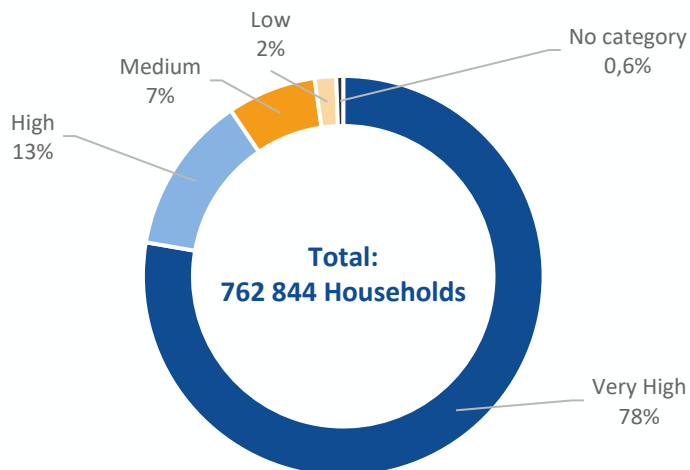
- » First energy crisis in late 2021 as Gazprom reduced its gas supply to MDA by over 50% in Oct-22 resulting in a sharp increase in energy import prices
- » The reduction in gas supply led to a halt in electricity supply by MGRES to MDA, resulting in an unprecedented energy crisis
 - Significant reduction in electricity load started in Q3-22 and continued into 2023
 - ENTSO-E synchronization in Mar-22 was vital to cushion the supply shock as it enabled UKR and ROU electricity imports
 - Between 1H-21 and 1H-23, household consumer prices for gas and electricity spiked by 531% and 86% respectively
- » New deal negotiated that ensures electricity supply from MGRES in exchange for sending all Russian gas supply to left-bank MDA
 - New electricity price set at 73 USD/MWh, later revised to 66 USD/MWh until end-24
- Any further reduction of gas supply from RUS could re-ignite this crisis

7. Recent crises and energy security



Source: BE depiction

Approved beneficiaries of the EVRF



Source: UNDP

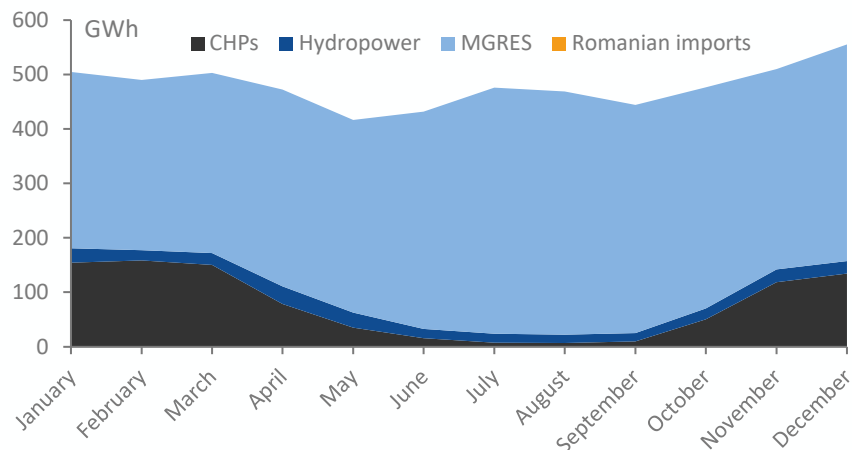
- » Programmes to increase energy security and resilience are the EU support package (EUR 200 m) and EU budgetary support (EUR 50 m)
- » Security measures include exploring gas storage facilities in UKR and ROU, as well as deploying domestic energy storage solutions
- » Challenges remain as ROU is a net electricity importer and sell at market prices which are higher MDA tariffs. In addition, RUS attacks on UKR threaten system stability
- » To alleviate the situation MDA launched the Energy Vulnerability Reduction Fund (EVRF) in Oct-22
 - As of Mar-23 almost 75% of MDA's households registered to benefit from the scheme, 78% were considered at very high risk
 - Subsidies covered 30% of the average energy prices during the winter 22/23 period and softened the impact
- MDA is actively trying to boost its energy security by fostering regional integration

8. Modelling gas supply disruptions to left-bank MDA

- » The gas transit contract between UKR and Gazprom terminates in Dec-24. UKR pledged not to renew contract, which could mean a stoppage of the flow of Russian gas to left-bank MDA:
 - The breakaway region has historically received gas from RUS effectively for free, which has represented a de-facto subsidy of approximately EUR 360 m annually between 2017-2021. This subsidy funds the region's fiscal deficit, but also allows natural gas to be provided to household and industrial consumers at extremely low prices, helping the latter's competitiveness
 - Crucially, the almost free natural gas is used by MGRES to generate electricity at extremely low prices, which it in turn sells to right-bank MDA at below market prices. Diversification away from MGRES has historically not been successful as it mostly can provide lower electricity prices than other bidders
 - As such, any disruption of the free gas flows to left-bank MDA would have high impact on prices
- » Within this context, a custom-built techno-economic model was used for economic impact analysis to show the difference and effects on electricity prices of two scenarios:
 - 1. **Status quo and baseline 2024** where left-bank MDA continues receiving free gas from RUS
 - 2. **Market scenario 2024** where free gas flows stop and gas has to be sourced at market prices, significantly affecting electricity generation costs and prices
- » **Key assumptions:**
 - Given the unpredictability of the effect that the cessation of free gas would have on left-bank MDA's ability to continue operations, a unified country-wide system electricity price was derived
 - Electricity demand includes possible savings in line with observed impacts of previous crises
 - MGRES runs primarily on natural gas in both scenarios

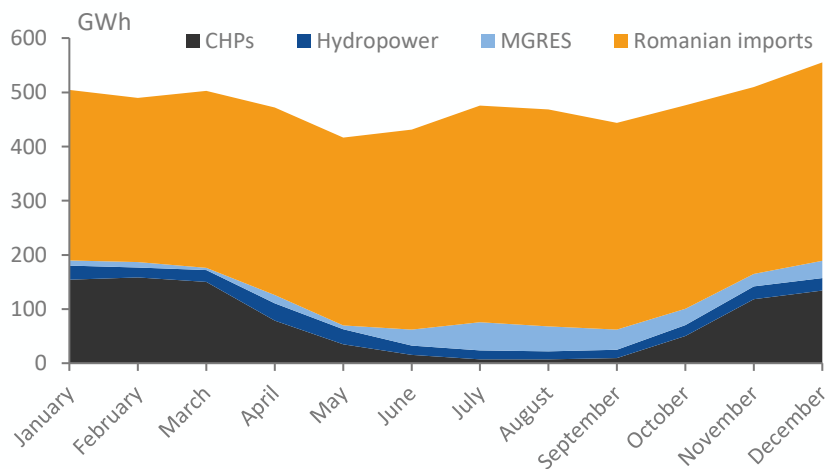
8. Scenario analysis: Generation

Baseline scenario electricity supply



Source: Modelling results

Market-based scenario electricity supply

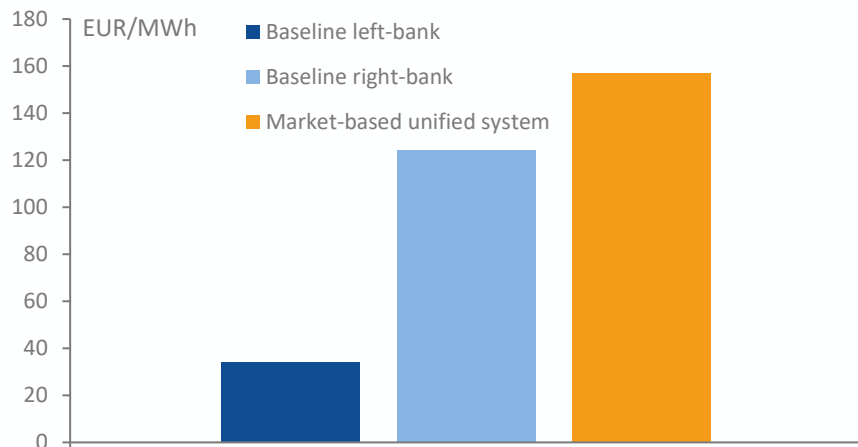


Source: Modelling results

- » **Status quo baseline 2024 scenario:** MGRES provides massive share of all electricity consumption in both left and right-bank MDA due to its low cost of production:
 - Breakeven for MGRES is estimated at between 25-30 EUR/MWh, with cheap domestic sales and sales to right-bank MDA at 66 USD/MWh
 - Imports from ROU are negligible as OPCOM DAM prices are consistently higher than MGRES
- » **Market-based 2024 scenario:** MGRES pays international prices for gas (here TTF), generation shifts significantly, with ROU imports outcompeting MGRES in all months:
 - MGRES breakeven of 290 EUR/MWh due to 10x higher gas cost, much lower use and need to pay fixed costs on > 1700 MW of installed capacity
 - MGRES acts as peaker plant when transmission capacity is reached, highlighting need to install additional transmission lines, including more directly between ROU and right-bank MDA
- » **If MGRES pays market prices for natural gas,** production will be more expensive, with ROU imports and cheaper and preferred option

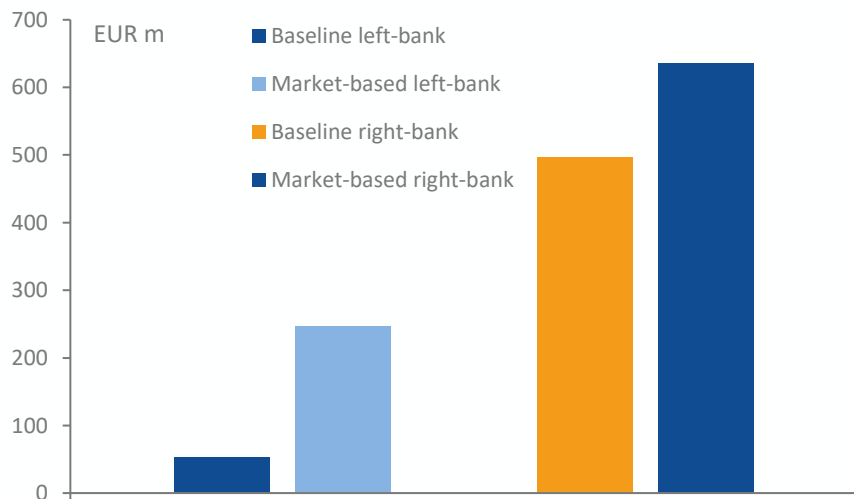
8. Scenario analysis: Electricity price increases

Household tariffs across scenarios



Source: Modelling results

Additional annual economic burden



Source: Modelling results

- » The higher cost of electricity increases tariffs in both left- and right-bank MDA:
 - With a unified system tariff of **157 EUR/MWh** in the market-based (also cost-covering) scenario, household tariffs increase by **27%** in right-bank MDA (from 124 EUR/MWh), but by **362%** in left-bank MDA (from 34 EUR/MWh)
 - Industrial tariffs also increase to **143 EUR/MWh** in the unified system, with a **412%** increase in TN region, potentially immediately threatening viability of several energy-intensive companies
- » This significantly increases annual electricity costs:
 - Overall annual system cost under market-based scenario is **EUR 882 m**, which is **EUR 333 m** higher than the baseline
 - Economic impact is lower in right-bank MDA (**EUR 138 m** more) than in left-bank MDA (**EUR 195 m** more) given currently hugely low tariffs
 - Compensation mechanisms have to be considered to prevent large-scale increase in energy poverty and human vulnerability
- » Moving to a market-based system would have significant impacts on electricity system, tariffs and costs

9. Conclusions and necessary steps

Conclusions:

- » While MDA has registered some improvements in terms of energy security, key dependencies still highlight system vulnerabilities
- » Import supply diversification is fundamental, but building additional generation and transmission capacity that reduces reliance on MGRES is key to prevent energy crises
- » In a possible scenario where left-bank MDA no longer receives effectively free natural gas from RUS, electricity tariffs would increase significantly in both right and left-bank MDA, which could have significant adverse impacts on both households and industry

Necessary steps:

- » Prioritize initiation of RES auctions and assess additional potential of installing other generation and storage capacity, taking into consideration regional solutions
- » Consider further diversifying energy supply sources, with more strategic focus on concluding supply agreements with friendly countries and regional partners
- » Improve energy efficiency further to decrease energy demand

About the German Economic Team

Financed by the Federal Ministry for Economic Affairs and Climate Action, the German Economic Team (GET) advises the governments of Ukraine, Belarus*, Moldova, Kosovo, Armenia, Georgia and Uzbekistan on economic policy matters. Berlin Economics has been commissioned with the implementation of the consultancy.

**Advisory activities in Belarus are currently suspended.*

CONTACT

Alina Kunde, Project Manager Moldova

kunde@berlin-economics.com

German Economic Team

c/o BE Berlin Economics GmbH

Schillerstraße 59 | 10627 Berlin

Tel: +49 30 / 20 61 34 64 0

info@german-economic-team.com

www.german-economic-team.com

Our publications are available under

<https://www.german-economic-team.com/en/belarus/>

Implemented by



10. Annex: Techno-economic assumptions

Location	Technical variable	Energy capacity (MW)	Efficiency (%)	Operations and maintenance costs (EUR/MWh)	Annual operations and maintenance costs (EUR/MW)	Total annual operations and maintenance costs (EUR)
MDA	MDA_LEG_CHP_NaturalGas_Steam_M_Balti	37.4	27%	4.88	31,435	1,175,665
MDA	MDA_LEG_CHP_NaturalGas_Steam_M_Chisinau	306	25%	4.88	31,435	9,619,078
MDA	MDA_LEG_ELC_Hydro_RoR_M_Kostesti	16	100%	1.071	28,773	460,365
TN	TRN_LEG_ELC_HardCoal_Steam_M_MGRES4	200	36%	3.125	34,651	6,930,250
TN	TRN_LEG_ELC_HardCoal_Steam_M_MGRES5	200	36%	3.125	34,651	6,930,250
TN	TRN_LEG_ELC_HardCoal_Steam_M_MGRES7	200	36%	3.125	34,651	6,930,250
TN	TRN_LEG_ELC_HardCoal_Steam_M_MGRES8	200	36%	3.125	34,651	6,930,250
TN	TRN_LEG_ELC_Hydro_RoR_M_Dubasari	48	100%	1.071	28,773	1,381,096
TN	TRN_LEG_ELC_NaturalGas_CombinedCycle_M_MGRES11	250	40%	2.881	28,358	7,089,376
TN	TRN_LEG_ELC_NaturalGas_CombinedCycle_M_MGRES12	250	40%	2.881	28,358	7,089,376
TN	TRN_LEG_ELC_NaturalGas_Steam_M_MGRES10	210	36%	2.749	19,861	4,170,903
TN	TRN_LEG_ELC_NaturalGas_Steam_M_MGRES9	210	36%	2.749	19,861	4,170,903
TN	ROU_LEG_ELC_Romanian_Imports_L_ALL	600	100%	0	0	0

10. Annex: Price assumptions and demand profile

Fuel price assumptions

Month	Current TN Region Gas Cost	OPCOM - Imports	TTF - Natural Gas	Rotterdam - Coal
January	4.245	115.3	47.135	12.17707
February	4.245	115.23	47.655	12.03555
March	4.245	115.22	47.275	11.94497
April	4.245	115.04	46.35	11.90534
May	4.245	115.04	45.5	11.91666
June	4.245	115.03	46.35	11.95629
July	4.245	114.81	46.45	12.04687
August	4.245	114.8	46.48	12.12612
September	4.245	114.8	46.49	12.2167
October	4.245	114.86	47	12.31294
November	4.245	114.85	49.74	12.46013
December	4.245	114.85	51.11	12.5224

Monthly demand profile (GWh)

Month	Right Bank demand	Left Bank Demand
January	377	127
February	353	137
March	363	139
April	331	141
May	293	124
June	289	142
July	331	145
August	326	142
September	303	140
October	362	114
November	374	136
December	410	146

10. Annex: Monthly generation profile

Baseline scenario

GWh	CHPs	Hydropower	MGRES	Romanian imports
January	154.1797	26.4863	323.676	0
February	158.3432	18.62929	312.9425	0
March	150.2915	21.71853	330.7097	0
April	78.69122	32.01041	361.5998	0
May	35.08819	27.58408	353.7167	0
June	15.52603	17.0073	399.0631	0
July	7.503182	16.28331	452.031	0
August	7.156163	15.02055	446.2437	0
September	9.634223	15.3221	418.785	0
October	50.58635	19.72071	406.1664	0
November	118.2376	23.99417	367.7636	0
December	134.3716	23.17298	397.7243	0

Market-based scenario

GWh	CHPs	Hydropower	MGRES	Romanian imports
January	154.1797	26.4863	9.197917	314.4781
February	158.3432	18.62929	9.785636	303.1569
March	150.2915	21.71853	4.32	326.3897
April	78.69122	32.01041	15.57356	346.0262
May	35.08819	27.58408	7.368218	346.3485
June	15.52603	17.0073	29.91497	369.1481
July	7.503182	16.28331	51.96194	400.0691
August	7.156163	15.02055	45.79825	400.4454
September	9.634223	15.3221	37.22157	381.5634
October	50.58635	19.72071	30.29496	375.8714
November	118.2376	23.99417	22.7837	344.9799
December	134.3716	23.17298	31.59421	366.13