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Modelling and Analysis of Moldova's Power System for the Integration of Renewables and Energy Storage Solutions

Prepared by: Tetra Tech

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Modelling and Analysis of Moldova's Power System for the Integration of Renewables and Energy Storage Solutions

Task 3: Analysis of the Moldovan power system's capability to integrate additional renewable energy capacities

30 April 2025 **Final version**

TETRA TECH

Deliverable 3: RES Integration Report

PRESENTED TO	SUBMITTED BY	
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ACRONYMS/ABBREVIATIONS

Acronym/Abbreviation	Definition
ANRE	National Energy Regulatory Agency
CHP	Combined Heat and Power
EnCS	Energy Community Secretariat
ENTSO-E	European Network of Transmission System Operators for Electricity
GWh	Gigawatt-Hour
HPP	Hydropower Plant
MW	Megawatt
MWh	Megawatt-Hour
NECP	National Energy and Climate Plan
NTC	Net Transfer Capacity
P2G	Power to Gas
PV	Photovoltaic
RES	Renewable Energy Sources
RoR	Run of River

1.0 INTRODUCTION

This report comprises the third deliverable of the PN07-2025 service agreement supporting the Moldovan government to fulfil certain commitments stemming from the Letter of Intent signed on 4 February 2025 between the Government of the Republic of Moldova and the European Commission.[1] The agreement underscores Moldova's determination to fast-track renewable energy deployment and the integration of energy storage solutions. This initiative is supported by the Energy Community Secretariat (EnCS), an international organization dedicated to bringing together the European Union and its neighbours to create an integrated, pan-European energy market, thereby extending European energy market rules and principles to the Contracting Parties of the Treaty establishing the Energy Community.

The Letter of Intent foresees the development of an action plan aimed at organizing new renewable energy and energy storage auctions throughout 2025, specifying the allocated capacities for each auction, to fast-track renewable energy deployment by the end of 2026. Counting on support from the European Commission, the Government of Moldova has been tasked with defining the capacity allocations for new renewable energy auctions. As part of this effort and in continuation of the work carried out under the United States Agency for International Development (USAID) Moldova Energy Security Activity, this assignment leverages an exhaustive review of existing studies and analyses, including the latest version of the Moldovan National Energy and Climate Plan (NECP) and the draft Ten-Year Network Development Plan, to thoroughly capture the current policy environment and strategic priorities for enhancing energy security and sustainability.

This report, the project's third deliverable, examines the capacity of Moldova's power system to integrate solar, wind and biomass generation—narrowing its focus to the supply/demand balance rather than internal transmission and distribution grid concerns. Building on prior assessments, this analysis employs the PLEXOS modelling platform to simulate hourly grid operations and economical dispatch of the generation units over a representative climate year, using historical generation profiles for renewables and other types of generation technologies. The work performed under Task 3 builds on the results of Tasks 1 and 2 and adopts a stepwise, iterative methodology to incrementally increase solar, wind and biomass capacities until it reaches an agreed-upon spillage threshold—a key metric developed in consultation with the Ministry of Energy—to balance energy ambitions with the economic feasibility of integrating large quantities of renewable energy sources (RES) into the Moldovan power system.

Task 1 ensured that the modelling and analysis of Moldova's power system were based on accurate, up-to-date data, incorporating insights from neighbouring countries like Romania and Ukraine. This regional context is crucial for understanding how Moldova fits into the broader European energy system.

Task 2 refined the PLEXOS model by incorporating updated operational constraints and regional interdependencies, preparing the system to accommodate accelerated renewable energy deployment.

Task 3's findings provide the necessary data and reasoning for Moldova's 2025 new renewable auction, ensuring that potential allocated capacities will align with market conditions, RES targets for 2030 in the NECP, and Moldova's political goals to decarbonize its economy by 2050. The scope of Task 3 covers the iterative inclusion

[1] Letter of Intent between the Government of the Republic of Moldova and the European Commission - European Commission

of additional solar, wind and biomass capacities (at the ratio set in the NECP) until the approved target spillage threshold of 5 per cent of total RES generation is met. By maximizing wind, solar and biomass projects using a mixed ratio of these technologies in line with the one set by the NECP, and minimizing the spillage risks (potential curtailed RES generation), the report provides sufficient technical details to help decision-makers understand the theoretical RES generation that can be integrated in the power system as well as the capacities that could be considered for the 2025 competitive auction. This granular approach reduces the risk of RES overgeneration, helping to enhance investor confidence and accelerate project commissioning to meet the 2026 deployment targets.

A set of iterative simulations were used as a means of performing a sensitivity analysis while exploring the case of implementing asymmetric capacity expansions (prioritizing solar or wind post-threshold based on the NECP wind/solar ratio) as a means of maximizing total RES integration.

However, this analysis does not consider the network issues (static and dynamic) or the overall system frequency regulation issues that could arise after integrating large amounts of RES in either the transmission or distribution network. (Task 4 will only address the variability of new RES and propose appropriate battery energy storage system solutions.) The network congestion problems largely depend on the connection point of a specific RES power plant and such specific problems were not analysed within the scope of this assignment.

2.0 SIMULATION SCENARIOS

In coordination with the Ministry of Energy and the National Energy Regulatory Agency (ANRE), three simulation scenarios were assessed to evaluate the additional RES capacities and their impact on the Moldovan power system. These scenarios focus on different possibilities for exporting electricity, assuming that local RES generation would primarily supply demand on the right bank of the Nistru River. They will help evaluate system performance and potential challenges under varying conditions, thereby enabling stakeholders to make informed decisions regarding the new renewable energy and energy storage auctions:

- **Scenario I** – No exports
- **Scenario II** – No exports to Ukraine and full net transfer capacity (NTC) to Romania[2]
- **Scenario III** – Reduced NTC to Ukraine and full NTC to Romania

The scenarios were simulated for two target years, 2026 and 2030. This time frame is particularly important, as it examines the long-term viability of the energy system in the context of increasing reliance on renewable energy and the need for a transition to a more sustainable energy model. The year 2026 reflects the expected status of the energy system based on current policies, market trends and generation capacities. The year 2030 serves as a mid-term outlook and provides a more strategic analysis of the system's capability to integrate RES without relying on additional capacity from a new gas-fired power plant in Moldova.

For both 2026 and 2030, the technical characteristics, techno-economic data and must-run constraints for power plants in Moldova were modelled as presented in Deliverable 2: Power system model report (Task 2).

[2] Detailed values of NTC per border and direction, specified for each year considered under this assessment are presented in Table 2-9 of the Stocktaking and data inputs report (Task 1 of the Modelling and Analysis of Moldova's Power System for the integration of Renewables and Energy Storage Solutions)

More precisely, in 2026, Combined Heat and Power Plant (CHP) 2 and CHP North were assumed to operate as must-runs during the winter and not to be operational during the rest of the year. CHP 1 was assumed to be non-operational throughout the entire year. In 2030, 33 MW of the new gas capacity, which will replace CHP 1 units, was assumed to be must-run during the winter, while another 22 MW of new capacity was assumed to be must-run throughout the whole year. The capacities of conventional power generation types were modelled for 2026 using their existing installed capacities, while for 2030 the planned capacities were considered.

Since historical data from 2022 were used as the basis for the demand forecast, the RES capacities that were already connected to the distribution system prior to 2023 were implicitly accounted for in the model. This is because the electricity demand historical time series data were collected from the transmission system operator, and the impact of the RES capacities already integrated into the distribution system was reflected in the reduction of the load. In total, 89 MW of solar photovoltaic (PV) and 88 MW of wind capacities were connected to the distribution system prior to 2023 and used in this implicit way in the market model. In each simulation iteration step, PV, wind and biomass were assumed as variables. Their capacities were increased until the validation criteria—5 per cent spillage threshold—was reached (spilled/curtailed RES generation compared to the overall annual available RES generation). Spillage/curtailment occurs when RES generation exceeds local electricity demand and cannot be exported due to already-saturated demand-supply conditions and restricted NTC of the interconnection capacities, considering the must-run constraints of CHPs during winter.

3.0 RESULTS OF THE MODELING

This section presents the results derived from the PLEXOS modelling simulations, with a specific focus on the energy landscape of Moldova. By examining the results of PLEXOS simulations, this paper identifies trends, challenges and opportunities within Moldova's electricity sector. This discussion not only contextualizes the findings within the broader framework of regional electricity market dynamics but also explores the implications of these results for policymaking and the overall sustainability of the energy system. Furthermore, it addresses how these insights can inform stakeholder decisions that align with Moldova's energy goals and commitments to reducing carbon emissions.

3.1 PRELIMINARY RESULTS

The analysis provides critical insights into the current and projected performance of Moldovan power system, highlighting key metrics such as generation capacity, demand forecasts and the integration of RES. Preliminary results reflect scenarios with high RES capacities, showcasing the theoretical potential of RES in the case of significant integration of renewables into the generation mix.

3.2 COORDINATION WITH THE MINISTRY OF ENERGY AND ANRE AND THEIR RECOMMENDATIONS

As part of the scenario development process, the underlying assumptions were coordinated with both the Ministry of Energy and ANRE. During discussions with the EnCS, the Ministry and ANRE, the team was asked to conduct another set of simulations under stricter technical constraints. This was intended to assist decision-makers in differentiating between RES capacities that may benefit from the support schemes and the total theoretical RES potential that can be integrated into the system. The difference between the theoretical maximum and the RES capacities eligible for support schemes is expected to be developed by investors in the open electricity market.

3.3 RESULTS WITH CONSTRAINED TECHNICAL CONSIDERATIONS

This section outlines the initial results, indicating where the Ministry of Energy requested further simulations to explore the implications of their additional proposed constraints. The values are derived from simulations conducted under conditions of no or limited export constraints, highlighting the impact of these limitations on overall system performance. The results of these analyses are presented in **Table 3-1**.

Table 3-1 Summary results of preliminary analyses

Scenario	Scenario I	Scenario II	Scenario III	Scenario I	Scenario II	Scenario III
Year	**2026**			**2030**		
Iteration	**4**	**5**	**6**	**4**	**9**	**10**
Total solar capacity [MW]	560	700	840	560	1 260	1 400
Total wind capacity [MW]	400	500	600	400	900	1 000
Total biomass capacity [MW]	12	15	18	12	27	30
Solar capacities connected at the distribution level before 2023 [MW]	89					
Wind capacities connected at the distribution level before 2023 [MW]	88.76					
Existing solar capacity (excluding capacity commissioned at the distribution level before 2023) [MW]	326					
Existing wind capacity (excluding capacity commissioned at the distribution level before 2023) [MW]	90					
Existing biomass capacity (excluding capacity commissioned at the distribution level before 2023) [MW]	3.6					
Additional solar capacity [MW]	**234**	**374**	**514**	**234**	**934**	**1 074**
Additional wind capacity [MW]	**310**	**410**	**510**	**310**	**810**	**910**
Additional biomass capacity [MW]	**8.4**	**11.4**	**14.4**	**8.4**	**23.4**	**26.4**
Annual solar generation [GWh]	703.4	872.6	1 036	699.8	1 532	1 687
Annual solar spillage [GWh]	9.5	18.5	33.83	12.5	72.01	94.93
Annual wind generation [GWh]	775.1	969.3	1 138	762.2	1 743	1 910
Annual wind spillage [GWh]	26.8	33	64.9	36.1	61.3	94.4

Scenario	Scenario I	Scenario II	Scenario III	Scenario I	Scenario II	Scenario III
Annual biomass generation [GWh]	69.3	86.1	99.7	68.6	154.1	167.5
Annual RES Spillage [%]	**2.29**	**2.60**	**4.16**	**3.07**	**3.74**	**4.79**

The table shows planned solar, wind and biomass capacities under three scenarios for 2026 (iterations 4–6) and 2030 (iterations 4, 9 and 10). It details the total, existing and additional capacities for each technology, along with projected annual generation and unavoidable spillage—energy that the system cannot absorb. The final spillage percentages highlight how greater RES penetration stresses system limits, providing decision-makers a clear view of capacity requirements versus grid-integration constraints.

The results show that in 2026, Moldova could theoretically integrate additional RES capacities of approximately 514 MW of PV and 510 MW of wind, which could generate 2 174 GWh of local renewable energy, thus contributing to increased security of the country's electricity supply. These additional RES capacities will lead to a spillage of 98.73 GWh, counting for 4.16 per cent of annual generation of new RES capacities.

Using the same validation criteria for 2030, the additional RES capacity can be doubled, reaching 1 074 MW for PV and 910 MW for wind, with an overall generation of 3 597 GWh, out of which 189.33 GWh or 4.79 per cent will need to be curtailed due to lack of interconnection capacities with neighbouring countries.

A rigorous review of hourly results showed a few interesting patterns that were brought to the attention of the Ministry of Energy and ANRE, namely:

- New additional RES capacities managed to significantly increase local generation, but Moldova still needs to import a high amount of electricity to cover its local demand during peak hours. For 2026, the model shows situations when Moldova is making use of all 600 MW of NTC with Ukraine to cover its peak. The situation is improving in 2030 due to additional RES capacities, but still, due to the variable generation pattern of RES, cases with high imports persist.
- There are multiple hours during the year when Moldova is using the full NTC with its neighbours to export high RES generation at prices close to zero, replacing conventional generation sources and decreasing the marginal electricity price in Romania and Ukraine.

These particular dispatch patterns led to a request from the Ministry to explore and assess several other scenarios, with an increased number of technical constraints, as presented in the chapter below.

4.0 FINAL RESULTS

For the final results, which reflected the scenario with RES and the NTC, consultations involving the Ministry of Energy, ANRE, Moldelectrica and representatives from the EnCS concluded that the values of new RES capacities obtained in both scenarios—without the export of electricity to Romania and Ukraine—should be used for further analyses to identify RES capacities that the Ministry could potentially propose for the 2025 RES auctions.

For the second set of calculations in PLEXOS, which considered NTC values and RES capacities based on the selected scenario, comprehensive analyses were conducted. These analyses assessed the potential impacts of various constraints, such as the limited export capabilities of the power system, as well as opportunities within the energy system. The results for 2026 and 2030 are presented below, providing a detailed overview of expected generation capacities, demand forecasts and the integration of renewable energy into the overall energy mix. This information is crucial for understanding the future energy landscape and for informing strategic decisions related to energy policy, investment and sustainability initiatives in the region.

4.1 RESULTS 2026

Because it was proposed that the analysis constrain exports from RES, the calculations estimate that the additional capacities for PV and wind energy will reach up to 234 MW of solar capacity and 310 MW of wind capacity. Table 4-1 presents the results for 2026, showing the generation, load, unserved energy, price for Moldova (right and left bank of the Nistru River), Romania and Ukraine. It also presents the power-to-gas (P2G) value for Romania because, according to the European Resource Adequacy Assessment 2024, Romania will have this kind of capacity in 2026. Based on all input assumptions, the analysis of the projected state of the electricity sector for 2026 in Moldova (on the right bank) indicates that local generation will cover about 50 per cent of demand, reflecting a lower but still significant reliance on imports. The price on the left bank is higher due to an unsupplied energy in certain hours of the year.

Table 4-1 Results per country – 2026

Results per country				
	Moldova (right bank)	**Moldova (left bank)**	**Romania**	**Ukraine**
Generation [GWh]	2 331	2 067	69 331	116 748
Load [GWh]	4 658	2 041	54 988	103 040
Unserved energy [GWh]	/	3.16	/	/
P2G [GWh]	/	/	862	/
Price [€/MWh]	76.58	127.54	94.2	77.49

Table 4-2 shows that Moldova is expected to obtain the majority of its electricity imports from Ukraine. This is due to the limited NTC with Romania, which forces Moldova to balance its load, especially during peak hours, from its eastern neighbour. Considering the power generation situation in Ukraine and the uncertainties regarding its rate of recovery after the war ends, this dependency highlights the challenges for Moldova to ensure its own security of supply. Additionally, the economical dispatch of the power generation units shows some transit flows of electricity from Ukraine to Romania through Moldova, further highlighting the benefits of the region's interconnectedness. The low NTC with Romania is anticipated to negatively impact commercial trade, making it difficult for Moldova to fully leverage its potential for cooperation with neighbouring markets. On a regional level, besides contributing to the security of Moldova's supply, Romania and Ukraine are expected to export electricity to European Network of Transmission System Operators for Electricity (ENTSO-E) member countries.

The results of the market analysis underscore the need for infrastructure improvements and enhanced regional collaboration to strengthen energy security and reduce dependence on imports.

Table 4-2 Exchanges – 2026

Exchanges per border	
Border	**Exchange [GWh]**
Moldova–Ukraine	-2 423
Moldova–Romania	121
Romania–ENTSO-E	15 639
Ukraine–ENTSO-E	10 098
Ukraine–Romania	1 187

Figure 4-1 presents the total yearly electricity generation by type, illustrating the contribution of different generation sources, including CHP, biomass, PV, wind and hydropower. The figure highlights the dominance of RES, particularly wind and PV, in the overall generation mix, as a consequence of the installed capacities of these sources. PV and wind generation are each higher than the annual generation of the gas-fired power plants from the right bank.

The economical dispatch of the power system shows that the market will select to buy electricity generated by RES every time when available, thanks to its lower levelized cost of electricity compared to conventional power plants in Moldova or even compared to the average cost of imports.

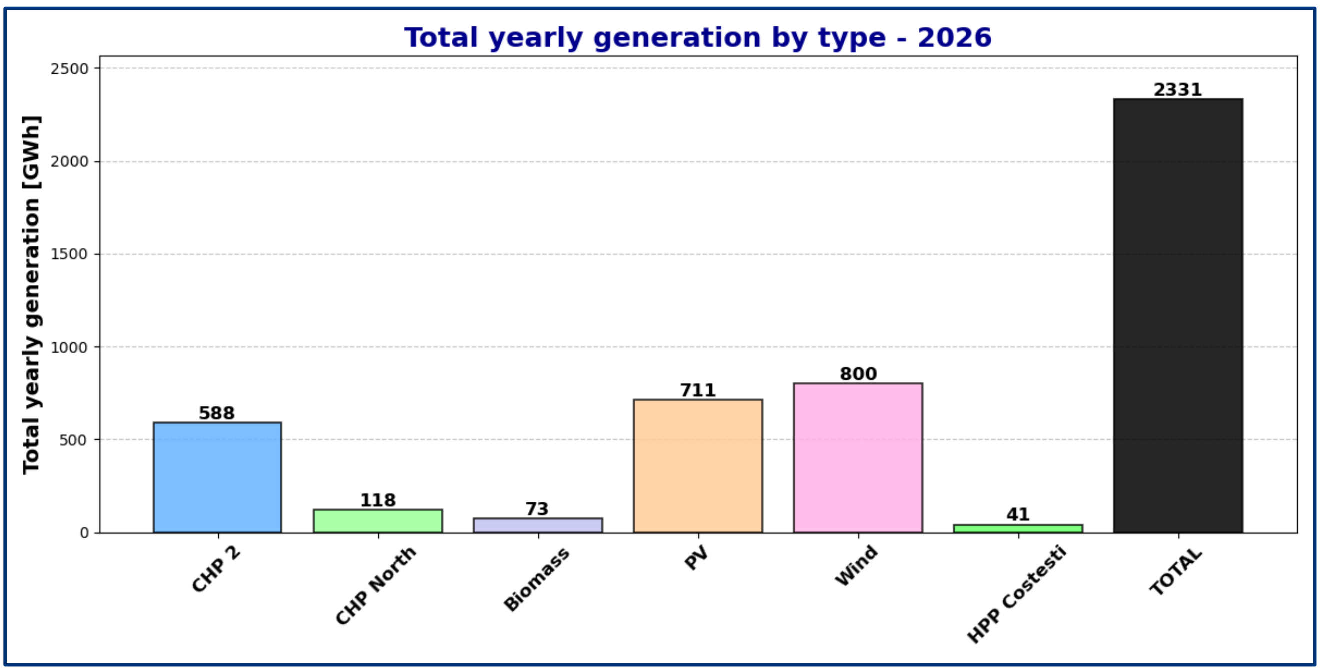

Figure 4-1 Total yearly generation by type for 2026 – right bank

Figure 4-2 presents yearly PV, wind and biomass generation as well as annual RES spillage in 2026 (right bank of the Nistru River).

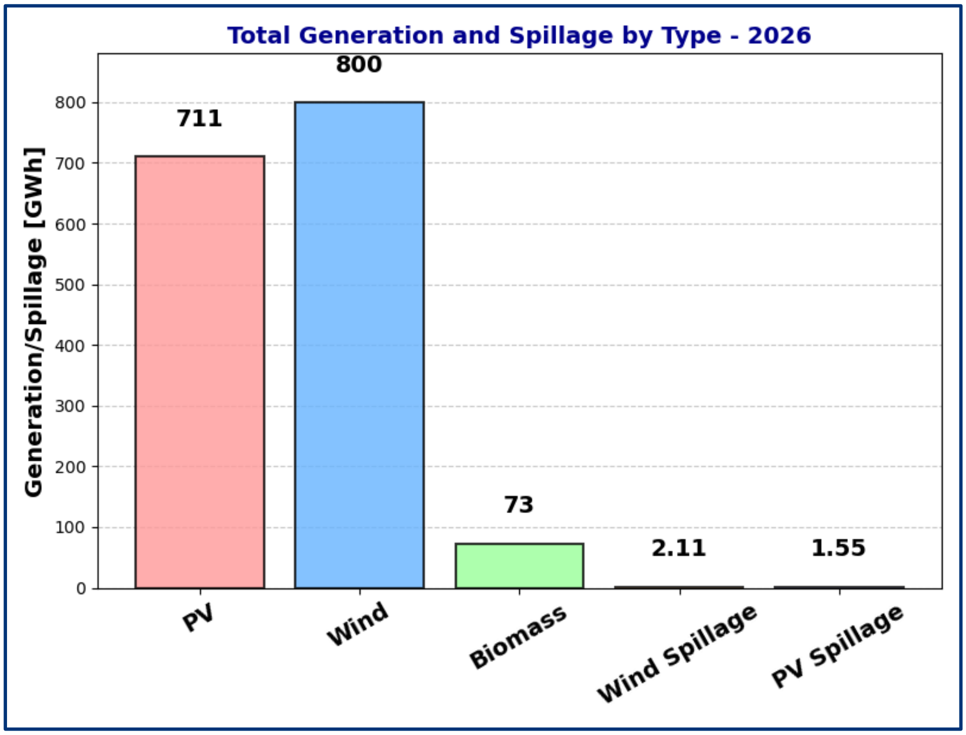

Figure 4-2 Results for 2026 – right bank

Analysing the monthly spillage helps understand the dynamics of the power system and identify potential challenges and opportunities for optimizing electricity production and consumption. Figure 4-3 illustrates the expected monthly RES spillage, the amount of electricity that could not be used or distributed. This spillage occurs due to low demand, must-run constraints or unavailability to export. In this case, the majority of spillage occurs in the spring due to relatively low demand during this period, the must-run constraint of CHP gas units and favourable weather conditions for RES generation, which benefit from high winds and increasing solar irradiation complemented by low temperatures, maximizing the generation from this technology.

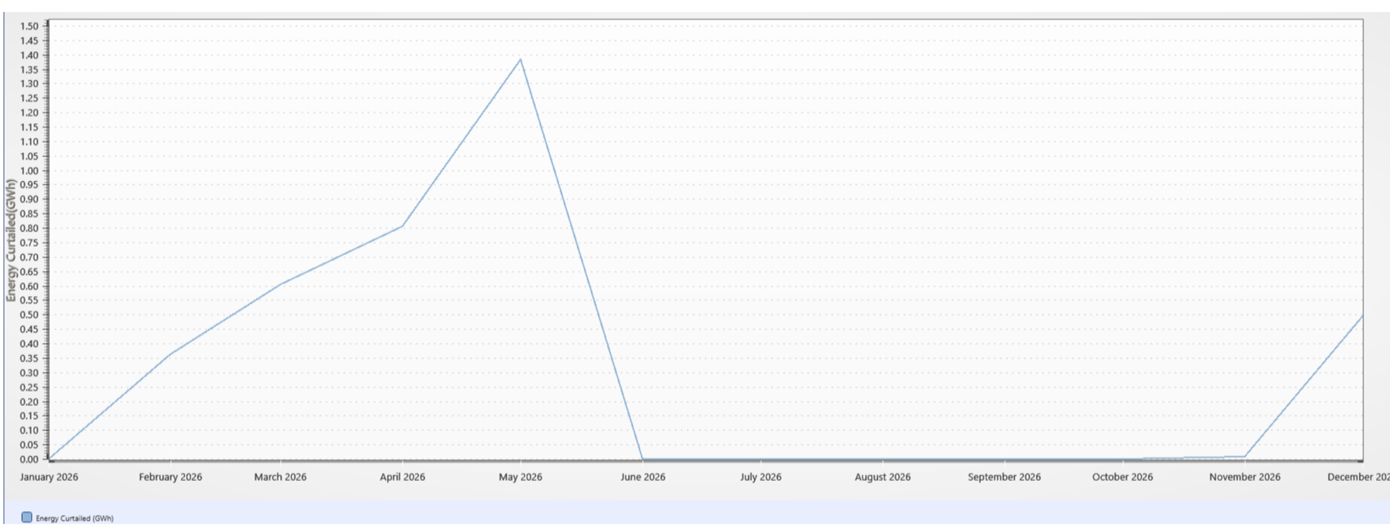

Figure 4-3 Monthly RES spillage for 2026

Figure 4-4 shows the calculated monthly electricity production (in GWh) for various generation units on the right bank throughout 2026. The data are visualized as a set of bar charts, where each subplot represents the electricity output of a specific generator. The x-axis denotes the months of the year, while the y-axis indicates the production levels in gigawatt-hours (GWh), as obtained from the PLEXOS simulation.

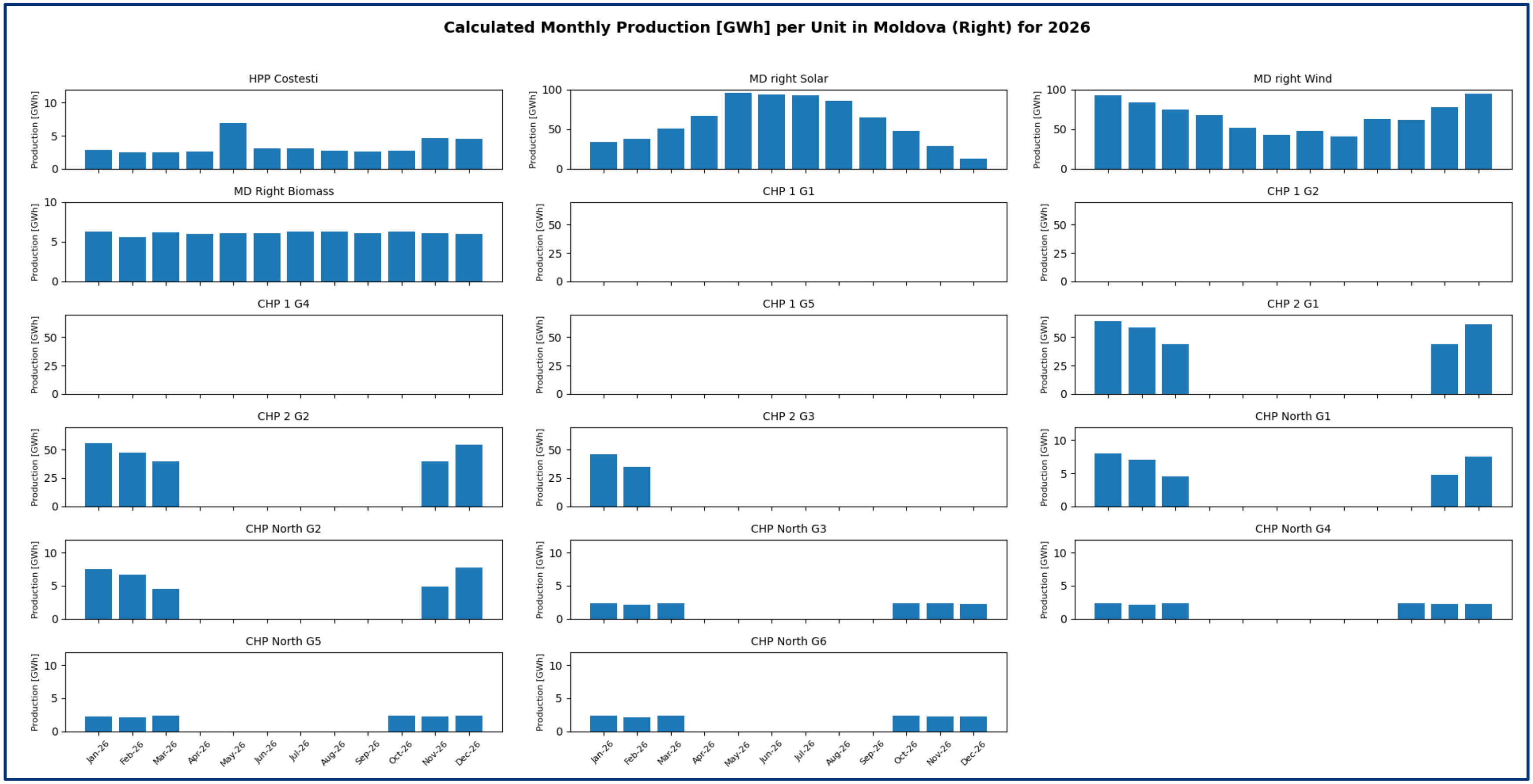

Figure 4-4 Monthly production per unit in Moldova for 2026 – right bank

According to the results shown in Figure 4-5, Moldova will import electricity throughout the year, considering the increase in consumption, the limited amount of new RES capacities, constraints on gas units, and the unavailable energy from MGRES (which will only cover consumption on the left bank). As shown in Table 4-2, the electricity will be mostly imported from Ukraine, since the interconnection with Romania, even if used at full, is not enough to have a significant impact on the amount needed to cover the demand on the right bank, with Moldova needing to supplement its imports from Ukraine.

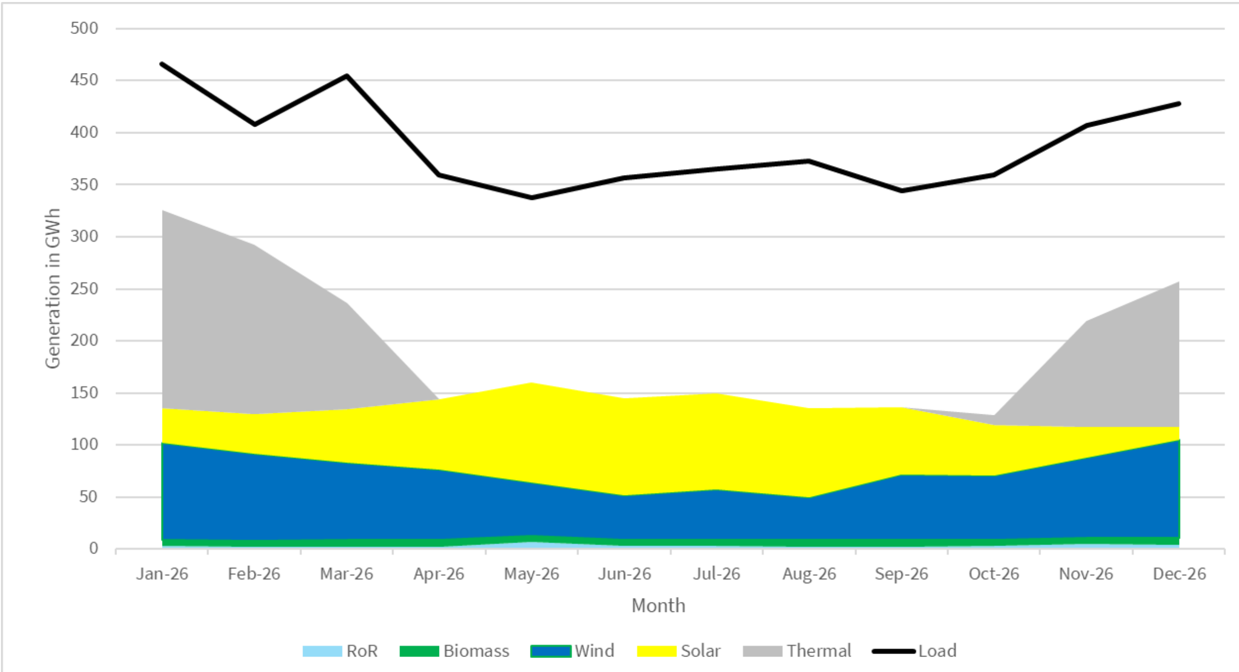

Figure 4-5 Monthly generation and load for Moldova in 2026

The results for 2026 are summarized in Table 4-3 , which presents the final simulation results for PV, wind and biomass capacities. The table also shows the values of capacities that were connected to the transmission and distribution network from the beginning of 2023 to the end of February 2025. RES capacities connected to the distribution network before 2023 were considered in the model within the net load time series.

Table 4-3 Results for RES generation for 2026 – right bank

Results for 2026			
RES technology	**Total RES capacity [MW]**	**Existing RES Capacity [MW]**	**Additional capacity [MW]**
PV	560	415	234
Wind	400	178.76	310
Biomass	12	3.6	8.4

4.2 RESULTS 2030

It is estimated that the additional capacities for PV and wind energy will reach 234 MW and 310 MW respectively, the same as the amounts projected for 2026, as constraints have been considered to prevent exports from RES. This strategic approach aims to optimize the utilization of domestic renewable resources.

Based on all input assumptions, the analysis of the projected state of the electricity sector in Moldova (right bank) indicates that local generation will cover 55 per cent of the demand for 2030, which is 5 per cent higher than in 2026. Due to the replacement of old units in CHP 1, an increase in electricity production in Moldova is expected. However, given the anticipated rise in consumption, Moldova will continue to rely on electricity imports in the selected scenario of RES evolution.

Table 4-4 Results per country – 2030

Results per country				
	Moldova (right)	**Moldova (left)**	**Romania**	**Ukraine**
Generation [GWh]	2 784	2 304	69 278	105 212
Load [GWh]	5 029	2 281	60 044	105 283
Unserved energy [GWh]	/	0.09	/	/
P2G [GWh]	/	/	110	/
Price [€/MWh]	82.26	138.76	80.85	80.1

The table below presents net cross-border electricity exchanges involving Moldova, Romania, Ukraine and the rest of ENTSO-E for 2030.

Table 4-5 Exchange Results – 2030

Exchanges per border	
Border	**Exchange [GWh]**
Moldova–Ukraine	-1 423
Moldova–Romania	-802
Romania–ENTSO-E	7 289
Ukraine–ENTSO-E	-461
Ukraine–Romania	-413

The construction of the 400 kV interconnection between Bălţi and Suceava is expected to increase NTC with Romania, which will likely increase electricity exchange and annual net import of electricity from Romania. However, the majority of electricity imports are expected to come from Ukraine, especially during peak hours, which may pose challenges to security of supply. Additionally, transit flows of electricity from Ukraine to Romania through Moldova have been spotty, highlighting the region's need to increase its interconnectedness.

Furthermore, due to increased consumption in Ukraine and Romania, as well as the impact of the CO_2 tax on marginal production costs (specifically in Ukraine), the results indicate that by 2030, there will be a decrease in exports from Romania to ENTSO-E countries. It is expected that Ukraine will become a net importer of electricity from the ENTSO-E region by 2030 owing to lower production and higher demand. This situation underscores the need for infrastructure improvements, the development of the additional generation units in Moldova, and strengthened regional collaboration to enhance security of supply and reduce dependence on imports by 2030.

Figure 4-6 presents the total yearly electricity generation by type, illustrating the contributions of different generation sources, including CHP, biomass, PV, wind and hydropower. The figure highlights the dominance of RES, particularly wind and PV, in the overall generation mix, due to the high installed capacity of these sources. It shows that under the validation criteria (5 per cent spillage with no export of RES generation), RES generation is comparable to results for 2026. This is explained by the impact of new gas-fired generation (33 MW + 22 MW) on the system. The new CHP units have increased efficiency and higher output of electricity per unit of thermal load. The new gas generation can cover the increase in load profile, keeping room for RES to maintain and amount of generation comparable to the 2026 values.

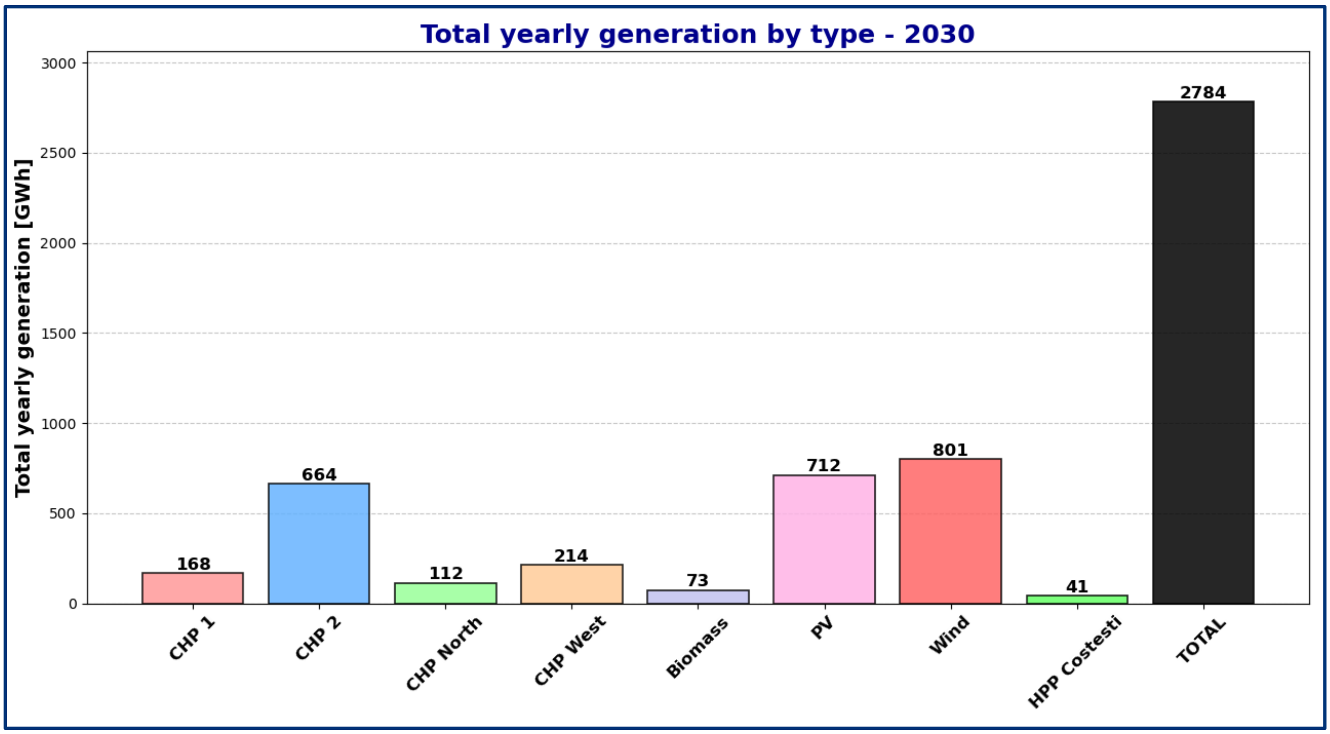

Figure 4-6 Total yearly generation for 2030 – right bank

Figure 4-7 illustrates the total renewable energy generation and spillage by type for 2030. The chart provides an overview of PV, wind and biomass generation as well as RES spillage, highlighting the impact on RES integration.

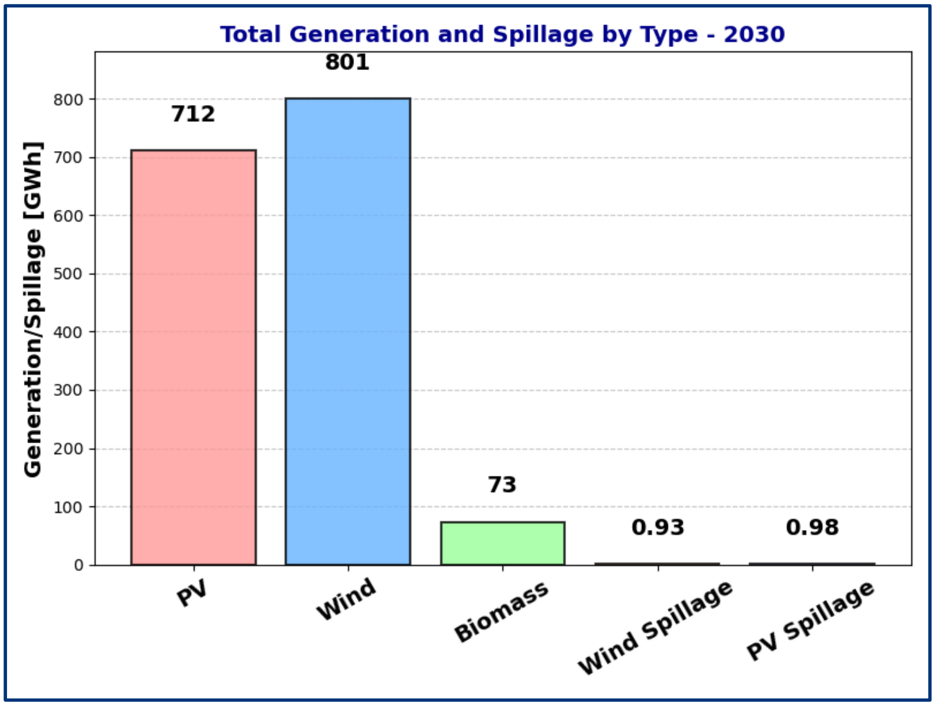

Figure 4-7 Results for 2030 – right bank

Figure 4-8 illustrates the expected monthly RES spillage, which represents the electricity that could not be used or distributed. For 2030, the spillage is expected to be lower compared to 2026 because consumption is higher during the specific hours when spillage occurs, while the RES capacities remain unchanged.

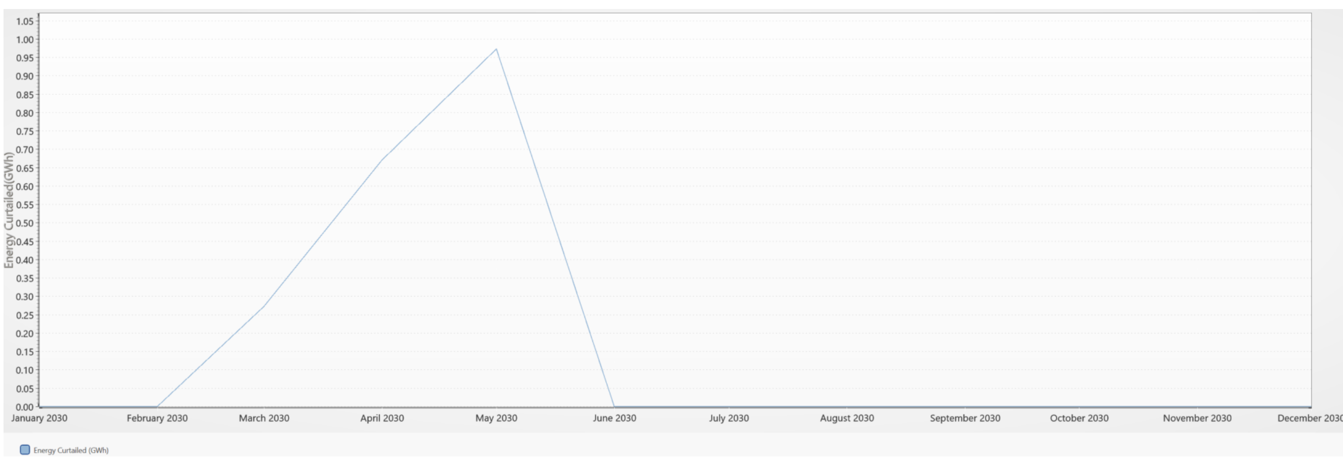

Figure 4-8 Monthly RES spillage for 2030

Figure 4-9 presents the calculated monthly electricity production (in GWh) for various generation units on the right bank throughout 2030. The data are visualized as a set of bar charts, with each subplot representing the electricity output of a specific generator. The x-axis denotes the months of the year, while the y-axis indicates the production levels in GWh, as obtained from the PLEXOS simulation.

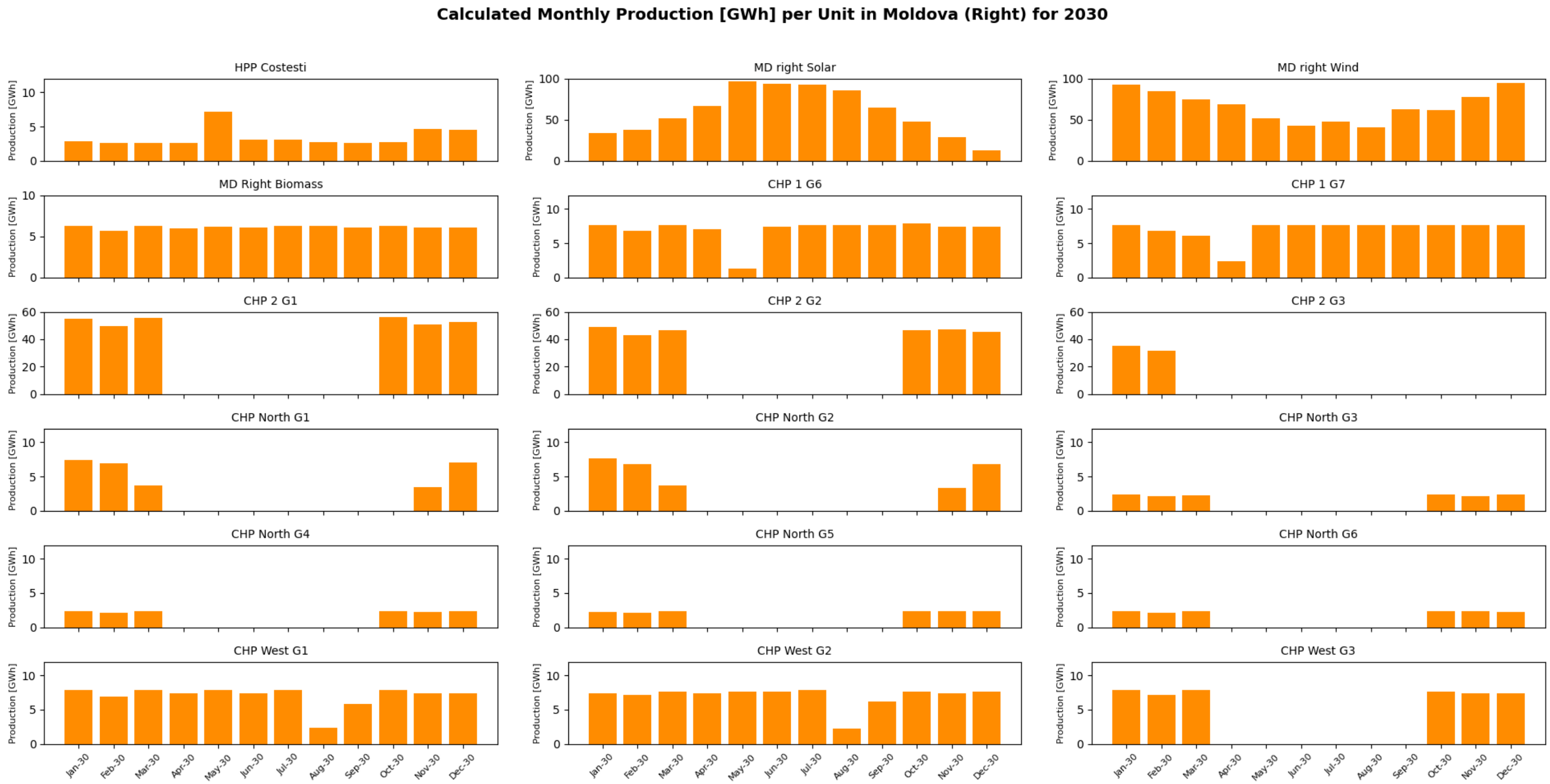

Figure 4-9 Monthly production in Moldova for 2030 – right bank

Figure 4-10 shows the monthly load and expected generation from all sources for 2030. Comparing the results to 2026, the forecasted load is higher due to expected GDP growth and, consequently, the development of industry, which increases consumption. Production is also projected to be higher than in 2026, as the replacement of units at CHP 1 is expected to lead to increased electricity generation from the new units (55 MW in CHP 1 G6, G7 and CHP West G1-G3). Additionally, electricity imports have increased to compensate for the shortfall in generated electricity relative to the expected demand in 2030.

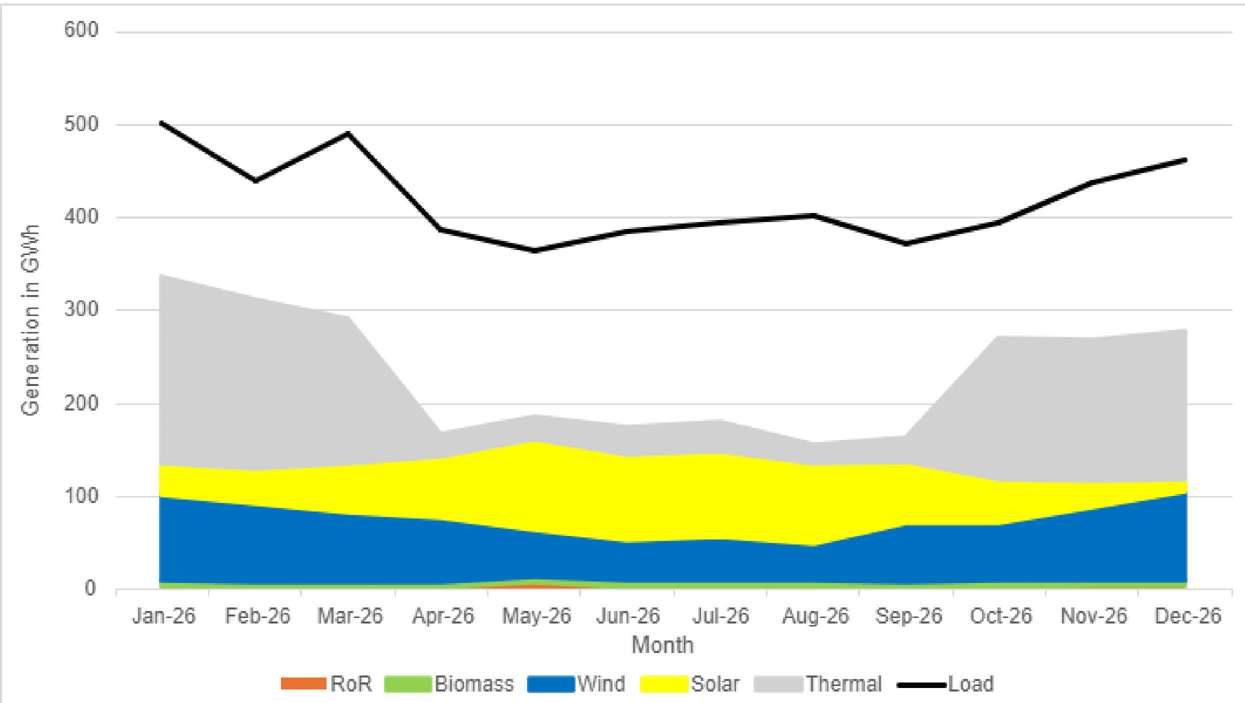

Figure 4-10 Monthly generation and load for Moldova in 2030

Table 4-6 shows the final results for additional installed PV, wind and biomass capacities in 2030. It also shows the values of existing capacities that were connected to the transmission and distribution network from the beginning of 2023 to the end of February 2025. Distributed RES capacities connected to the distribution grid before 2023 were considered in the model within the net load time series.

Table 4-6 Results for RES generation in Moldova for 2030– right bank

Results for 2030			
RES technology	**Total RES capacity [MW]**	**Existing RES Capacity [MW]**	**Additional capacity [MW]**
PV	560	415	234
Wind	400	178.76	310
Biomass	12	3.6	8.4

4.3 CONCLUSION

Task 3 addresses the crucial question of how much additional RES capacity can be integrated into Moldova's renewable energy roadmap, considering the system constraints of integrating solar, wind and biomass-based generation while ensuring a reasonable level of spilled energy. The answer to this question is essential to Moldova's renewable energy roadmap, as it will guide decisions on the future support of RES development in the country.

As of March 2025, Moldova had integrated a total of 433 MW of solar PV capacity and 187.2 MW of wind capacity at both the transmission and distribution level. Out of the total solar PV capacity, 136 MW is included in the support scheme, 151 MW is under net billing and 146 MW is on the free market.

The preliminary results show that Moldova's power system could integrate up to 514 MW of PV and 510 MW of wind capacities in 2026 without the risk of exceeding the validation criteria of 5 per cent of annual RES generation considered as spilled/curtailed. For 2030, the estimated theoretical maximum RES capacities can be increased up to 1 074 MW for PV and 910 MW for wind, in addition to those existing in February 2025.

However, since these high RES capacities may lead to a significant amount of electricity produced from renewable sources and exported at low prices, which is not aligned with the purpose of the current support schemes, following the preliminary simulations and after discussing the results with the Ministry of Energy and ANRE, it was decided to select the scenario with no export for further analysis. Thus, three scenarios were developed to assess the additional RES capacities in 2026 and 2030 that would result in limited export of RES generation when prices are low or zero.

The final round of simulations considered full NTC at the Moldovan borders, taking into account the additional RES capacities calculated in the previous simulations while keeping all other system constraints in place. Additionally, several other key factors were considered, including MGRES's unavailability to cover the demand on the right bank and the anticipated increase in electricity consumption.

The additional assessment determined that 234 MW of additional solar PV and 310 MW of additional wind capacity, for both 2026 and 2030, will allow Moldova's power system to consume most RES generation locally, minimizing the amounts of RES generation that would need to be exported or curtailed.

The results of the final round of simulations indicate that with tempered RES capacity development, Moldova will continue to be a net importer of electricity in both 2026 and 2030. The limited amount of new RES capacities being integrated into the energy mix will not be sufficient to meet the demand, specifically during peak hours.

Furthermore, the must-run constraints on gas units, which are critical for maintaining a stable electricity supply, have a significant impact on the RES capacities that could be integrated into the power system. These constraints may arise from operational limitations or regulatory requirements that restrict the output of gas-fired power plants.

It is important to note that the final results, which assume no exports, can be safely used as reference values to determine the RES capacities that can be offered in the upcoming auction. If the decision-makers decide to allocate all the additional capacity for the next auction, the RES generation will be absorbed almost entirely by local demand, with only a small quantity exported to neighbouring countries for a few hours during the year.

However, if the integration of RES capacities by 2030 is limited to the values obtained in the additional assessment (234 MW of PV and 310 MW of wind), Moldova will remain highly reliant on electricity imports, necessitating strategic planning and investment in both additional domestic energy production and interconnection infrastructure to ensure energy security and sustainability in the coming years. This highlights the importance of attracting more investments in new RES and in new firm capacities that are able to cover the base load.

APPENDIX A: COMPARISON OF RESULTS

Year	2026				2030			
	Moldova (right)	Moldova (left)	Romania	Ukraine	Moldova (right)	Moldova (left)	Romania	Ukraine
Generation [GWh]	2 331	2 067	69 331	116 748	2 784	2 304	69 278	105 212
Load [GWh]	4 658	2 041	54 988	103 040	5 029	2 281	60 044	105 283
Unserved energy [GWh]	/	3.16	/	/	/	0.09	/	/
P2G [GWh]	/	/	862	/	/	/	110	/
Price [€/MWh]	76.58	127.54	94.2	77.49	82.26	138.76	80.85	80.1

Year	2026		2030	
Unit/generation type	Total yearly generation [GWh]	Total yearly generation [%]	Total yearly generation [GWh]	Total yearly generation [%]
CHP 1 G1	0	0	/	/
CHP 1 G2	0	0	/	/
CHP 1 G4	0	0	/	/
CHP 1 G5	0	0	/	/
CHP 1 G6	/	/	84	3.01
CHP 1 G7	/	/	84	3.03
CHP West G1	/	/	84	3.02
CHP West G2	/	/	84	3.02
CHP West G3	/	/	45	1.63
CHP 2 G1	272	11.65	319	11.48
CHP 2 G2	236	10.12	277	9.96
CHP 2 G3	81	3.46	67	2.40
CHP North G1	32	1.36	28	1.02
CHP North G2	31	1.34	28	1.01
CHP North G3	14	0.59	14	0.49
CHP North G4	14	0.59	14	0.50
CHP North G5	14	0.59	14	0.50
CHP North G6	14	0.59	14	0.49
Biomass	73	3.13	73	2.63

Year	2026		2030	
PV	711	30.51	712	25.57
Wind	800	34.31	801	28.77
HPP Costesti	41	1.75	41	1.48
TOTAL	2 331	100	2 784	100

Year	2026	2030
Border	Exchange [GWh]	
Moldova–Ukraine	-2 423	-1 423
Moldova–Romania	121	-802
Romania–ENTSO-E	15 639	7 289
Ukraine–ENTSO-E	10 098	-461
Ukraine–Romania	1 187	-413

Year	2026	2030
Zone	Moldova (right)	
PV generation [GWh]	711	712
Wind generation [GWh]	800	801
Biomass generation [GWh]	73	73
Wind spillage [GWh]	2.11	0.93
PV spillage [GWh]	1.55	0.98
RES Spillage [h]	62	20
RES spillage [%]	0.23	0.12

Year	2026	2030
Zone	Moldova (right)	
RES generation share of total generation [%]	67.95	56.97
RES generation share of final demand [%]	34	31.5

APPENDIX B: DETAILED MONTHLY ELECTRICITY GENERATION BY UNIT IN MOLDOVA (2026 AND 2030, RIGHT BANK)

Detailed Monthly generation per unit in Moldova for 2026 – right bank																		
Month	Units	HPP Costesti	MD right Solar	MD right Wind	MD Right Biomass	CHP 1 G1	CHP 1 G2	CHP 1 G4	CHP 1 G5	CHP 2 G1	CHP 2 G2	CHP 2 G3	CHP North G1	CHP North G2	CHP North G3	CHP North G4	CHP North G5	CHP North G6
Jan-26	GWh	2.89	33.29	92.87	6.25	0	0	0	0	63.90	55.58	45.75	7.97	7.53	2.41	2.41	2.25	2.41
Feb-26	GWh	2.52	37.63	84.01	5.60	0	0	0	0	58.38	47.07	34.86	7.00	6.62	2.09	2.09	2.17	2.17
Mar-26	GWh	2.49	51.18	74.53	6.13	0	0	0	0	44.10	39.70	0	4.56	4.53	2.33	2.41	2.33	2.41
Apr-26	GWh	2.66	66.91	68.13	5.96	0	0	0	0	0	0	0	0	0	0	0	0	0
May-26	GWh	6.96	96.04	51.42	6.11	0	0	0	0	0	0	0	0	0	0	0	0	0
Jun-26	GWh	3.06	93.22	42.99	6.05	0	0	0	0	0	0	0	0	0	0	0	0	0
Jul-26	GWh	3.11	92.31	47.63	6.25	0	0	0	0	0	0	0	0	0	0	0	0	0
Aug-26	GWh	2.69	85.94	40.81	6.25	0	0	0	0	0	0	0	0	0	0	0	0	0
Sep-26	GWh	2.56	65.14	62.94	6.05	0	0	0	0	0	0	0	0	0	0	0	0	0
Oct-26	GWh	2.74	47.93	62.18	6.25	0	0	0	0	0	0	0	0	0	2.33	2.41	2.33	2.33
Nov-26	GWh	4.62	28.99	77.63	6.05	0	0	0	0	43.96	39.58	0	4.71	4.84	2.33	2.25	2.25	2.25
Dec-26	GWh	4.49	12.78	94.60	5.95	0	0	0	0	61.30	54.06	0	7.51	7.79	2.25	2.25	2.33	2.25

Detailed Monthly generation per unit in Moldova for 2030 – right bank																			
Month	Units	HPP Costesti	MD right Solar	MD right Wind	MD Right Biomass	CHP 1 G6	CHP 1 G7	CHP 2 G1	CHP 2 G2	CHP 2 G3	CHP North G1	CHP North G2	CHP North G3	CHP North G4	CHP North G5	CHP North G6	CHP West G1	CHP West G2	CHP West G3
Jan-30	GWh	2.89	33.29	92.87	6.25	7.66	7.66	54.83	48.93	35.07	7.45	7.58	2.38	2.41	2.25	2.41	7.92	7.39	7.92
Feb-30	GWh	2.57	37.63	84.38	5.64	6.86	6.86	49.8	43.16	31.68	6.89	6.76	2.09	2.17	2.17	2.09	6.86	7.13	7.13
Mar-30	GWh	2.57	51.32	74.72	6.22	7.66	6.06	55.27	46.6	0	3.63	3.65	2.25	2.33	2.33	2.33	7.92	7.66	7.92
Apr-30	GWh	2.67	66.79	68.39	6	7.1	2.39	0	0	0	0	0	0	0	0	0	7.39	7.39	0
May-30	GWh	7.11	96.58	51.28	6.17	1.35	7.66	0	0	0	0	0	0	0	0	0	7.92	7.66	0
Jun-30	GWh	3.06	93.22	42.99	6.05	7.39	7.66	0	0	0	0	0	0	0	0	0	7.39	7.66	0
Jul-30	GWh	3.11	92.31	47.63	6.25	7.66	7.66	0	0	0	0	0	0	0	0	0	7.92	7.92	0
Aug-30	GWh	2.69	85.94	40.81	6.25	7.66	7.66	0	0	0	0	0	0	0	0	0	2.39	2.3	0
Sep-30	GWh	2.56	65.14	62.94	6.05	7.66	7.66	0	0	0	0	0	0	0	0	0	5.8	6.15	0
Oct-30	GWh	2.74	47.93	62.18	6.25	7.85	7.66	56.13	46.36	0	0	0	2.41	2.33	2.41	2.33	7.92	7.66	7.66
Nov-30	GWh	4.62	28.99	77.63	6.05	7.46	7.66	50.6	46.88	0	3.42	3.3	2.17	2.25	2.33	2.33	7.39	7.39	7.39
Dec-30	GWh	4.54	12.78	95.1	6.05	7.39	7.66	52.85	45.42	0	7.07	6.8	2.33	2.33	2.33	2.25	7.39	7.66	7.39