ANNUAL STATEMENT OF TRANSMISSION SYSTEM OPERATOR

RIGA – 2023

TABLE OF CONTENTS

The report is prepared in accordance with the Regulations No. 322 “Regulations on the TSO’s annual statement” by the Cabinet of Ministers of the Republic of Latvia, in accordance with the informative report on the Latvian Long-Term Energy Strategy for 2030 and the National Energy and Climate Plan 2021-2030 developed by the Ministry of Economics (NECP)

1.

ELECTRIC ENERGY AND ELECTRIC POWER DEMAND IN THE COUNTRY DURING THE PREVIOUS YEAR

1.1. Electricity consumption (net) for the year 2022 on the week-by-week basis

The total annual electricity consumption excluding electric energy losses is 7,106,177 MWh.

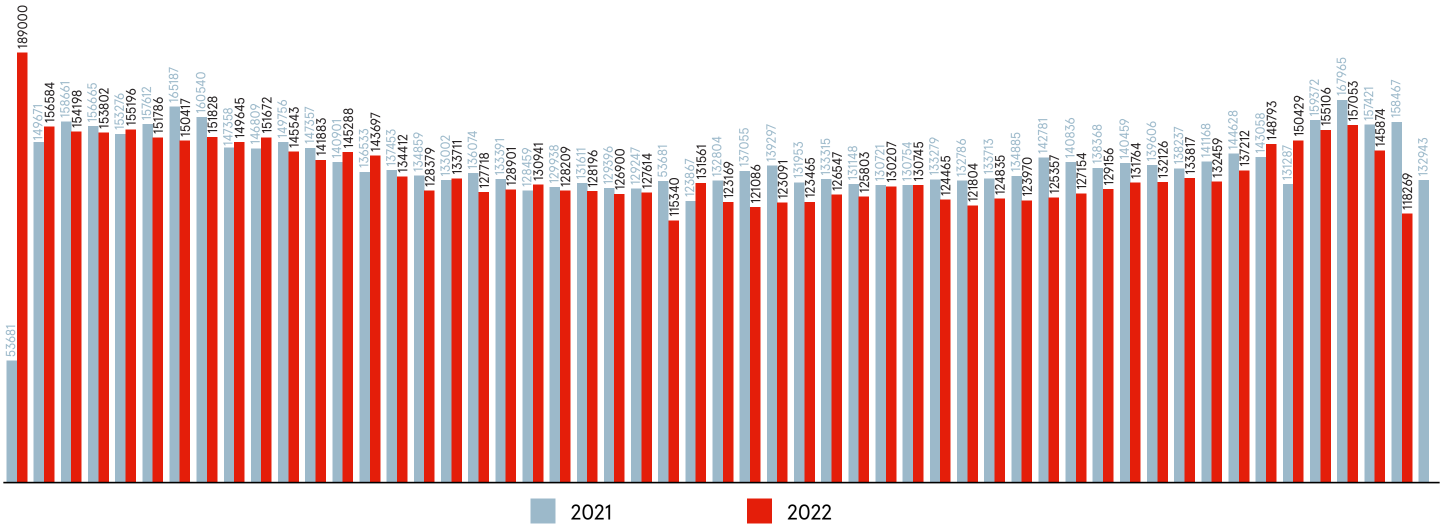
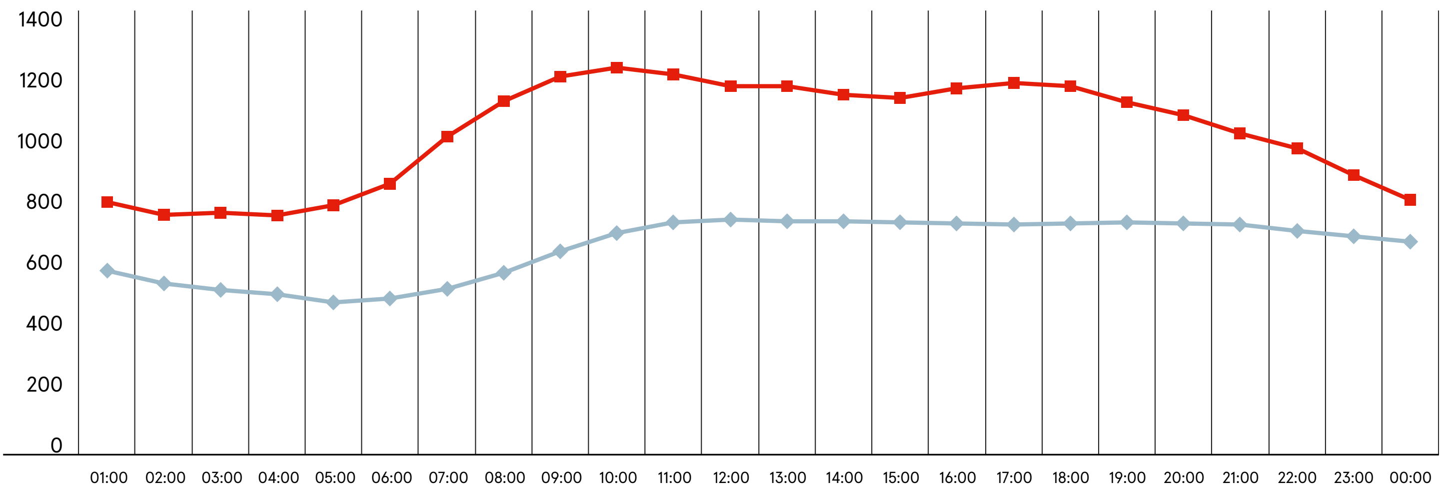


Fig.1. Weekly electric energy consumption in Latvia (net), MWh

1.2. Maximum winter peak load and minimum summer low load (data from the control measurements, MWh/h)

Minimum load	480 MW	25.06.2022.	05.00
Maximum load	1220 MW	12.01.2022.	10.00

1.3. The day energy consumption of the system (data from control measurements of 24 hours)



	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	00:00
12 JAN MWh	795	757	762	754	785	854	1003	1113	1192	1220	1198	1163	1160	1133	1123	1153	1172	1160	1112	1070	1013	965	881	804
25 JUN MWh	581	541	519	504	480	491	522	571	641	698	732	741	737	737	731	727	724	730	732	730	724	706	687	673

12 january MWh 25 june MWh

Fig.2. Electricity consumption during 24 hours

2.

ENERGY AND CAPACITY DEMAND FORECAST IN THE COMING YEARS (MINIMUM FORECAST PERIOD – 10 YEARS), INDICATING ANNUAL ELECTRIC ENERGY CONSUMPTION AND MAXIMUM LOAD IN DIFFERENT DEVELOPMENT SCENARIOS

The peak load of the electricity system has been calculated (normalized) based on the Latvian GDP growth forecast, submitted by the Ministry of Economy of the Republic of Latvia at the average regulated ambient temperature during winter period (December – February) -3.5 °C (see Table 1). Changes in outdoor temperature also affect changes to the maximum load.

Electricity system consumption is forecasted based on the AST expert opinion for three economic development scenarios of Latvia – Conservative development (Scenario A), Base scenario (Scenario B) and Optimistic development scenario (EU2030). The information from electricity system producers, consumers and distribution systems has been used in the development scenarios, as well the increase of consumption in the electric transport sector and future technologies – P2X and hydrogen technologies (see Fig. 3) has been considered.

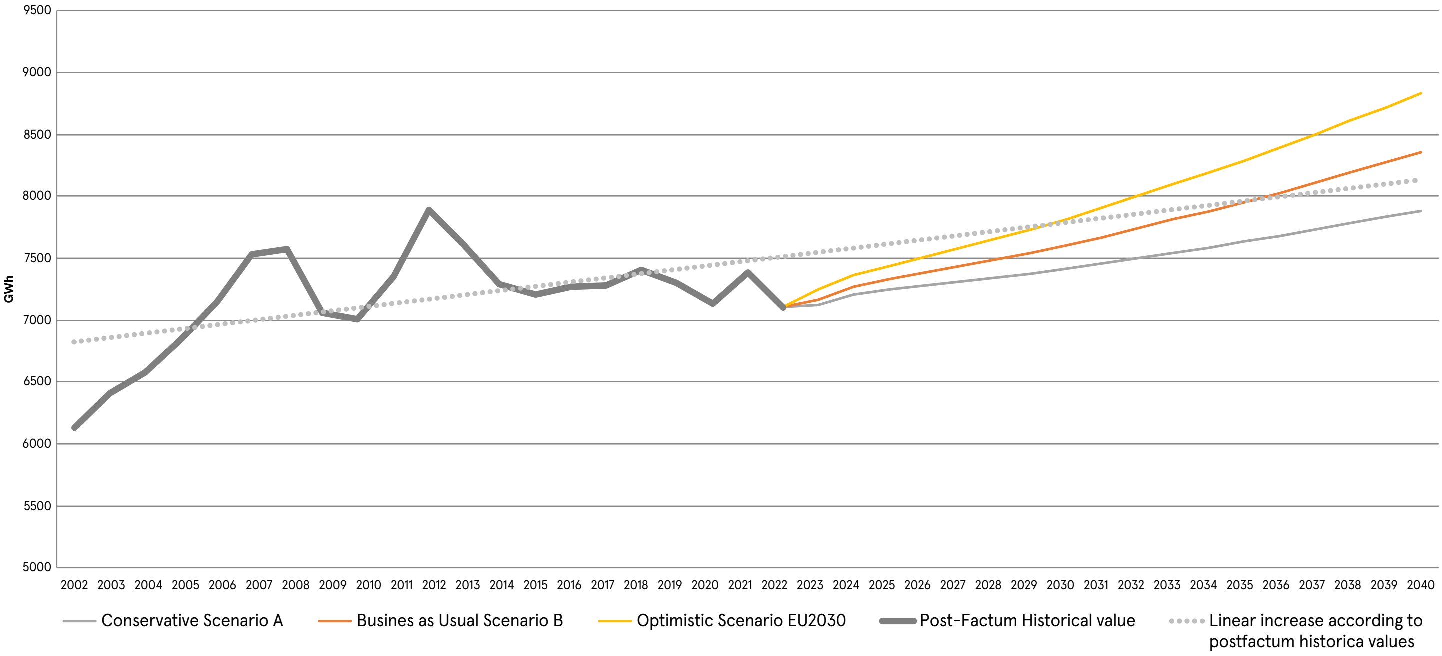


Fig. 3. Forecast of electricity consumption growth until 2040

Table 1

Year	Annual consumption for Conservative scenario (A) GWh	Annual consumption for Base scenario (B) GWh	Annual consumption for Optimistic scenario (EU2030) GWh	Peak load MW
2023	7125	7169	7243	1275
2024	7206	7270	7363	1304
2025	7245	7329	7440	1325
2026	7276	7381	7511	1344
2027	7306	7432	7582	1365
2028	7338	7485	7656	1386
2029	7373	7543	7734	1408
2030	7411	7604	7817	1431
2031	7454	7670	7906	1455
2032	7498	7739	7998	1481
2033	7543	7810	8093	1507

3.

DEVELOPMENT OF GENERATION CAPACITIES IN LATVIA

The development of generation capacities by scenarios is shown in figure 4. The figure separates the high-power base load power plants and distributed, low-power gas cogeneration plants and RES power plants. The picture shows a separate position for battery energy storage system (hereinafter – BESS), which is planned to be installed for the needs of TSO, to provide regulation and balancing services.

BESS is not intended to be used in the wholesale electricity market, but it is planned to be installed for the TSO needs to provide balancing power reserves. In the TSO annual statement, the development projects of the electricity system of new BESS are not discussed, because their readiness and development plans are currently very unclear.

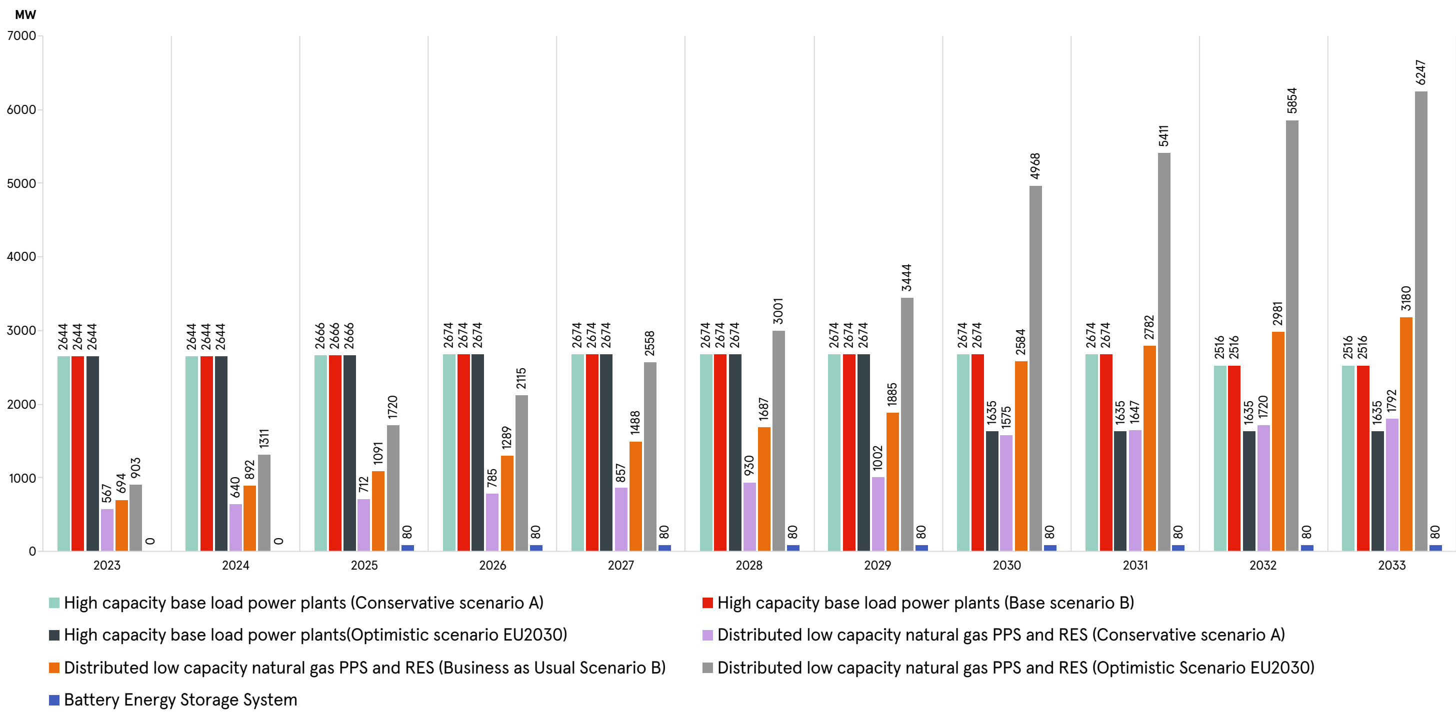


Fig. 4. Development of electricity generation capacities by scenarios (gross)

4.

ASSESSMENT OF POWER SUPPLY AND CONSUMPTION ADEQUACY IN THE REPORTING PERIOD AND FORECAST FOR THE FOLLOWING YEARS (MINIMUM FORECAST PERIOD – 10 YEARS)

4.1. Annual electricity consumption and possible sources of its coverage

The electric energy and power balance forecast, as well as the electricity consumption forecast, has been developed for three long-term development scenarios, where all scenarios include accelerated synchronous operation of the Baltic States with Continental Europe, starting from February 2025.

The detailed analysis of such scenarios has been selected based on the political decision by European Commission, Baltic States and Poland on 2018 June 28, and approved political synchronisation roadmap of the Baltic electricity networks with the electricity network of continental Europe, as well as on the basis of the Baltic States and European electricity TSOs to add the Baltic States to the synchronous zone of continental Europe with signing connection agreement on May 27 2020, as well as the joint declaration signed by the Prime Ministers of Latvia, Lithuania and Estonia on August 3, 2023 on the accelerated synchronization of the Baltic electricity networks with the Continental European electricity system.

The detailed description of the scenarios:

- **Scenario A "Conservative development":** Electricity system load forecast is based on information submitted by distribution systems operators (hereinafter – DSO) and other electricity system participants on the development of load and electricity consumption, including information from electricity system users, including electric transport sector and new P2X or hydrogen technology equipment.

  In a conservative scenario, system load and consumption development has a stagnant character, and electricity consumption develops slowly. The generation capacity development forecast is based on the AST expert opinion, taking into account information on development plans from electricity system producers and RES producers associations. In the conservative scenario, the operation of natural gas power plants is planned under free electricity market coditions, mostly working only in cogeneration mode during the winter period. In the conservative scenario, the development of wind power plants, biomass and biogas stations, small gas cogeneration stations and solar power stations is planned under the condition that the development plans of each generation source in Latvia are affected by changes in the state support mechanism. The development of offshore wind farms is slow, and TSO assumes that offshore wind farm projects till 2030 are realized in Latvia with 500 MW amount of installed capacity. Due to the termination of the state support mechanism, the operation of Imanta CHP is stoped, maintaining the existing capacity, but not participating in the electricity system capacity balance provision process. Due to slow development of the electricity system and conservative development of new generation capacities, Riga CHP-2 power plant remains in operation to ensure the balance of power system during evaluation period, but the generation of electricity during the year is reduced. Starting from 2032, Riga CHP-1 is stopped of operation and does not participate in the balance service provision.

- **Scenario B "Base scenario":** The electricity system load forecast is planned according to the AST expert opinion, based on the GDP growth forecast for Latvia, prepared by the Ministry of Economics of Latvia, on the information provided by the energy system participants, including information from electricity system users developing electric transport and new P2X or hydrogen technology equipment, as well as information submitted by Latvian DSOs on the development of load and electricity consumption.

  In the base scenario, the rate of consumption development is moderate. The forecast of generation capacity development takes into account the power plants planned to be put into operation or shut down according to the information submitted by electricity system participants, as well as taking into account the information about the development plans from the associations of solar and wind producers. In the base scenario (B), the development of Daugava hydro power plants (hereinafter – HPP) is based on the average annual power plant development, and the production of both Riga CHPs is planned according to the free electricity market conditions and state support for high-capacity gas cogeneration plants. Starting from 2032, Riga CHP-1 could be stopped, as it will be possible to replace its capacity with RES generation, which amount will be increased dramatically.

The development of wind power plants, biomass and biogas stations and solar power stations is planned based on the historical development rate of each generation source in Latvia and moderate, stable long-term economic development rates in the country. The forecast of development of offshore wind farms is quite high, and TSO assumes that offshore wind farm projects, including ELWIND, are being implemented in full, which would be the installed capacity of 500 MW for Latvia by 2030. The rapid development of small natural gas cogeneration power plants is not planned, and according to the increase of gas prices and gas import restrictions, the volume of small gas cogeneration power plants is decreasing. The operation of Imanta CHP has been stopped in 2021 due to changes in the national state support scheme.

- **Scenario EU2030 "Optimistic development":** The forecast for the development of generating capacity and load increase on the electricity system is planned, based on the AST expert opinion of long-term experience of adequacy planning, on the GDP growth forecast in Latvia, issued by the Ministry of Economics, on the information of energy system participants, including information from participants, developing electric transport and P2X or hydrogen technologies, taking into account the declared amounts and goals of generation and load, set by the European Union for 2030, where the long-term energy strategy in Latvia for 2030 and the National Energy and Climate Plan 2021–2030 developed by the Ministry of Economics is used as a basis.

In compare with scenarios A and B, is planned that electricity consumption in the optimistic scenario will grow faster due to higher interest of electric vehicles and electromobility, which will replace existing internal combustion engine vehicles. Such assumption is made based on the support mechanisms adopted by the Latvian government for the purchase of electric cars. In addition, the optimistic scenario predicts a faster development of hydrogen, electrolysis and P2X technologies, which will contribute the growth of Latvia's electricity consumption.

In the optimistic scenario, in addition to the electricity production development rates in scenarios A and B, future power plants are also taken into account, which commissioning, according to the TSO available information, is considered as possible, mainly envisaging the development of solar and wind power plants, based on the information submitted by the relevant associations and required technical requirements from electricity producers. In the optimistic scenario, a faster development of wind, solar, biomass and biogas power plants is expected, and RES will be able to replace the production of Riga CHP-1 and Riga CHP-2, resulting the transition from fossil fuel to RES.

In the optimistic scenario is assumed that from 2030 Riga CHP-1 and Riga CHP-2 will not be able to compete with RES power plants due to the termination of the state support scheme for cogeneration power plants, therefore CHPs will stop produce electricity and will not participate in covering of the peak load. The development of offshore wind farms is moving faster, and TSO assumes that offshore wind farm projects are developing more successfully, according to the State easier conditions for the development of offshore wind farm projects. It is assumed that the offshore wind farm project (for example ELWIND) has been realized in a bigger volume than planned at the beginning, due to technological development, which could be 1000 MW of installed capacity for Latvia by 2030. Since 2021, Imanta CHP does not participate in the covering of power adequacy, and the station is terminated due to changes in state support scheme.

Note: *The power plants generation in the attached tables are shown as net, and power plants planned annual repair schedules are taken into account.*

Assumptions and explanations for the tables in the attachment:

1) According to statistical data, the average multi-year net development of the Daugava cascade hydro power plants (hereinafter referred to as Daugava HPP) is 2700 GWh per year.

2) The five-party agreement concluded in 2010 between TSOs of Estonia, Latvia, Lithuania, Russia and Belarus foresees mutual provision of power reserves till 12 hours from the beginning. The power reserve to Latvia is provided by the five-party agreement on the maintenance of common power reserves, where each party maintains 100 MW, which makes a total of 500 MW. Taking into account the load of the largest generation unit in Latvia, the power reserve for the needs of the Latvian electricity system should be provided in accordance with the planned load of the maximum generation unit, i.e. up to 440 MW of Riga CHP-2 largest block (steam and gas turbines). Taking into account that the available power reserve in Latvia is 100 MW, the missing power of 340 MW can be guaranteed to be received from the neighbouring electricity systems only for 12 hours. Starting from February 2025, when the electricity systems of the Baltic countries will work synchronously with electricity system of Continental Europe, the necessary reserves (primary, secondary and tertiary reserves) for the Latvian electricity system will be called balancing power reserves. All necessary reserves will be used for balancing and maintaining of system frequency, so from February 2025, additional reserves will not be needed for balancing.

3) The required power reserve for ensuring the reliability of the Latvian electricity system, is according to the planned load and generation development scenarios, as well as in cooperation with Estonian and Lithuanian TSOs.

4) The regulation reserve of the electricity system is estimated as 6% of the system peak load and 10% of the installed capacity of the wind power plants, considering the winter peak day.

5) For power adequacy evaluation by month, is necessary to consider the water inflow un the Daugava HPP. In the conservative scenario (A), the lowest average monthly water inflow of January since 2000 was in 2003 (150 m3/s, which corresponds to 270 MW power to cover the peak hour of electricity consumption). In the base scenario (B) in January, the average water inflow is assumed to be 200 m3/s, which is equivalent to approx. 350 MW of power. In the optimistic scenario (EU2030), the water inflow for Daugava HPP is assumed to be 230 m3/s, which is equivalent to approx.. 400 MW capacity. To cover the minimum load in June, the same water inflow values are assumed depending on the scenario.

6) In the capacity table, the installed capacities of power plants are presented including their self-consumption capacity (gross capacity), while in the other tables the capacities are presented without including their self-consumption (net capacity). Gross power is the total power developed by the main and self-consumption generators in the power plants. The net power is the gross power of the power plant minus the self-consumption amount and power losses in the transformers.

7) The installed and net capacity of wind and solar power plants in the Conservative scenario (A), Base scenario (B) and Optimistic scenario (EU2030) is based on the forecast submitted by the Ministry of Economics of Latvia of the development of high-capacity wind farms, technical requirements issued by AS "Augstsprieguma tīkls" and AS "Sadales tīkls" for RES development, information from wind and solar associations, as well as the Latvian National Energy and Climate Plan 2030 approved by the Ministry of Economics.

8) The net capacity of the biomass and biogas power plants in the Conservative scenario (A), Base scenario (B) and Optimistic scenario (EU2030) is shown based on the technical requirements issued by AS "Augstsprieguma tīkls" and AS "Sadales tīkls", as well as the Latvian National Energy and Climate Plan 2030 approved by the Ministry of Economics.

9) The electricity balance tables in Conservative scenario (A) and the Base scenario (B) show, that the electricity production of Riga CHP-1 and Riga CHP-2 is evaluated according to the electricity market conditions in the Latvian bidding zone. In the optimistic scenario (EU2030) till 2029, the electricity production of Riga CHP-2 and Riga CHP-1 is evaluated as the maximum possible, that is, independently of the electricity market conditions in the Latvian bidding zone, producing the maximum

possible amount of electricity during the year. In order for the cogeneration power plant to receive the state support for installed capacity, according to the Cabinet Regulations No. 221 "On electricity production and pricing, during producing electricity in cogeneration", the number of hours of use of the installed electric power of the cogeneration power plant or some of its equipment must be at least 1200 hours per year.

10) In the power demand tables by hours of the day, the development of Latvian power plants is shown without possible power system reserve (assumption 3). Power reserves for Latvia's electricity needs will be provided by purchasing the necessary reserve under competitive conditions from electricity system participants in Latvia or Baltic.

11) In the Conservative scenario (A) is assumed that Riga CHP-2 can operate only in cogeneration mode, when its maximum net output capacity is 803 MW. In the Base scenario (B) and the Optimistic scenario (EU2030), the maximum output net capacity of Riga CHP-2 can reach 850 MW, assuming that the plant can operate in condensation mode.

12) The political decision about Baltic States synchronisation with Continental Europe and disconnection (desynchronization) from the electricity systems of Russia and Belarus was made in June 28, 2018. Due to the existing geopolitical situation in the world and the war in Ukraine, on August 3, 2023 Baltic States politically decided for the accelerated synchronization of the Baltic power systems with continental Europe starting from February 2025, at the same time desynchronizing from the electricity systems of Russia and Belarus.

13) In 2025, the Latvian TSO plans to install Battery Energy Storage Systems (BESS) with the total capacity of 80 MW/160 MWh in order to ensure frequency primary (FCR – Frequency Containment Reserve), secondary (aFRR – automatic Frequency Restoration Reserve) and tertiary (English mFRR – manual Frequency Restoration Reserve) regulation. According to AST evaluation, the total amount of necessary reserves could be 276 MW, including FCR ~11 MW, aFRR ~32 MW and mFRR of up to 233 MW. The BESS will be used only for providing of TSO reserves in synchronization mode, until the balancing market in the Baltics can provide balancing capacities. Therefore, the amount of energy from BESS is not shown in the energy development tables.

4.2. Information of cross-border electricity trade amounts, comparing the year 2022 with the years 2021 and 2020

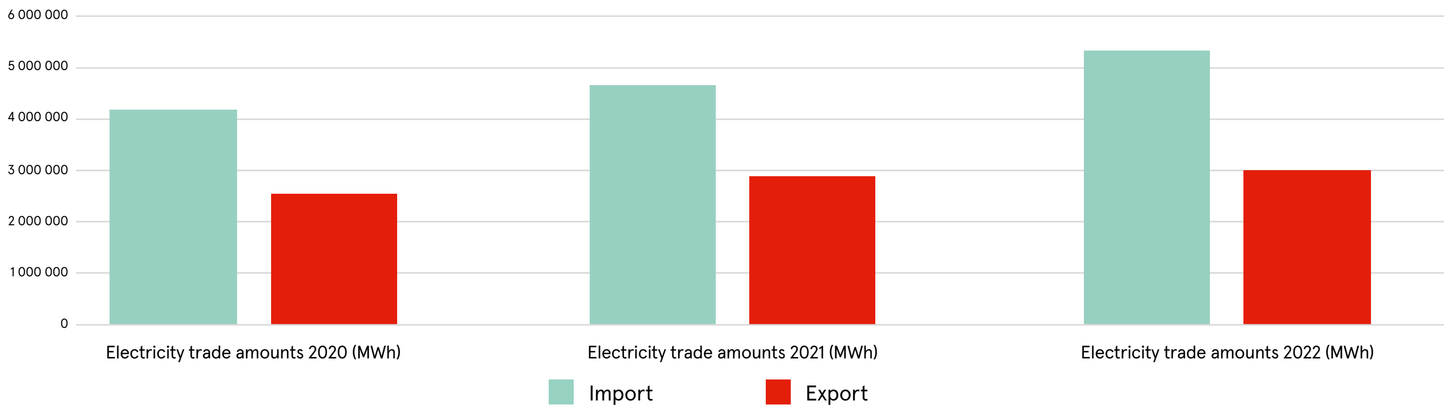


Fig. 5. Cross-border electricity trade amounts

Table 2

	Electricity trade amounts 2020 (MWh)	Electricity trade amounts 2021 (MWh)	Electricity trade amounts 2022 (MWh)
Import	4 173 365	4 666 370	5 308 232
Export	2 547 730	2 893 735	2 996 705

Table 2 shows that the import of electricity is increasing during the last three years. In 2021, compared to 2020, imports increased by 11.8%, while in 2022, compared to 2021, the import increase was 13.8%. The amount of electricity exported in 2022 has slightly increased in compare to 2021. Last year, the difference between export and import increased till 2 311 527 MWh, resulting to a 30.4% increase compared to 2021, which shows to a lower amount of electricity generation in Latvia.

Starting from 2020, the interest for developing of renewable energy resources (hereinafter – RES) power plants, mainly onshore wind and solar parks in the territory of Latvia was significantly increased, which is reflected in the amount of technical requirements for connections to the transmission network, issued by AST. The rapid increase in issued technical requirements began in the spring and summer 2022. To react for significant increase of interest for RES connections to the transmission network and their impact to the security and stability of the transmission network, on January 12, 2023, the Council of the Public Utilities Commission (hereinafter – PUC) issued decision No. 1 “On the fee for one unit of capacity reservation in the electricity sector”, which obliged the electricity producer to provide the system operator with a fee for capacity reservation in the electricity system within 60 days from the moment of receiving the technical requirements for the connection.

The amount of reserved capacities of transmission network in 2023 is shown in the table 3. The table contains data at 16.08.2023. The purpose of the implemented capacity reservation payment is to promote the competitiveness among developers, because in the middle of 2023 the amount of reserved network capacity, including payied reservation fee, exceeded 6000 MW.

Currently, according to the volume of AST issued technical requirements, there is a significantly bigger interest for solar park connections than for wind parks, the percentage distribution of which is given in Figure 6. The reason of this, that according to the existing legislation, an environmental impact assessment is not obligatory for solar power plants.

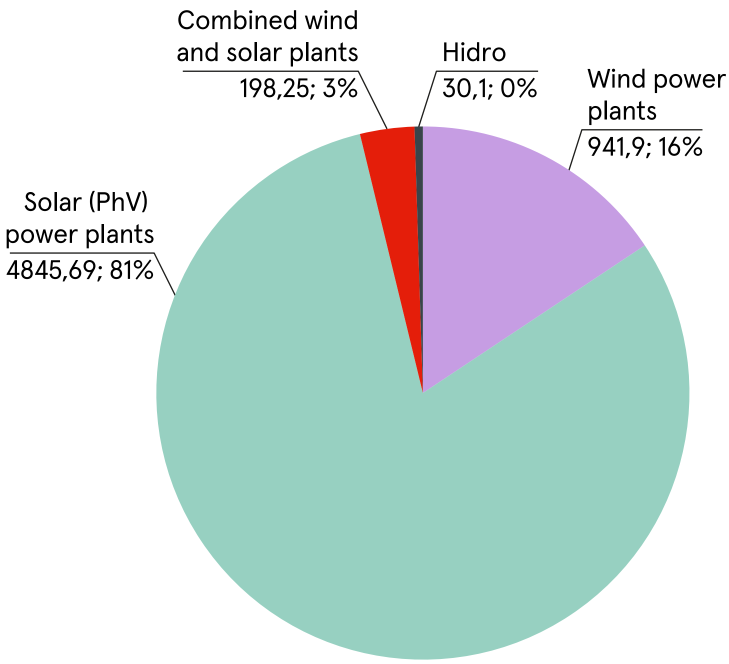


Fig. 6. Distribution of RES reserved capacities in the transmission network in Latvia, MW and %

Table 3

	Required technical requirements MW	Solar (PhV) power plants MW	Wind power plants MW	Combined wind and solar plants, MW
Kurzeme	2761	1923	750	88
Zemgale	404	190	90	110
Vidzeme	1249	1131	102	0
Latgale	1602	1602	0	0
TOTAL	**6016**	**4876**	**942**	**198**

Thereby, a situation has arisen that the development of solar parks has advantages in compare with wind parks, although from technical point of view wind parks are more efficient. According to information available in AST, also the amount of requested connections to the distribution network, is about 1300 MW, which creates new technological challenges in the electricity system, because in some power system operating modes, the power flows from the traditional direction from ransmission network to distribution network turns in the opposite direction from distribution to transmission network. For both the transmission network and the distribution network, the amount of connections of solar power plants is several times higher than the amount of wind power plants, and as mentioned above, the solar solution is a less efficient. Network capacity is reserved equally in both cases. An optimal RES generation portfolio is one that would ensure the most even distribution of generation during the year, since uneven generation distribution leads to inefficient use of network capacity. For example, if the grid is dominated by solar generation, then the grid will be efficiently used only during peak generation times when the sun is shining, but there are not so much such modes, especially in the autumn and winter months. During the rest of the time, the network will be unloaded. The existing legislation obliges to reserve the full network capacity for any type of generation connection. This assumption applies both to the entire network as a whole and to individual network elements, such as 330 kV or 110 kV transmission lines. With an uneven distribution of solar and wind generation, there is more often an overproduction of generation that exceeds Latvia's consumption and should be exported to neighbouring countries, but there is no guarantee that there will not be a similar situation in neighbouring countries at specific hours, in which case it will be necessary to restrict electricity producers. Therefore, solutions for a more even distribution of generation between solar and wind must be found, regardless to the amount of total installed capacity, so that in the future the capabilities and functionality of the transmission network will be used most efficiently. Although requests for connection of solar power plants are currently dominant (80% solar vs. 20% wind), AST, together with Climate and Energy Ministry, is looking for solutions and ways to stimulate the equalization of the share of solar and wind power plants in the overall RES generation portfolio. At the same time, various types of hybrid projects combining solar and wind power plants, electricity storage, hydrogen or other P2X production facilities should be developed. Thus, a more optimal generation portfolio would be formed, as well as technologies would be developed that could be used to balance the system and ensure power reserves.

Assuming that RES capacities will be installed according to table 3 mentioned amounts and using historical generation profiles for each type of generation in Latvia, AST found that 75% of the time during the year, the total RES production does not exceed 1000 MW, and RES power plants operate at maximum capacity only short period during the year. Accordingly, in periods when these power plants are not working at full capacity, it is possible to connect additional generation. But there is no guarantee that the additional power connected in this way will not work at the same time, therefore, for provision of system security and stability, its power could be limited if necessary. According to the existing legislation, TSO does not have the right to limit the electricity generation of developers in normal network operation mode. As already mentioned above, currently AST is working with the policy-maker Ministry of Climate and Energy on the development of the most appropriate solution and the development of new regulation or changes to the existing regulation in order to connect the largest possible RES potential in Latvia to the transmission network, but at the same time still ensure the security and stability of the system, which will allow TSO to limit the percentage production of new RES power plants during the year, depending on the operation mode of the electricity system, without compensation.

The TSO plans the development of new generating capacities and their connection to the transmission network in the long term period and accordingly reserves the transmission network capacities, as a result the reinforcement of Latvia's internal transmission network will be necessary, as well as construction of new interconnections with neighbouring electricity systems, promote the increase in electricity consumption in the region, ensure quick power reserves and, from a system management point of view, to provide the necessary amount of inertia in the power system.

4.3. TSO's assessment of the periods where capacities were not adequate to the demand, and proposals for ensuring the power for the following years (possibility of power development in specific locations, consumption management measures, construction of new system facilities)

The Latvian TSO, as the responsible institution in Latvia for the security of the electricity system and power supply under electricity market conditions, working together with Baltic Sea region countries according to the open electricity market "Nord Pool" principles, ensures electricity trade in the Latvian bidding zone, an interrupted power balance between Latvian consumption and production, as well as controls and publishes the available interconnection capacities for trade with the electricity systems of neighbouring countries. Since European Union (EU) adopted Energy Action Plan 2050, which stipulates that generation development and national power adequacy should be focused on areas with RES potential, in order to stimulate the reduction of CO_2 and other greenhouse gas emissions, as well as promote the development of more efficient, competitive power plants, the bases the capacity sufficiency within one country is not an unequivocal indicator of the sufficiency of the generating capacities, but it must be considered in combination with the available transmission capacities to/from the country or region. In normal operating modes of the Latvian electricity system, the cross-border capacity of interconnections with the electricity systems of neighbouring countries is sufficient to ensure the forecasted electricity import or export. In previous years, there have been no situations where it would have been necessary to disconnect an electricity user or region in Latvia due to insufficient generating capacity or insufficient interconnection capacity with neighbouring countries. Until now, working synchronously with the united electricity system of Russia and Belarus, the Latvian TSO has been able to ensure the transmission of the requested power (consumption) in the Latvian electricity system in all modes, regardless of the generating unit portfolio operating in the territory of Latvia.

Analysing the capacity provision for the 10 years period, in the Conservative scenario (A) capacity (MW) provision analysis table (Table 7) shows that the generating capacities are insufficient to cover the peak load, provide power reserves and meet the system regulation and security requirements for the winter months from 2022 to 2023, as well as in 2033. In the conservative scenario (A), a slow development of RES in Latvia's electricity system, a slow tempo of economic growth is planned, and the existing cogeneration power plants participate in covering of power balance, therefore, the operation of the natural gas cogeneration power plants, including Riga CHP-1 and Riga CHP-2 in free electricity market conditions will not be competitive and the amount of gas imports will be limited. Due to changes of state support scheme for generation, TSO forecasts that the amount of electricity produced by Riga CHP-2 and Riga CHP-1 will also be lower than the average historical data. Riga CHP-1 and Riga CHP-2 power plants will be in operation to participate in peak load covering, but the generation of electricity will be relatively small. In the conservative scenario (A), based on generation development tendencies, the power deficit will reach up to 2% in 2023-2024 and 6% in 2033. It is planned that in 2030, 495 MW of the total net capacity of wind power plants could be covered by offshore wind farms, the real development temps of which are currently difficult to predict, taking into account the fact that no wind power plants have been installed yet in the territorial waters of the Baltic States. Due to the slow development of wind power plants, in the Conservative scenario (A) it is planned that the development of offshore wind farms could start no earlier than in 2030 (the minimum timeline for the construction of wind farms, including studies, permits and construction is approximately 4-6 years), when the planned offshore wind farm project – ELWIND could be implemented, or any other wind farm project instead. During all forecasted period (2023-2033), the power adequacy is in the range of 98% to 112%, which indicates that the generating capacities are practically sufficient to cover the electricity consumption, as well as during forecasted period, the power deficit is relatively small – 29-98 MW. The Conservative scenario (A) clearly shows that, in order to ensure the electricity balance in the system, it is very important not to lose/reduce the existing Latvian base load generation (Daugava HPP, Riga CHP-1 and Riga CHP-2). In the Conservative scenario (A), electricity production is analysed with condition that Riga CHP-1 and Riga CHP-2 will work under free electricity market conditions, when the stations are less efficient and, under free competitive issues, where they are able to produce only a part of the maximum possible capacity. From 2032, Riga CHP-1 will no longer be competitive in compare with the production by the renewable energy resources, so Riga CHP-1 could be closed. It can be seen from the electricity balance table (Table 6) that the deficit of electricity for the Latvian electricity system in the Conservative scenario (A) ranges from approximately 54 GWh to 1303 GWh, which will be possible to import through interconnections from neighbouring countries to ensure the electricity balance in the system. In the Conservative scenario (A), starting from 2030, the electricity deficit could decrease due to the development of offshore wind farms.

In the Base scenario (B), the power (MW) provision analysis table (Table 8) shows that the Latvian electricity system is able to cover the peak load from 2023 to 2033 and, during next years the power surplus in the system is from 11% up to 47%. The Base scenario (B) shows that the power surplus is growing significantly due to the rapid development of the planned RES, for which technical requirements of approximately 6000 MW have been issued. It is essential not to lose/reduce the existing Latvian base load generation (Daugava HPP, Riga CHP-1 and Riga CHP-2). In the Base scenario (B), it is assumed that the development of offshore wind farms could start developed gradually from 2030. This assumption is based on the fact that ELWIND or any other wind farm project could be fully realized in 2030, when the installed capacity of the offshore wind farm would reach at least 500 MW. It can be seen from the electricity balance table (Table 11) that in the Base scenario (B) the supply of electricity will not be sufficient in the period from 2023 to 2029 (86-95%), but after the implementation of ELWIND or another offshore wind farm project in 2030, provision of electricity will exceed 100%. Until 2030, Latvia will import electricity from the neighbouring countries to ensure the power balance in the system, and the cross-border capacities will be sufficient to ensure Latvia's electricity balance. In the Base scenario (B), it is assumed that Riga CHP-2 works under free electricity market conditions, but from 2032 Riga CHP-1 will shut down.

In the Optimistic scenario (EU 2030), the capacity (MW) provision analysis table (Table 9) shows that the Latvian electricity system is able to cover the peak load from 2023 to 2033 (119% to 176%). Due to the dramatic increase of RES development, the Riga CHP-1 and Riga CHP-2 gas power plants will be taken out of operation starting from 2030, as RES are capable of replacing them and the power deficit can be imported from the RES of neighbouring countries. The power surplus in Latvia indicates that it is possible to export electricity to the neighbouring countries to help cover the peak loads of the electricity systems in neighbouring countries. In the Optimistic scenario (EU 2030), it is assumed that the development of offshore wind farms could gradually start from 2030 and the capacity of offshore wind farms could reach 1000 MW, based on the information about ELWIND wind farm project development with a capacity of up to 1000 MW. It can be seen from the electricity balance table (Table 12) that in the Optimistic scenario (EU 2030), the provision of electricity will be sufficient from 2023 to 2033 (121–176%). In the Optimistic scenario (EU2030), it is assumed that after 2030 Riga CHP-1 and Riga CHP-2 will no longer be competitive with RES capacities in the region and therefore it is necessary to close these stations or to reconstruct them to some other RES. In the Optimistic scenario (EU2030), it is assumed that the development of gas-fired cogeneration power plants is not based on the electricity market principles and, in order to ensure the security of the Latvian electricity system and electricity supply in Latvia, it is able to produce the maximum possible amount of electricity, taking into account the annual maintenance schedule of the power plant. In the Optimistic scenario (EU2030), increasing the share of onshore wind power plants in the Latvian electricity system even more rapidly, the need for regulation reserve will increase as well. The cross-border interconnections capacity will be sufficient to export electricity and power surplus to the neighbouring electricity systems.

Analysing the winter peak load coverage during 24h, the total reserve of the Latvian electricity system is not included there. In the Conservative scenario (A), is concluded that from 2023 to 2028, the Latvian electricity system will be able to cover the daily load schedule, and it will not be necessary to import power to cover the daily peak load (Table 13-14). In 2033, small power import is in place, ranging from 38 MW to 105 MW (Table 15).

In the Base scenario (B), the Latvian TSO will be able to fully cover the daily load from 2023 to 2033 (Table 16-18). It is possible to cover 100% of the daily load schedule because the need for power reserves is not included in the tables. In the Base scenario (B), it will be possible to export power to neighbouring power systems, if necessary, to help neighbouring countries cover peak loads during winter months, as interconnectors allow for the export/import of power surplus. From daily peak load tables, it can be seen that in 2028 and 2033, Latvia could have forced export to neighbouring countries in order to keep the Riga CHP-2 power plant operating during 24 hours with minimum capacity, because, during peak load hours, the Riga CHP-2 is participating in the covering of the balance. In the Optimistic scenario (EU 2030), the Latvian TSO will be able to fully cover the daily load in 2023 (Table 19) and in 2028 (Table 20), but in 2033 (Table 21) there will be a large energy export during the day when solar power plants are operating, but in the morning and evening there will be a relatively large energy import. Power import will range from 492 MW to 717 MW. Such scenario shows that in addition to the development of large RES and offshore wind farms, it is necessary to additionally develop base load capacities which are able to daily peak load and to balance the unpredictable RES capacities. The main influencing factors for covering the winter peak load are the water inflow in the Daugava HPP and the development characteristics of wind power plants.

For daily minimum load coverage during summer period in the Conservative scenario (A) Riga CHP-1 is stopped in 2023 (Table 22), and the power balance is basically provided by RES producers – biomass, biogas, wind power plants, Daugava HPP, small HPP, solar power plants, and distributed natural gas cogeneration power plants, and regulation reserves of electricity system is provided by Riga CHP-2. Power export is possible during the minimum daily load hours, when the minimum production of Riga CHP-2 is assumed 340 MW, for ensure the power adequacy during the day. In the Conservative scenario (A), biomass and biogas power plants, small HPPs, wind and solar power plants, Daugava HPP, small natural gas cogeneration plants operate as base load power plants in 2028, and Riga CHP-2 provides regulation services (Table 23). The minimum production of Riga CHP-2 is 340 MW, so that it can cover the power adequacy during the day. In such a scenario, the forced export of electricity to the electricity systems of neighbouring countries is planned during the minimum load mode and it is from 1 MW to 195 MW. In 2033, the base load power plant Riga CHP-1 is stopped of operation, the power balance is provided by RES, and the system is balanced by Riga CHP-2. The minimum production of Riga CHP-2 is 340 MW, in order to be able to provide power output till 448 MW. The Latvian electricity system will export 3376 MWh of electricity during the day (Table 24). For coverage of daily minimum load in the Base scenario (B) in 2023, Riga CHP-1 and Imanta TPP are stopped of operation, (Table 25), and the power balance is basically provided by RES – biomass and biogas, wind power plants, Daugava HPP, small HPPs, solar power plants, and small natural gas cogeneration plants, and regulation is provided by Riga CHP-2. The minimum production of Riga CHP-2 is 340 MW. In such a scenario, the forced export of electricity to neighbouring countries would range from approximately 15 MW to 251 MW. In the 2028 of Base scenario (B) biomass and biogas power plants, small HPP, wind and solar power plants, Daugava HPP, small natural gas cogeneration plants operate as base load power plants, and Riga CHP-2 provides regulation service (Table 26). The minimum production of Riga CHP-2 is assumed at 340 MW, in order to be able provide the balance of power system during the day. The export of surplus electricity to the neighbouring electricity systems is from 17 MW to 500 MW. In 2033 (Table 27), the base load power plants are the same, only, due to the increase of RES production, Riga CHP-2 can work with a minimal power 170 MW and will be able to provide a power balance with one unit (442 MW).

To cover the daily minimum load in the Optimistic scenario (EU 2030) in 2023, when the fastest development and use of RES is expected, Riga CHP-1 and Imanta CHP are stopped of operation (Table 28), and the power balance is basically provided by RES – biomass and biogas, wind power plants, Daugava HPP, small HPPs, solar power plants and small natural gas cogeneration plants, and only Riga CHP-2 is providing regulation services. The minimum production of Riga CHP-2 is 340 MW. Power export is planned from 1 MW to 374 MW, and the amount of exported electricity during the day will be approximately 3183 MWh. In the Optimistic scenario (EU2030) in 2028, biomass and biogas power plants, small HPP, wind and solar power plants, Daugava HPP, small natural gas cogeneration plants operate as base load power plants, and Riga CHP-2 provides regulation services (Table 29). The minimum production of Riga CHP-2 is 340 MW. Power export will be ensured by cross-border interconnection capacities, that is adequate, and the amount of exported power will range from 3 MW to 254 MW. Approximately 1879 MWh of electricity will be exported during the day in 2033, the base load power plants will not change (Table 29), but RES power plants will be changed, and due to high gas and CO_2 prices, big capacity gas power plants will be closed, as a result, the Latvian electricity system will import from 38 MW to 339 MW of power at night in the period from 00:00 to 07:00 and from 295 MW to 336 MW in the time period from 19:00 till 23:00. During the day, from 08:00 to 18:00, the Latvian electricity system will be able to cover the peak load and will export from 7 MW to 1347 MW.

By increasing the production of electricity from RES, problems arise with covering the daily minimum and maximum load. At the minimum load mode, it is necessary to keep the highly manoeuvrable gas stations in operation (minimum power output) to ensure the regulation service of the electricity system, which after ensure the coverage of the daily peak loads. In this way, in order to ensure the security, stability and electricity balance functions of the system, in minimum load scenario is necessary to export the electricity produced by RES to the neighbouring electricity systems, but at peak load it is necessary to additionally maintain high-speed regulated gas power plants to ensure the regulation service, because only with RES it is not possible to cover the daily peak load consumption.

With the development of RES, there is a bigger necessity for a quickly regulated power reserves that is able to regulate the power balance according to the needs of the daily load schedule. In order to ensure a quickly regulated power reserve, the TSO can buy the service from already existing power plants in Latvia, from electricity producers in neighboring countries, or provide the mentioned service with installed Battery Energy Storage Systems (BESS), what decided to install, based on the market test carried out on September 24 2021, and Cabinet decision No. 674 (https://www.vestnesis.lv/op/2021/187.3) has been made in Latvia to allow TSO install and operate BESS for system regulation needs. BESS will be installed in 330/110 kV substations. Information about the necessary and available power reserves (MW) for 2022 are given in Table 4.

Table 4

Month	Maximum required power reserve	Available power reserve	
		Latvia	Agreement between system operators until 12 hours
	MW	MW	MW
January	440	100	340
February	440	100	340
March	440	100	340
April	440	100	340
May	440	100	340
June	440	100	340
July	440	100	340
August	440	100	340
September	440	100	340
October	440	100	340
November	440	100	340
December	440	100	340

4.4. Conclusions of the transmission system operator on electricity generation capacity and energy availability for provision of power supply to all Latvian users

Looking at the power adequacy table (Table 8), can see that in 2023, in the Conservative scenario (A), self-sufficiency of the Latvian electricity system with power will reach approximately 98-115%, and with electricity by 2029, 81-84% (Table 10), but from 2030 to 2033, 98-104%. In the Conservative scenario (A) there are signals of a deficit of generating capacity, reflecting the current situation without drastic changes. In this scenario is not planned to close the high-capacity gas-fired power plants in Riga until 2030. In the Base scenario (B), provision with a capacity above 100% will be present throughout the considered time interval (Table 8). In the Base scenario (B), the provision of electricity from 2023 to 2029 will be between 84% and 93%, but after the construction of ELWIND or another offshore wind farm project, the provision of electricity will exceed 100% throughout the forecasted period (Table 11). The missing amount of electricity will be imported through interconnections from the neighboring electricity systems. In the Optimistic scenario (EU 2030), the amount of electricity produced in the time interval from 2023 to 2033 will be from 117% to 173%, which indicates that the Latvian electricity system will be able to cover the balance of electricity consumption during the forecasted time period (Table 12). In the case of maximum energy production, the Latvian electricity system will be able to ensure the export of electricity to the neighbouring electricity systems. After 2030, when the high-capacity gas power plants will be closed, there will be no deficit of electricity, because there will be a lot of RES in the system. From the power adequacy table, can see that in the Optimistic scenario (EU 2030) capacities are sufficient in the forecasted period from 2023 to 2033 (Table 9).

4.5. The development of the Latvian transmission network, considering the development of RES and the necessary connections to the transmission network

Commissioning of new fossil-fuelled base load capacity power plants in Latvia is not planned until 2033 and, according to the information available in AS "Augstsprieguma tīkls", no decisions have been made regarding the implementation of big capacity power plant projects in the Baltic States. At the same time, the Ministry of Economics of Republic of Latvia, providing information on potential high-capacity power plant projects in Latvia, states that the National Energy and Climate Plan (NECP) sets goals for the development of wind energy until 2030, expecting the development of at least 800 MW of installed wind power capacity in Latvia. Currently, as already mentioned, there is a dramatical interest from RES producers in Latvia for connections to the transmission network, which requires TSO to plan also the strengthening, modernization and development of the transmission network. The amount of the issued technical requirements for connections to the transmission network exceeds 6 GW, which is 5 times more than the current peak load of the Latvian power system. Therefore, the TSO should also plan the development of it network in order to export the surplus electric energy produced by RES to neighbouring countries. According to the information mentioned above based on the memorandum of understanding signed by the governments of Estonia and Latvia on September 18, 2020, on the development of a joint wind farm project in the Baltic Sea, as well as based on the maritime spatial plannings of the Latvian and Estonian sea areas, the work of the development of a joint Latvian-Estonian offshore wind farm in the Baltic sea has started and ongoing. The jointly developed offshore wind farm project name ELWIND (Estonia, Latvia, Wind) is planned on hybrid mode, building both the offshore wind farms and the transmission infrastructure together with the electricity transmission interconnection between Estonia and Latvia. The project promoter of ELWIND project in Estonia is the investment centre KIK together with the Estonian Ministry of Economics and Communications, whereas the project promoter in Latvia is the Latvian Investment Development Agency (hereinafter – LIAA) together with the Ministry of Economics of Republic of Latvia. Taking into account the development of offshore wind farms technologies, it is planned that the installed capacity of the Estonian-Latvian joint wind farm could reach 500-2000 MW (with Latvian part from 500-1000 MW and Estonian part from 500-1000 MW). Transmission system operators of Latvia and Estonia AS "Augstsprieguma tīkls" and AS Elering are currently involved in the project as observers and are planning to be involved in the project if States decides that TSOs are responsible for the construction of connection infrastructure to the transmission network in each country. Currently, AST together with the Elering have started activities on the development of the fourth Latvian-Estonian electricity transmission interconnection, which is planned to be built in the Baltic Sea territorial waters in order to increase the transmission capacity between Latvia and Estonia. In 2022, AST and Elering prepared detailed onshore right of way study for possible onshore connection options, as well as prepared the technical catalogue study of measures to understand the existing technologies, solutions and potential costs for the construction of offshore wind farms. The ELWIND project is included in the Pan-European Ten Years Network Development Plan together with infrastructure development and is a candidate for the list of European projects of common interest (PCI), which will allow to apply project for European Union co-financing from the CEF RES (Connecting Europe Facility of renewable energy) structural funds for the support of the wind park itself, and also from CEF-Energy structural funds for the construction of transmission infrastructure. The auction of the wind park project for the potential investor is planned 2026-2027. The implementation of the project itself, together with the construction of the infrastructure, is planned until 2030-2035. In connection with the implementation of ELWIND or another offshore wind farm project, the strengthening of internal transmission network of Latvia is necessary, incl. reconstruction of the existing interconnection Grobiņa – Darbenai between Latvia and Lithuania and construction of a new interconnection between Latvia and Lithuania "Ventspils-Brocēni-Varduva". It is planned that the existing electricity transmission infrastructure will also promote the construction of other wind farms in the region, as the network infrastructure for the common park gives possibility to other potential wind farms to connect to the network in the same region.

Considering the Latvian offshore wind potential, which is estimated at around 15 GW, it is important to develop interconnections to the neighbouring electricity systems for the development of big capacity offshore wind farms in order to promote the EU's goal of integrating the electricity market and ensuring the security and stability of the system, as well as to promote use of RES in the region. As already mentioned above, AST together with Elering have started the development of the fourth Latvian-Estonian electricity transmission interconnection, but Latvia needs to develop interconnections not only with the Baltic States, but also with other European Union countries.

Latvia continues to develop the possibility for construction of High Voltage Direct Current (HVDC) interconnection with Sweden. The planned implementation time of the project is until 2040.

The Latvia-Sweden electrical interconnection is an important transmission infrastructure project not only for Latvia and Sweden, but also for the whole Baltic Sea region, especially in the Baltic power system synchronization mode with electricity system of Continental Europe, as well as due to increase share of RES in the generation portfolios of the Baltic countries. Taking into account the planned increase of electricity consumption, development of the electricity market, as well as the provision of N-1 security criteria, the reinforcement of transmission network and development of new interconnections among the countries of the Baltic Sea region is necessary in the long term period. Latvia, unlike the other Baltic States, is currently only one without electrical interconnections with the Nordic countries or continental European electricity systems. Latvia has borders with a small amount of European Union countries, and due to this one of the possible development options for the connection to other European Union countries is the Latvian-Sweden interconnection option as HVDC offshore cable. Currently, the project is named LaSGo (Latvia-Sweden-Gotland) interconnection, taking into account the geographical location and included in the development documents of Latvia.

Currently, AST, together with the Ministry of Climate and Energy of Republic of Latvia, as responsible authority for the energy sector in Latvia, are working on the further development of the vision of the project and the support of the Latvian government with the aim of justifying the Swedish side to support the further development of this project, allowing both TSOs to start a detailed technical-economic analysis. In the mutual negotiations between the Latvian and Swedish TSOs about the further development of the project, the Swedish TSO Svenska Kraftnat (SvK) does not give a clear answer about the possibility of developing this project, referring to the needs of internal transmission network reinforcement in Sweden, for which SvK received the appropriate state funds. The development of offshore wind farms around the Gotland island in Sweden and in the Kurzeme shore in Latvia is planned in a radial mode, connecting them to the existing onshore transmission network, but in the future SvK and AST do not exclude the possibility of expanding these radial connections and creating a hybrid transmission interconnection in the sea between Latvia and Sweden. Mentioned project could be supported by Latvia and Sweden, and it is in accordance with the planned Baltic Sea offshore grid initiative (BOGI), which is currently on the initial development stage among the TSOs of the Baltic Sea region. The negotiations with Swedish TSO bout project development possibilities are currently ongoing, and the preferred type of the project implementation is a hybrid project with the possibility to connect other offshore wind farms to the interconnection in the future. The transmission capacity of the interconnection between Latvia and Sweden is planned to till 700 MW, defined by the magnitude of so called design contingency (size of generation/load capacity Baltic power systems are capable to lose unexpectedly and still maintain the stable and secure operation). The project has good chances to receive the EU co-financing for project implementation and for detailed studies as well, including the costs-benefits analysis. In 2023, AST initiated study of the technical and economic possibilities of the project, which it plans to complete in 2024.

Taking into account dramatic RES amount increase in the Baltic States and the need to export it to countries with energy deficit, on May 9, 2023, Baltic TSOs (Elering, AST and Litgrid) signed a letter of intend with the German TSO 50Hertz for the construction of an electricity offshore transmission interconnection between the Baltic States and Germany to increase cooperation among TSOs, prepare common steps for countries' energy independency and to help Germany with its power adequacy issues. The project is named "Baltic WindConnector". The development of "Baltic Wind Connector" electricity transmission interconnection in the Baltic Sea foresees the construction of HVDC cable around 800 km in the Baltic Sea between Germany and Estonia, which will ensure the possibility of connecting high-capacity offshore wind farms in the future, and the Baltic countries will be able to become exporters of green electricity to the electricity price zones of central Europe. At the moment, the development of the project is on the beginning stage and on exchange of ideas/opinions stage, and the signed letter of intent is the initial step of the creation of such a serious, ambitious and, at the same time, challenging interconnection, where initially is planned to prepare technical and economic analysis. The "Baltic Wind Connector" from Estonia to Germany, with Latvian connection to the project in its economic zone, will be an important transmission infrastructure object in whole Baltic Sea region, which is in line with already mentioned Baltic Sea offshore grid initiative. In the synchronous operation mode of the Baltic States with the electricity system of continental Europe, where the synchronous interconnection of the Baltic States will be provided through the Poland-Lithuania High Voltage Alternating Current (HVAC) interconnection, additional trade capacities could be provided by HVDC interconnections with continental Europe, incl. Poland and Germany. The development of the project would be important in the context of dramatical increase of RES generation amount in the whole Baltic Sea region, including also planned increase of electricity consumption, the development of the electricity market, as well as ensuring the n-1 security criterion in all modes of system operation. In the long term, it will be necessary to reinforce the transmission network and develop new interconnections between Baltic Sea region countries, promoting the common goals of the European Union for a unified and integrated electricity system. Negotiations between 50Hertz and Elering regarding the project development design and the possibilities of Latvia joining in the project development activities are currently ongoing. Estonia, Lithuania and the other countries of the Baltic Sea region also plan to develop large offshore wind farms by 2030, and in the next decade there will be development of large offshore wind farms, which will make a significant contribution to the overall reduction of CO_2 emissions in the EU and mitigation of the effects of climate change. Taking into account mentioned above, the Baltic Sea region TSOs, including AST, shall continue their work on the development of BOGI initiative, promoting the development of offshore wind farms, CO_2 reduction and the development of an environmentally friendly energy systems. The goal of the BOGI initiative is to develop common planning principles for the Baltic Sea electricity network, as well as to prepare studies, that prepare a common vision for the creation of the network in the Baltic Sea and allow it to be included in the Pan European Ten Year Network Development plan and in other European and national planning and development documents.

The cooperation between Baltic Sea TSOs was started taking into account declaration signed by the Baltic Sea countries and the European Union on September 30, 2020, which requires the participating parties to jointly plan sea areas where offshore wind power plants could be located, providing the most effective use of wind energy potential. European development documents note that the Baltic Sea region has significant potential to reach of green energy policy goals by building offshore wind farms and using existing and potential Baltic Sea network interconnections.

Implementation of the offshore transmission network will also ask many radial network connections, not just interstate connections. According to the Baltic Energy Market Interconnection Plan (BEMIP) studies, the offshore wind potential of the Baltic Sea exceeds 90 GW, and the total annual electricity generation could reach 325 TWh. The BOGI initiative has been signed by almost all Baltic Sea region TSOs: Finland's Fingrid, Sweden's Svenska Kraftnät, Denmark's Energinet, Germany's 50 Hertz, Estonia's Elering, Latvia's AST and Lithuania's "Litgrid AB", while the Polish TSO PSE plans to join the BOGI initiative to achieve a common goal, and the Norwegian TSO "Statnett" participates in the initiative as an observer. The BOGI conceptual map is currently is under development, and a concept map of the Baltic Sea offshore transmission network could be ready at the end of 2023. The LaSGo project, the 4th Estonia-Latvia interconnection, Baltic Wind Connector project, as well as other potential long-term projects of the Baltic Sea region, are shown in figure 7. Some projects could be implemented as a common solution, therefore, more detailed technical-economic solutions of the projects should be evaluated in the coming future.

The European Commission has approved a strategy (COM/2015/080) on the Clean Energy Package, which envisages the production of a certain amount of electricity from RES until 2030 and until 2050, as a result of which cooperation between neighbouring TSOs is necessary to provide efficient and cost-effective development of the transmission network and creation of network connection points for RES generation on the same basis. The EU member States have developed their National Energy and Climate Plans (NEKP – https://www.em.gov.lv/lv/nacionalais-energetikas-un-klimata-plans), which foresees long term development of wind energy production, so the promotion of cooperation should be started immediately. The aim of BOGI initiative is to simultaneously promote the construction of interconnections, which will provide transmission of wind energy from producers to consumption centers and the construction of new interconnections. Also the aim of the BOGI is to share information between Member States and create a common transmission network in the Baltic Sea, to develop and improve common principles for the development of the Baltic Sea transmission network, to include projects in the

Pan European Ten Year Network Development Plan (TYNDP) and to prepare studies for future development of wind farms in the Baltic Sea. The development of offshore wind farms and transmission network must be economically justified, profitable and based on market oriented solutions. The Offshore Network Development Plan (ONDP) is being developed within the framework of the ENTSO-E System Development Committee, following the development trends of offshore wind farms in European countries. The ONDP plan will take into account the development of the offshore infrastructure, which will be observed in the network future long term planning. The ONDP plan will include BOGI projects from the Baltic Sea Region Development Plan.

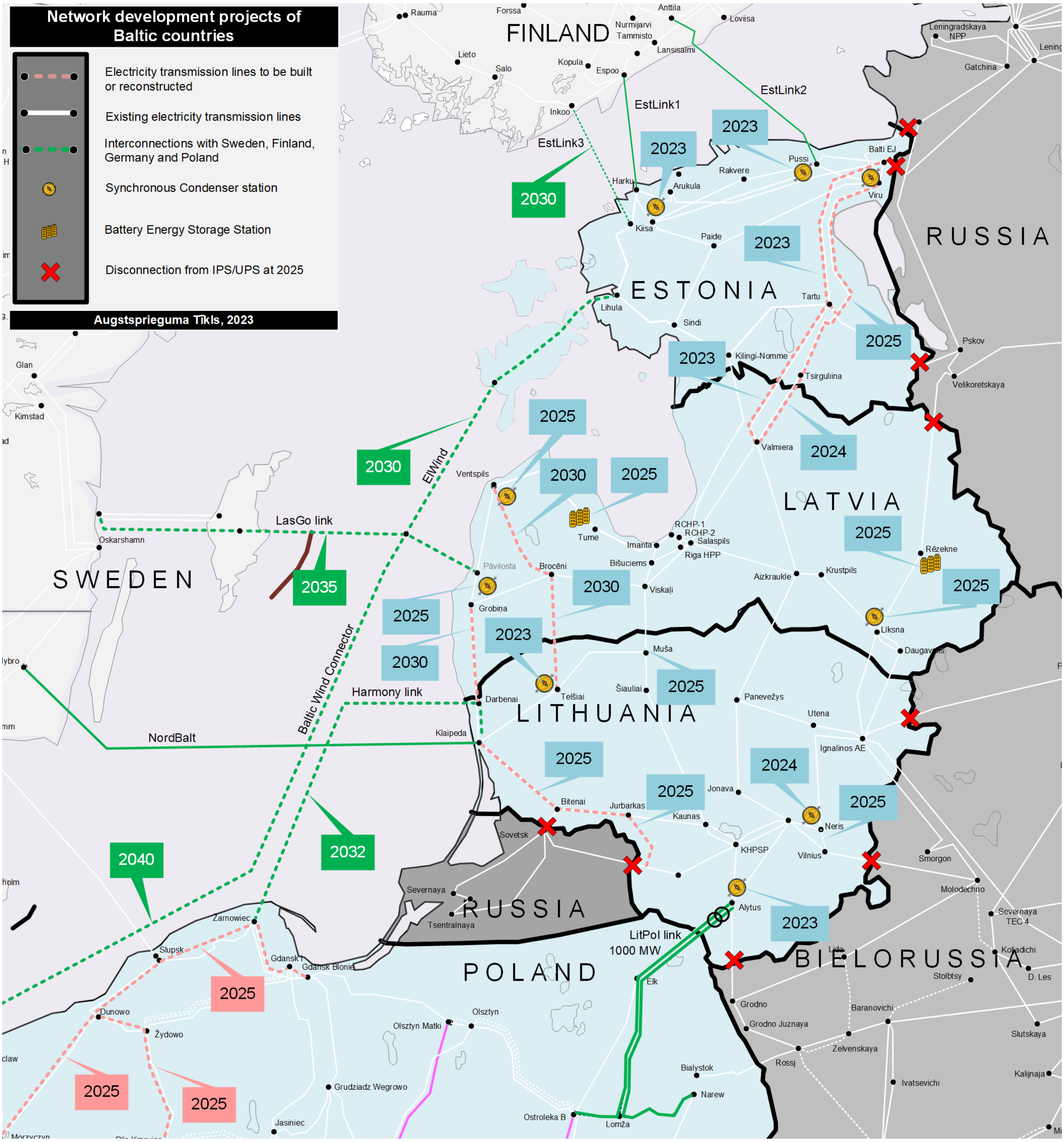


Fig. 7. The common transmission network of the Baltic Sea

4.6. Conclusions of the transmission system operator on energy production capacity and energy availability at the European Union and regional level

In 2022, the electricity production adequacy at the regional level was evaluated by the ENTSO-E European Network Transmission System Operators (ENTSO-E) association, where the Latvian TSO AS "Augstsprieguma tīkls" is a member and participates in the preparation of the report with submission of input data of the Latvian electricity system. Based on the data from all European TSOs, the European Resource Adequacy Assessment report for 2022 (ERAA 2022) was elaborated and prepared. The adequacy assessment is prepared for three target years, 2025, 2027 and 2030. The ERAA power adequacy assessment is divided into two stages, where the Monte Carlo mathematical analysis method is applied for the analysis. First of all, the economic viability assessment (EVA) of power resources is evaluated, solving the problems of optimal long-term planning. In the second stage, the power adequacy situation is evaluated in 30 different scenarios of climatic years for the three target years mentioned above, in order to more successfully identify scenarios when undelivered energy to consumers could occur. The full European Resource Adequacy Assessment report is available here: https://www.entsoe.eu/outlooks/eraa/2022/eraa-downloads/

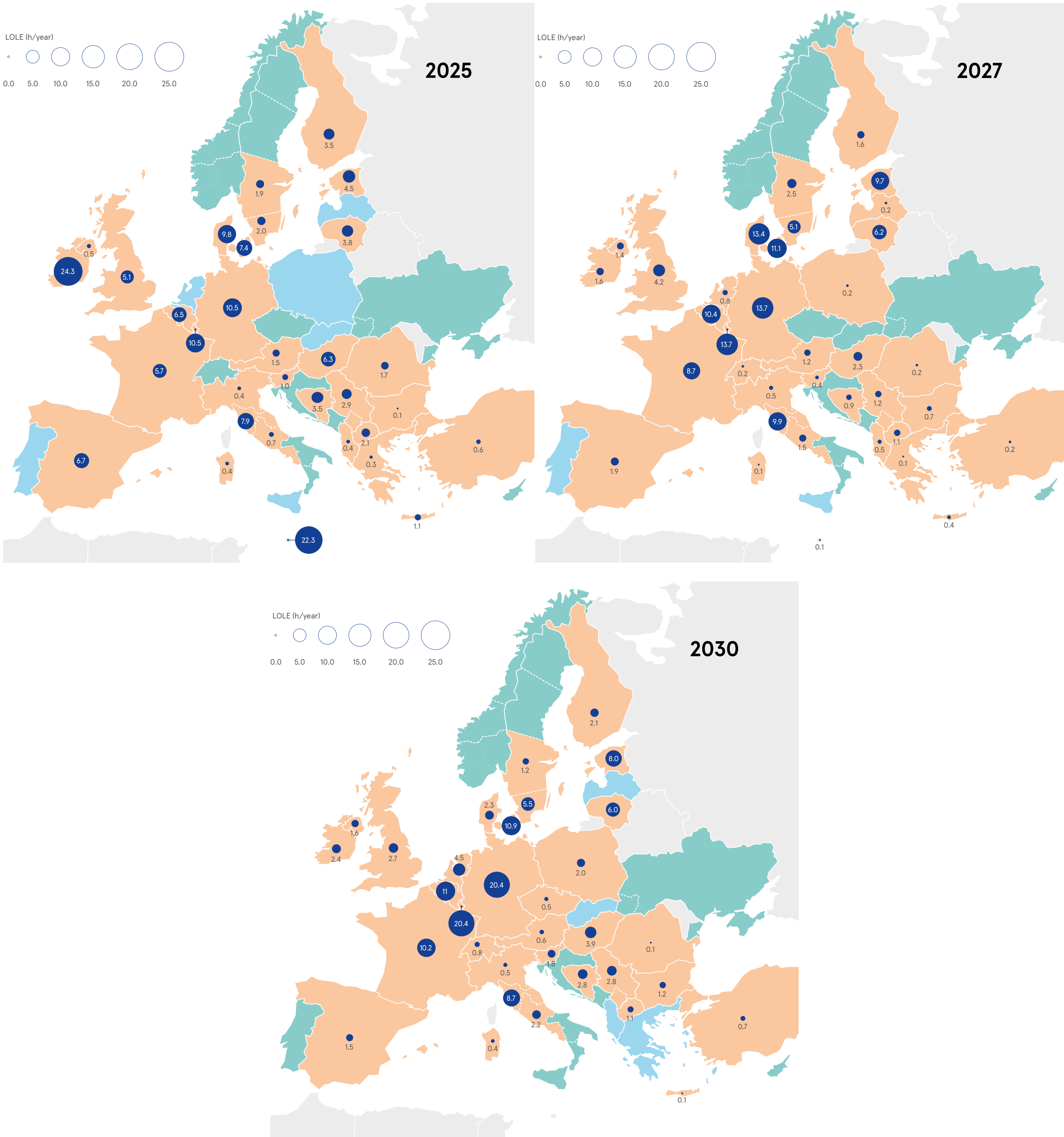


Fig. 8. LOLE values for 2025, 2027 and 2030

Power adequacy is characterized by the LOLE (Loss of Load Expectation) value, which is calculated for each bidding zone. The LOLE value allowed by the European Union guidelines may vary depending on the country and is in the range of 3-9 hours/year. The allowed value in Latvia is 3 hours/year, while in Estonia and Lithuania it is higher, 9 and 8 hours/year (Fig.8).

The results of the Economic Sustainability Assessment (EVA) showed that a significant amount of fossil fuel power plants, around 60 GW, are at risk of decommissioning for economic reasons in Europe.

The Latvian results showed that 180 MW of gas-fired power plants capacity could be at risk starting from 2024. In Estonia, such risk appears starting from 2027 with amounts to 660 MW of oil shale power plants capacity. In Lithuania, no problem years until 2030 were identified in which the existence of power plants would be endangered. EVA is an economic sustainability assessment, which results show the amount of power plants installed capacity, which becomes unrentable and is not able to exist during long time in the expected economic conditions. The EVA analysis showed that starting from 2030, it will be necessary to introduce load flexibility Demand Side Response (DSR) technologies in the Baltic States, which are capable to provide flexibility service. The figures show that the possibility of LOLE in Latvia is only in the scenario 2027 and amounts are 0.2 hours per year, which corresponds to the European Union guidelines. In Estonia the LOLE value in 2027 reaches 9.7 hours per year, which is higher than the allowed diapason, due to the reduction of the power plants capacity by 660 MW, but in 2030, the risk decreases till 8.0 hours per year, which is related with increase of RES installed capacity. Lithuania's situation is slightly better than Estonia's, and the LOLE value in 2027 and 2030 is 6.2 and 6 hours per year.

A deficit of power adequacy in one country also affects the power balance in neighbouring countries, therefore, in case of a large deficit in Lithuania and Estonia, the Latvian electricity system will also be affected, and this may create risks of undelivered electricity. Lithuania plans to develop its onshore and offshore wind farms, which could reach up to 7 GW in the next 4-7 years, in order to reduce the electricity deficit and ensure the goals set by Lithuania's national climate plan. From ENTSO-E ERAA 2022 assessment, it can be concluded that Latvia's generation capacity at the regional level is sufficient in 2025 and 2030, but a very small and insignificant power deficit is expected in 2027.

5.

TRANSMISSION SYSTEM ADEQUACY FOR DEMAND AND MAINTENANCE QUALITY

5.1. TSO conclusions on the power transmission system adequacy for the tasks of energy transmission and the ability to provide non-interrupted functioning of the power system in outage of one of the systems units and activities (individually and jointly with other transmission system operators) for the reliable operation of the transmission system for the coming years (minimum forecast period – 10 years)

At the moment, the top priority project for Latvia and the Baltic States is the synchronization of the Baltic States with continental Europe and accelerated desynchronization from Russia's unified power system, which is supported by each Member State and by the European Commission. During the synchronization phase 1 project, the reinforcement of the internal Baltic transmission network is ongoing, due to this the cross-border capacity on the Latvia-Estonia cross-border is still reduced in various Baltic transmission network operational modes. The bottleneck is expected to be completely eliminated in 2025. Taking into account the loading of the interconnections of Baltic States with the Nordic countries and Poland, in normal operating modes the transmission capacity of the Estonian-Latvian cross-border is not critical and is not overloaded, but in emergency and repair modes it remains limited and capacity congestions occur.

The third Estonian-Latvian interconnection was commissioned in 2021, which significantly increased the transmission capacity of the Estonian-Latvian cross border reconstructed 330 kV electricity interconnection Valmiera – Tartu was commissioned in May 2023. But in order to fully eliminate the limitations of the Estonian-Latvian cross-border, it is planned till 2025 to reconstruct one more Latvian-Estonian interconnection: Valmiera (Latvia) – Tsirguliina (Estonia), as well as to reconstruct the 330 kV transmission line Viru – Tsirguliina in Estonia. The transmission capacity on the Latvian-Estonian cross-border will still be limited until 2025, but the restrictions will be less than they were before 2021.

The situation may be affected by RES connections to the network, which could require additional reinforcement of the Estonian-Latvian cross-border capacity.

Transmission capacity on the cross-border between Latvia and Lithuania is currently sufficient for trade and does not show additional problems for electricity transmission in normal operation modes, except case of planned ELWIND offshore wind farm development, when reinforcement of cross-border capacity is necessary to transfer the RES produced electricity to the Lithuanian electricity system.

Due to decisions of accelerated desynchronization from the Russian unified power system, the development of the cross-border capacity between Latvia and Russia is not planned, and with start of Russian war in Ukraine, in February 2022, the Baltic States cancelled all economic trade with Russia. After synchronization with Continental Europe, the Russian – Latvian 330 kV interconnection will be disconnected. Due to the war in Ukraine, the Baltic States are planning an accelerated desynchronization from BRELL and synchronization with Continental Europe starting in February 2025, which was agreed by the Baltic TSOs with signing a cooperation agreement on August 1, 2023, and by Baltic Prime Ministers on August 3, 2023, when Latvian Prime Minister Krišjānis Kariņš, Prime Minister of Lithuania Ingrida Šimonytė and Prime Minister of Estonia Kaja Kallas signed a joint declaration on accelerating Baltic power systems synchronization with European electricity system.

5.2. Information about the planned system interconnections and internal power system infrastructure projects of strategic importance (minimum forecast period – 10 years)

Co-financed by the European Union
Connecting Europe Facility

In 2022, with European co-financing support, the work on the Baltic synchronization Continental Europe and desynchronization from the unified electricity system of Russia was actively on going. The synchronization project is implementing in two phases, where the first phase is related for internal Baltic transmission network reinforcement activities, while the second phase is related with activities of HVDC interconnection "Harmony link" construction between Lithuania and Poland, as well as measures to ensure the operational stability and provision of frequency regulation of the Baltic States.

The reinforcement of Baltic transmission network is ongoing under Synchronisation phase 1 project, including the installation of equipment for provision of necessary inertia amount and frequency regulation and control in synchronization mode with continental Europe. The reconstruction of two existing Estonian-Latvian interconnections Valmiera-Tartu and Valmiera-Tsirguliina in Latvia is the part of Synchronisation 1st phase project, as well as the installation of one synchronous condenser, modernization and installation of power control automatics, which are identified in the technical catalogue of measures, issued by ENTSO-E. The all synchronisation phase 1 projects received 75% EU co-financing, based on that a Grant Agreement among the Baltic TSOs and European Innovation and Network Executive Agency (CINEA) was signed on March 19, 2019, for the conditions for using and control mentioned co-financing. The reconstruction of the existing 330 kV interconnections Valmiera – Tartu and Valmiera – Tsirguliina is proceeding according to the planned schedule, despite the geopolitical situation in the world and the price increase in all energy sectors. The reconstruction of both 330 kV lines is combined in one activity (see Fig. 6). Taking into account Estonian TSO plans to reconstruct the transmission lines to the Narva power, in order not to reduce the transmission capacity for the electricity market, the Latvian and Estonian TSOs are reconstructing the existing lines one by one, according to the transmission line outages schedule agreed by AST and Elering. Based on the procurement procedure announced in 2020, a contract with constructor community EMPOWER and LEONHARD WEISS was signed on July 15, 2021 for the development and construction of the both lines. The reconstruction works of the Valmiera-Tartu line started in June 2022 and were completed in May 2023, and the line was energised on May 31, 2023. The Valmiera-Tartu interconnection was officially opened in June 2023, but commissioning in Latvia is planned until the end of 2023. While the reconstruction works of 330 kV transmission line Valmiera – Tsirguliina have been started in June 2023 with planned commissioning at the end of 2024. Both projects are included in the list of Projects of Common Interest under the Baltic Synchronization Project, as well as both projects are included in all national and European development documents.

As part of the synchronization phase 1 project, electricity control systems and transmission network remote control systems are modernized by installing Phasor Measurement Units (PMU) and Wide Area Monitoring System (WAMS) in all critical nodes, as well as by installing frequency monitoring and control remote systems in power plans and substations. The PMU and WAMS equipment has been completed and put into operation in 2022, while the deadline for the implementation of the other mentioned measures is 2025, when the synchronization of the Baltic electricity systems with continental Europe and desynchronization from the unified electricity system of Russia and Belarus is planned.

In addition to frequency regulation measures, for electricity system secure and stable operation in synchronization mode, Baltic TSOs must jointly and continuously provide a sufficient amount of inertia in the system. Therefore, as a part of the synchronization phase 1, the installation of one 200 MVA synchronous condenser is planned in substation Ventspils, for which agreement between AST and constructors community Ener&SynCon was signed on October 5, 2022.

The construction of new direct current interconnection between Poland and Lithuania (Harmony link), the creation of the necessary infrastructure for connecting the interconnection to the transmission network, the reinforcement of the transmission network in Lithuania and Poland for secure and stable system operation, the installation of six synchronous condensers (SC) in the Baltic States, installation of BESS, as well as installation of frequency regulation equipment and IT infrastructure is planned under Baltic synchronisation phase 2 project. The 75% European co-financing was received in 2020 from Connecting Europe Facility Funds (CEF) with total amount of 960 million EUR to the activities of synchronisation phase 2 part 1, which consists of construction of the Harmony link, the construction of 6 synchronous condensers in Baltic and the reinforcement of the Polish transmission network, where AST part of synchronization project phase 2 part 1 is 74 million EUR for construction of two synchronous condensers in Latvia. Also the synchronisation phase 2 part 2 projects received 75% European co-financing in January 2022 from CEF with total amount of 238 million EUR, based on what the Grant Agreement among the Baltic TSOs, Polish TSO and CINEA was signed on June 3, 2022. AST part of synchronization phase 2, part 2 project is 49.9 million EUR, planned for the BESS installation, the installation of the frequency regulation system, the modernization of instrument transformers and measurement system and emergency automatics, as well as upgrade of dispatch control and information technology systems.

Due to significant changes in the global energy market, which has been affected by pandemic, war in Ukraine, as well as a dramatic increase of offshore wind farms development, currently the manufacturers of cables and other HVDC and HVAC technologies are not interested for standard interconnection projects solutions, which also affected the development process of the Lithuanian – Polish interconnection "Harmony link". Due to the significant increase of the project price and the low interest of the participants, the old procurement was cancelled and new procurement of the project will be announced. All this affected the construction timeline of the project, which means that project construction till 2025 is not possible, and provisionally it could be realized after 2030. The exact time schedule will be known after the finalisation of the procurement and the announcement of tender winner of the project.

During the implementation of synchronisation phase 2 in Latvia, the active work with construction of two synchronous condensers in Grobiņa and Līksna substations is ongoing. The contract with the constructor community "EM&SE Syncons" for the delivery and and installation of three synchronous condensers has been signed on October 5, 2022, with one SK in the Ventspils substation, which is planned to be installed under synchronisation phase 1 and 2 SC in Grobina and Liksna, implemented under synchronisation phase 2. According to the concluded contract, the first SC should be implemented at the Grobina substation by February 2025, the second in Ventspils substation by June 2025, and the third in Līksna substation by October 2025.

During synchronisation phase 2 part 2 project AST implements the Battery Energy Storage System (BESS) project in Latvia, where BESS with the capacity of 80MW/160MWh will be installed in Latvia in two substations – one 20MW/40MWh BESS in the substation Tume and the other 60MW/120MWh – in substation Rēzekne, in parallel reconstructing both substations for BESS connection to the transmission network. The installation of BESS is essential for secure and stable operation in synchronization with continental Europe and desynchronization from the Russian electricity system, which will provide frequency regulation and balancing power reserve measures, as well as frequency maintenance and restoration reserves. The frequency and balancing reserves market is not developed yet and there is a risk that the availability of such reserves will be insufficient during synchronisation mode. Therefore, in order not to jeopardize the implementation of the synchronization project, the Cabinet of Ministers with decision No. 674 (https://www.vestnesis.lv/op/2021/187.3) decided to allowed AST purchase, develop, manage and operate BESS as a transitional solution for provision of necessary reserves during the implementation of the synchronization project and for a long period as well if such reserves will not be available on the market at reasonable costs. Provision of mentioned services with BESS is more efficient and with lower costs compared to buying this service on the market from existing power plants, as well as with lower operational and maintenance costs, which was also identified in the market test jointly prepared by Latvian, Lithuanian and Estonian TSOs, concluded, that it will not be possible to provide frequency curtailment reserves (hereinafter – FCR), automatic frequency restoration reserves (hereinafter – aFRR) and manual frequency restoration reserves (hereinafter – mFRR) neither in Latvia nor in the Baltics as a whole with the existing power plants. The BESS project is planned to be implemented by the end of 2025 and the procurement of the project is currently ongoing.

One of the technical requirements, identified in Catalogue of Measures, that AST, together with other Baltic TSOs, must fulfil according to requirements identified by TSO of Regional group Continental Europe (RGCE), is the preparation of dynamic stability studies, based on which the European TSO consortium will issue recommendations for emergency and system protection automation, as well as ensuring frequency stability and establishment or development of power frequency control for the Baltic States. Based on this in 2021–2022 the Baltic TSO together with the European TSO consortium prepared 5 studies – dynamic stability study, isolated operation stability study, Frequency stability assessment system (FSAS) study and Load frequency controller (LFC). All studies were completed in November 2022 and the results were used in frequency control and stability provision projects in the Baltic and Latvia, for example FSAS and LFC.

After start of war in Ukraine in 2022, the Baltic States, together with the European Commission, seriously considered the issue of accelerated synchronization with continental Europe before the originally planned deadline at the end of 2025. At the beginning of 2023, TSOs of the Baltic States conducted 3 additional studies for the evaluation of accelerated synchronization:

1. Dynamic stability study;
2. Power adequacy study;
3. Market and operational costs assessment study.

The mentioned studies concluded that until the end of 2024 there are risks to the security and stability of the system operation based on the dynamic stability and power adequacy, but from Q1 2025 synchronization is technically possible. Based on this, on August 1, 2023, the electricity transmission system operators of Estonia, Latvia and Lithuania, Elering, AST and Litgrid, signed a cooperation agreement to ensure readiness for synchronization with the continental European transmission system from February 2025. The agreement establishes a plan agreed among the operators on the steps to be taken to ensure the readiness of the Baltic electricity system for accelerated synchronization with the Continental Europe electricity system, which is essential for provision of secure operation of the electricity system in the region. The agreement also foresees that the Baltic States will announce their stepping out from the BRELL agreement concluded with Russian and Belarusian operators. The announcement is expected in the summer 2024, half a year before the end of the agreement and the planned accelerated synchronization.

5.3. Synchronous operation of Latvia power system with Continental Europe starting from February 2025 – RES development impact to the Baltic power system

On August 3, 2023, the Prime Ministers of Latvia Krišjānis Kariņš, Lithuania Ingrīda Šimonīte and Estonia Kaja Kallas signed a joint declaration on the accelerated synchronization of Baltic power systems with Continental Europe through Poland starting from February 2025. Evaluating the possible scenarios of Baltic synchronization with Continental Europe, the Latvian TSO together with the Estonian and Lithuanian TSOs prepared accelerated synchronization market study and modelled the development of Baltic States electricity system for three years (2024–2026). Currently, there is a big interest from RES developers for connection to the transmission network

A big amount (6015MW) of technical requirements from new generating capacities connections the transmission network has been issued, but it is impossible to forecast the real RES development volumes and connections to the network yet. The Baltic TSOs prepared market simulations with the Energy Exemplar Plexos market model in order to consider possible scenarios of accelerated synchronization, as well as to assess the impact of renewable energy development on the Baltic electricity system and the functioning of electricity market in general.

The assessment of growing of RES installed capacities in Baltic is given in Figure 9, where capacities have been accepted according to the Conservative Development Scenario (A) for all Baltic States – Latvia, Estonia and Lithuania.

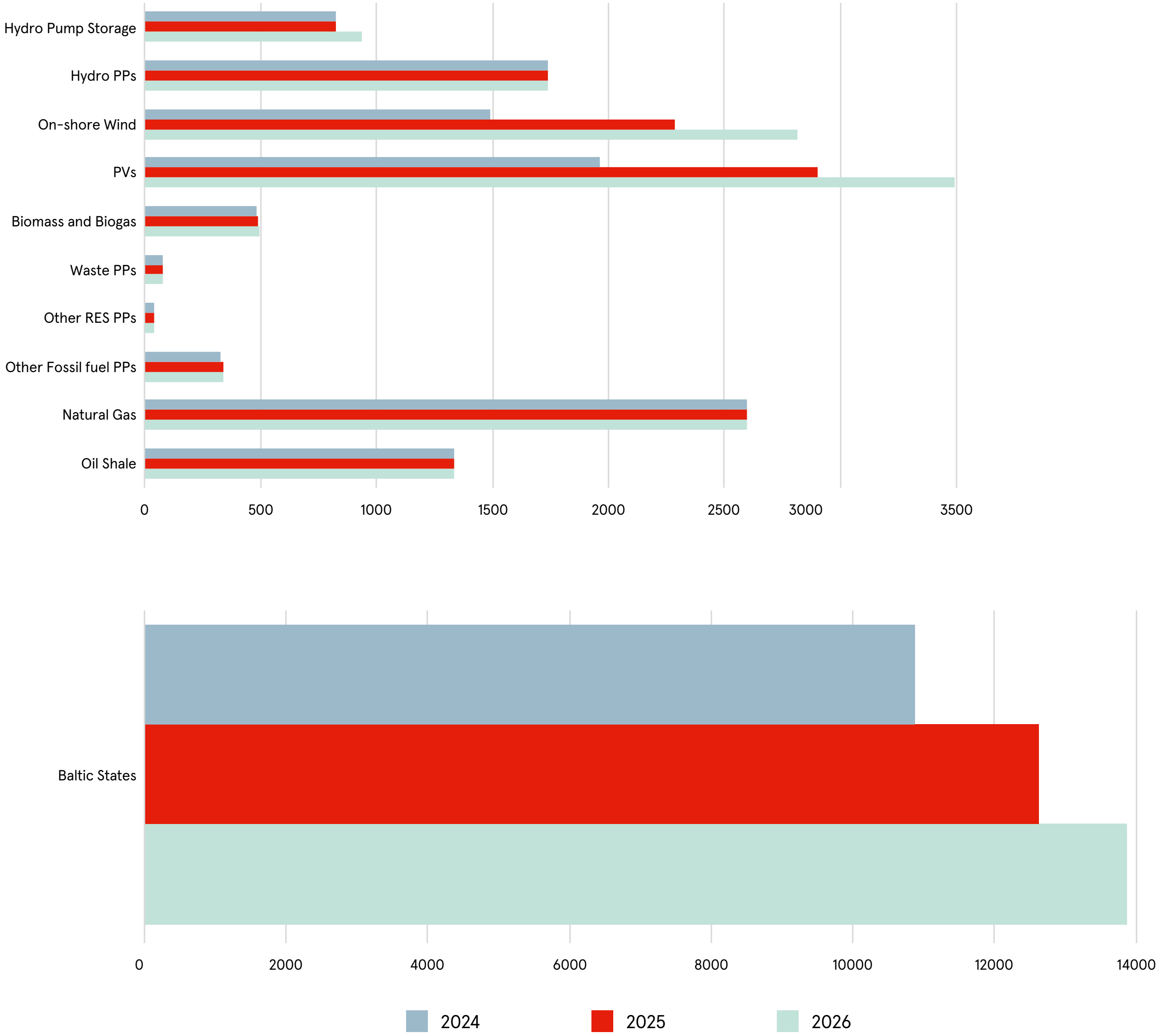


Fig. 9. Installed capacities in Baltic countries in market simulations for the years 2024–2026, MW

Figure 9 shows that solar and onshore wind power plants will mainly develop during the next three years, where interest for such power plants connection to the transmission system is greater. By preparation of market simulations with Plexos market model, where AST used the installed capacities from fig.9, it was assessed how the amount of electricity produced in the Baltic States is changing from 2024 to 2026. The amount of electricity produced by years in Baltic States is given in figure 10.

The significant increase of energy produced amount is expected from solar and onshore wind power plants, which respectively affect and reduce the energy production from oil shale and natural gas power plants, because the production of electricity from these stations is dependent by the natural gas price in the gas market, as well as the CO_2 price in world markets (CO_2 quotas).

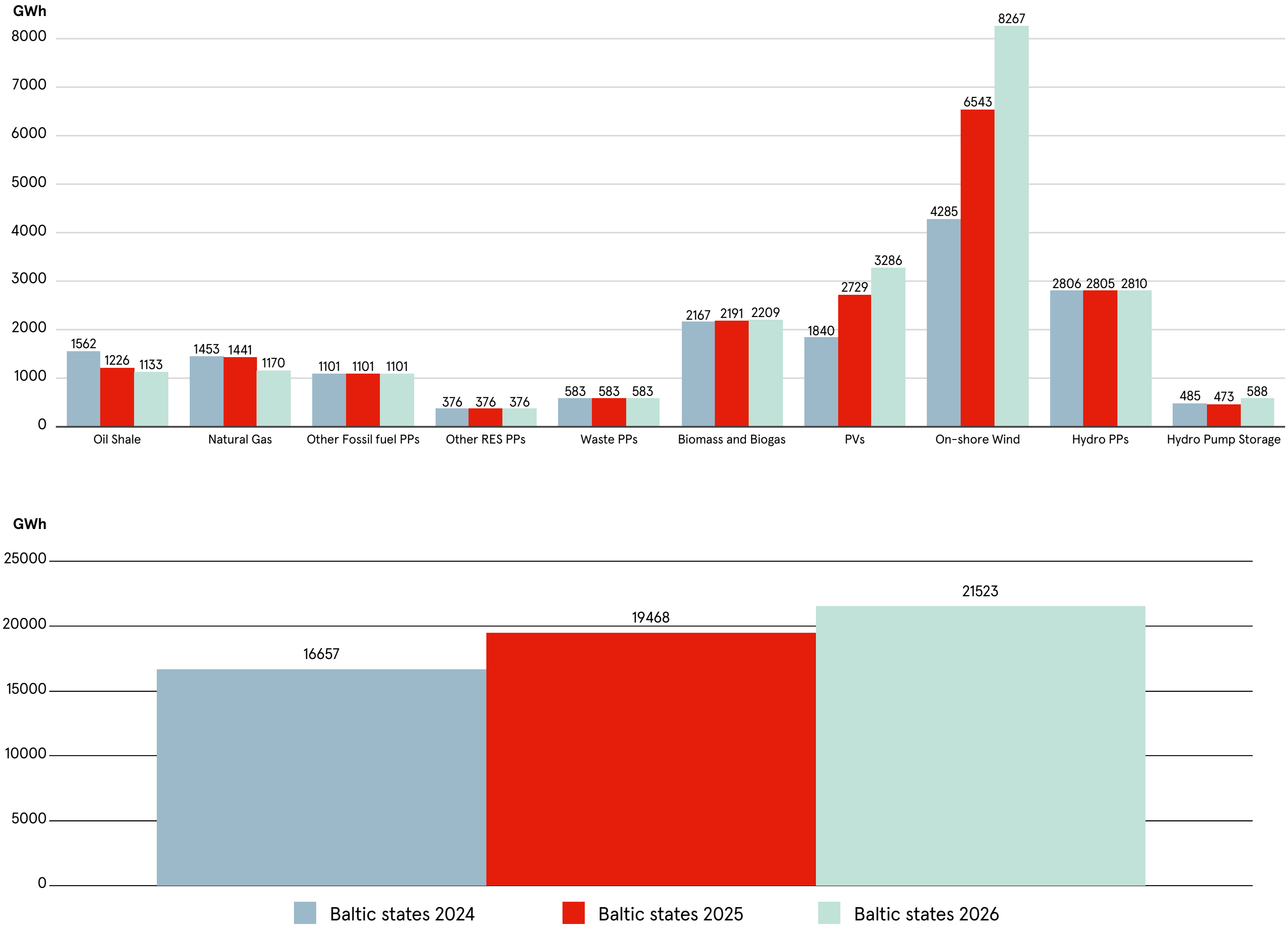


Fig.10. The amount of produced energy in the Baltic States for the years 2024–2026, GWh

The increasing amount of produced energy by renewable energy sources has an impact on the annual average electricity price in the Baltic States, which has a decreasing tendency during the years. The RES connection to the power system is preferable and has a positive impact to the market electricity price (lowers it), and electricity consumers can expect a lower price of electricity.

5.4. TSO conclusions on the electricity transmission system reliability and adequacy of all consumers to provide secure power supply in the previous year and the following years (minimum forecast period – 10 years).

Implementation of the projects mentioned in the paragraph 4.5 will provide secure and reliable operation of transmission network, compliance with the increasing electricity consumption, possibilities to connect new power plants, stable operation of the power plants and electricity transit through Latvia and the Baltic States, as well as will promote the interconnection of the Baltic States with the European electricity transmission networks.

The 330 kV and 110 kV transmission network is foreseen to be reconstructed, modernized and developeded in accordance with the Electricity Transmission System Development Plan of Latvia developed by AST and approved by the Public Utilities Commission (PUC), which is published on the AST and PUC websites. In parallel with the 330 kV transmission network, the 110 kV transmission network should be also developed, especially in the places where the N-1 reliability criterion cannot be met. The planned reconstruction of 110 kV substations and planned replacement of aged transformers is planned in the 110 kV network.

5.5. Existing power generation capacities bigger than 1 MW, for January 1, 2023.

Table 5

Nr.	Name of the power plants	Installed capacity (MW)
Natural gas generation power plants – 76.8 MW		
1	Small natural gas fired co-generation power plants (from DSO)	61.9
2	Juglas jauda, SIA	14.9
Biomass, biogas power plants – 149.62 MW		
1	Biomass and biogas power plants (from DSO)	125.8
2	Gren Latvia SIA	23.82
Wind power plants – 129.9 MW		
1	Wind power plants (from DSO)	50.4
2	WINERGY, SIA	20.7
3	SIA TCK	58.8
Hydro power plants – 28.6 MW		
1	Distributed small hydro power plants (from DSO)	28.6
Solar (PhV) power plants – 104.8 MW		
1	Distributed PhV (from DSO)	104.8
Latvenergo power plants – 2600 MW		
1	Ķeguma HPP	248
2	Rīgas HPP	402
3	Pļaviņu HPP	908
4	Riga CHP-1	158
5	Riga CHP-2	832/881
6	Aiviekstes HPP	1.47
7	Ainažu WPP	1
	TOTAL	**3089.72 MW**

6.

KEY TSO RECOMMENDATIONS AND CONCLUSIONS

- The synchronization project is the top priority project in the Baltics and Latvia, which initially was planned to be implemented by the end of 2025. The political decision for Baltic accelerated synchronization in February 2025 was done by Member States in August 2023. TSO is obliged to implement a lot of challenging infrastructure, IT and system regulation projects, before February 2025, for secure and stable operation of the system during synchronisation mode.
- The results of power adequacy assessment prepared by ENTSO-E do not show significant risks of electricity supply resource adequacy in Latvia until 2030, but in order to increase power adequacy level in the region, each country must pay higher attention for RES generation planning issues, and to the adequacy of balancing and regulation capacities.
- A significant development of RES connections to the transmission network is planned in Latvia and whole Baltic Sea region, therefore the energy produced by RES will increase. In order to ensure the power system security and stability, a bigger involvement of balancing capacity will be required, which will ask the balancing market development in whole Baltic region. For not reducing of reliability and stability of Latvian electricity system in the next decade, it is important to ensure that the existing generation capacities of Latvia do not decrease and to develop the new generation capacities, which could also participate in the balancing market for services provision.
- The role of interconnections, reinforcement of the transmission network and closer and faster Baltic integration into European electricity market will be essential in the covering of electricity demand and interest of increasing of number of RES connections. With the dramatic increase of RES capacities after 2030, it is essential to develop interconnections to Estonia, Sweden, Germany and Lithuania, as well as to reinforce the internal 330 kV transmission network.
- In order to further promote the development of RES in Latvia and to connect RES producers to the transmission networks as much as possible, thereby reducing carbon dioxide emissions and moving towards the goal of a climate neutral energy system, it is necessary to development electricity consumption technologies in Latvia and their connection to the transmission network, i.e. electrification of the economy, transport and industry sectors, as well as new sectors such as the production and use of hydrogen and other P2X technologies.
- In order to ensure the system security and stability, the TSO in cooperation with energy policy makers in Latvia, should develop a new regulation to connect the largest possible amount of RES to the transmission network in Latvia, while at the same time not reducing the security and stability of the electricity system.

AS "Augstsprieguma tīkls"

Board member A. Daugulis

APPENDIXES

INSTALLED CAPACITIES (GROSS) OF POWER STATIONS, MW

Table 6

Years		2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Big power base load power plants [6]	**1**	**2644**	**2644**	**2666**	**2674**	**2674**	**2674**	**2674**	**2674/1588**	**2674/ 1588**	**2516/ 1588**	**2516/ 1588**
Including:												
Daugava HPPs	1.1	1558	1558	1580	1588	1588	1588	1588	1588	1588	1588	1588
Riga CHP-1 [11]	1.2	158	158	158	158	158	158	158	158/0	158/0	0	0
Riga CHP-2 [11]	1.3	881	881	881	881	881	881	881	881/0	881/0	881/0	881/0
Imanta CHP [13]	1.4	48	48	48	48	48	48	48	48	48	48	48
Installed capacity of small power stations (Conservative Scenario A)	**2**	**566**	**639**	**711**	**784**	**856**	**929**	**1001**	**1574**	**1646**	**1719**	**1791**
Including:												
Natural gas co-generation stations	2.1	74	72	69	67	64	61	59	56	54	51	48
Hydro power stations	2.2	29	29	29	29	29	29	29	29	29	29	29
Wind power stations [7]	2.3	153	174	194	215	235	255	276	796	817	837	857
On-shore	2.3.1	153	174	194	215	235	255	276	296	317	337	357
Off-shore	2.3.2	0	0	0	0	0	0	0	500	500	500	500
Biomass power stations [8]	2.4	97	100	103	107	110	113	116	119	122	125	128
Biogas power stations [8]	2.5	58	60	62	64	65	67	69	71	73	75	77
Solar power stations	2.6	155	204	254	304	353	403	453	503	552	602	652
Installed capacity of small power stations (Base Scenario B)	**3**	**693**	**891**	**1090**	**1289**	**1487**	**1686**	**1885**	**2583**	**2782**	**2981**	**3179**
Including:												
Natural gas co-generation stations	3.1	73	70	66	62	58	55	51	47	44	40	36
Hydro power stations	3.2	29	29	29	29	29	29	29	29	30	30	30
Wind power stations [7]	3.3	181	229	278	326	374	422	470	1018	1067	1115	1163
On-shore	3.3.1	181	229	278	326	374	422	470	518	567	615	663
Off-shore	3.3.2	0	0	0	0	0	0	0	500	500	500	500
Biomass power stations [8]	3.4	100	106	112	118	124	129	135	141	147	153	159
Biogas power stations [8]	3.5	60	64	68	72	77	81	85	89	93	97	101
Solar power stations	3.6	249	393	537	682	826	970	1114	1258	1402	1547	1691
Installed capacity of distributed, small cogeneration and RES power plants (Optimistic Scenario EU 2030)	**4**	**903**	**1310**	**1719**	**2114**	**2557**	**3001**	**3444**	**4967**	**5410**	**5854**	**6247**
Including:												
Natural gas co-generation stations	4.1	73	68	64	60	56	51	47	43	39	34	30
Hydro power stations	4.2	30	29	29	29	29	29	29	29	29	30	30
Wind power stations [7]	4.3	178	223	268	300	380	460	540	1700	1780	1860	1890
On-shore	4.3.1	178	223	268	300	380	460	540	700	780	860	890
Off-shore	4.3.2	0	0	0	0	0	0	0	1000	1000	1000	1000
Biomass power stations [8]	4.4	101	108	115	122	129	136	143	150	157	164	171
Biogas power stations [8]	4.5	61	66	72	77	82	87	93	98	103	108	113
Solar power stations	4.6	460	815	1171	1526	1881	2237	2592	2947	3302	3658	4013
TSO generating capacities for reserve and balancing services only	**5**	**0**	**0**	**80**	**80**	**80**	**80**	**80**	**80**	**80**	**80**	**80**
Battery Energy Storage System	5.1	0	0	80	80	80	80	80	80	80	80	80

LATVIAN POWER SYSTEM BALANCE FOR SCENARIO A WINTER PEAK LOAD HOURS, MW (NETT)

Table 7

Years		2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Maximum load	1	1275	1304	1325	1344	1365	1386	1408	1431	1455	1481	1507
Big power base load power plants	2	2506	2506	2528	2536	2536	2536	2536	2536	2536	2383	2383
Including: Daugava HPPs	2.1	1550	1550	1572	1580	1580	1580	1580	1580	1580	1580	1580
Riga CHP-1	2.2	153	153	153	153	153	153	153	153	153	0	0
Riga CHP-2	2.3	803	803	803	803	803	803	803	803	803	803	803
Imanta CHP	2.4	0	0	0	0	0	0	0	0	0	0	0
Distributed, small capacity gas cogeneration and RES power plants	3	527	594	661	729	796	863	930	1492	1559	1626	1693
Including: Natural gas co-generation power stations	3.1	68	65	63	61	58	56	53	51	49	46	44
Hydro power stations	3.2	28	28	28	28	28	28	28	28	28	28	28
Including: Wind power stations	3.3	152	172	192	212	233	253	273	788	808	829	849
Onshore	3.3.1.	152	172	192	212	233	253	273	293	313	334	354
Offshore	3.3.2.	0	0	0	0	0	0	0	495	495	495	495
Biomass power stations	3.4	88	91	94	97	100	102	105	108	111	114	117
Biogas power stations	3.5	53	54	56	58	59	61	63	65	66	68	70
Solar power stations	3.6	139	184	229	273	318	363	408	452	497	542	587
Available capacities for peak load and reserve provisions	4	1448	1470	1491	1593	1614	1635	1657	1807	1830	1701	1645
Including: Daugava HPPs [5)]	4.01	270	270	270	270	270	270	270	270	270	270	270
Riga CHP-1	4.02	153	153	153	153	153	153	153	153	153	0	0
Riga CHP-2	4.03	803	803	803	803	803	803	803	803	803	803	803
Imanta CHP	4.04	0	0	0	0	0	0	0	0	0	0	0
Natural gas co-generation power stations	4.05	47	46	44	42	41	39	37	36	34	32	31
Hydro power stations	4.06	6	6	6	6	6	6	6	6	6	6	6
Wind power stations	4.07	15	17	19	21	23	25	27	158	162	166	170
Biomass power stations	4.08	99	102	105	108	111	115	118	121	124	127	130
Biogas power stations	4.09	56	74	91	109	127	145	163	181	199	217	235
Battery Energy Storage System [13)]	4.10	0	0	80	80	80	80	80	80	80	80	80
Power system emergency reserve [2)]	5	100	100	164	195	203	212	220	242	247	260	276
Power system regulating reserve [4)]	6	92	95	0	0	0	0	0	0	0	0	0
Total reserve in Latvia [3)]	7=5+6	192	195	164	195	203	212	220	242	247	260	276
Power surplus (+), deficit (–)	8=4–1–7	–19	–29	43	93	87	78	69	174	168	1	–98
Power adequacy	9=(4–7)/1	99%	98%	103%	107%	106%	106%	105%	112%	112%	100%	94%

LATVIAN POWER SYSTEM BALANCE FOR SCENARIO B WINTER PEAK LOAD HOURS, MW (NETT)

Table 8

Years		2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Maximum load	1	1275	1304	1325	1344	1365	1386	1408	1431	1455	1481	1507
Big power base load power plants	2	2506	2506	2528	2536	2536	2536	2536	2536	2536	2383	2383
Including: Daugava HPPs	2.1	1550	1550	1572	1580	1580	1580	1580	1580	1580	1580	1580
Riga CHP-1	2.2	153	153	153	153	153	153	153	153	153	0	0
Riga CHP-2	2.3	850	850	850	850	850	850	850	850	850	850	850
Imanta CHP	2.4	0	0	0	0	0	0	0	0	0	0	0
Distributed, small capacity gas cogeneration and RES power plants	3	643	826	1010	1193	1376	1559	1743	2421	2604	2787	2970
Including: Natural gas co-generation power stations	3.1	67	63	60	56	53	50	46	43	40	36	33
Hydro power stations	3.2	28	28	28	28	28	28	28	28	28	28	28
Wind power stations	3.3	179	227	275	322	370	418	466	1008	1056	1104	1151
Onshore	3.3.1.	179	227	275	322	370	418	466	513	561	609	656
Offshore	3.3.2.	0	0	0	0	0	0	0	495	495	495	495
Biomass power stations	3.4	91	96	102	107	112	118	123	128	134	139	144
Biogas power stations	3.5	55	58	62	66	70	73	77	81	85	88	92
Solar power stations	3.6	224	354	484	613	743	873	1003	1132	1262	1392	1522
Available capacities for peak load and reserve guaranteeing	4	1615	1677	1738	1879	1941	2002	2063	2275	2341	2255	2177
Including: Daugava HPPs [5)]	4.01	350	350	350	350	350	350	350	350	350	350	350
Riga CHP-1	4.02	153	153	153	153	153	153	153	153	153	0	0
Riga CHP-2	4.03	850	850	850	850	850	850	850	850	850	850	850
Imanta CHP	4.04	0	0	0	0	0	0	0	0	0	0	0
Natural gas co-generation power stations	4.05	47	46	44	42	41	39	37	36	34	32	31
Hydro power stations	4.06	6	6	6	6	6	6	6	6	6	6	6
Wind power stations	4.07	18	23	27	32	37	42	47	202	211	221	230
Biomass power stations	4.08	102	108	115	121	127	134	140	146	153	159	101
Solar power stations	4.09	90	142	193	245	297	349	401	453	505	557	609
Battery Energy Storage System [13)]	4.10	0	0	80	80	80	80	80	80	80	80	80
Power system emergency reserve [2)]	5	100	100	164	195	203	212	220	242	247	260	276
Power system regulating reserve [4)]	6	94	101	0	0	0	0	0	0	0	0	0
Total reserve in Latvia [3)]	7=5+6	194	201	164	195	203	212	220	242	247	260	276
Power surplus (+), deficit (–)	8=4-1-7	145	172	290	380	413	445	476	643	679	555	434
Power adequacy	9=(4-7)/1	111%	113%	122%	128%	130%	132%	134%	145%	147%	137%	129%

LATVIAN POWER SYSTEM BALANCE FOR SCENARIO EU2030 WINTER PEAK LOAD HOURS, MW (NETT)

Table 9

Years		2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Maximum load	1	1275	1304	1325	1344	1365	1386	1408	1431	1455	1481	1507
Big power base load power plants	2	2506	2506	2528	2536	2536	2536	2536	2536	2536	2383	2383
Including: Daugava HPPs	2.1	1550	1550	1572	1580	1580	1580	1580	1580	1580	1580	1580
Riga CHP-1	2.2	153	153	153	153	153	153	153	0	0	0	0
Riga CHP-2	2.3	850	850	850	850	850	850	850	0	0	0	0
Imanta CHP	2.4	0	0	0	0	0	0	0	0	0	0	0
Distributed, small capacity gas cogeneration and RES power plants	3	833	1203	1575	1933	2340	2746	3152	4628	4996	5440	5797
Including: Natural gas co-generation power stations	3.1	66	62	58	54	51	47	43	39	35	31	27
Hydro power stations	3.2	29	28	28	28	28	28	28	28	28	28	28
Including: Wind power stations	3.3	176	221	265	297	376	455	535	1683	1725	1842	1871
Onshore	3.3.1.	176	221	265	297	376	455	535	693	772	851	881
Offshore	3.3.2.	0	0	0	0	0	0	0	990	952	990	990
Biomass power stations	3.4	92	98	105	111	117	124	130	136	143	149	155
Biogas power stations	3.5	56	60	65	70	75	79	84	89	94	98	103
Solar power stations	3.6	414	734	1054	1373	1693	2013	2333	2652	2972	3292	3612
Available capacities for peak load and reserve guaranteeing	4	1742	1881	2019	2236	2378	2520	2662	1908	2046	2192	2329
Including: Daugava HPPs [5)]	4.01	400	400	400	400	400	400	400	400	400	400	400
Riga CHP-1	4.02	153	153	153	153	153	153	153	0	0	0	0
Riga CHP-2	4.03	850	850	850	850	850	850	850	0	0	0	0
Imanta CHP	4.04	0	0	0	0	0	0	0	0	0	0	0
Natural gas co-generation power stations	4.05	47	46	44	42	41	39	37	36	34	32	31
Hydro power stations	4.06	6	6	6	6	6	6	6	6	6	6	6
Wind power stations	4.07	18	22	27	30	38	46	53	168	172	184	187
Biomass power stations	4.08	103	111	119	127	134	142	150	158	165	173	181
Solar power stations	4.09	166	294	421	549	677	805	933	1061	1189	1317	1445
Battery Energy Storage System [13)]	4.10	0	0	80	80	80	80	80	80	80	80	80
Power system emergency reserve [2)]	5	100	100	164	195	203	212	220	242	247	260	276
Power system regulating reserve [4)]	6	94	100	0	0	0	0	0	0	0	0	0
Total reserve in Latvia [3)]	7=5+6	194	200	164	195	203	212	220	242	247	260	276
Power surplus (+), deficit (–)	8=4-1-7	273	377	571	737	851	963	1075	276	384	492	587
Power adequacy	9=(4-7)/1	121%	129%	143%	155%	162%	169%	176%	119%	126%	133%	139%

POSSIBLE POWER BALANCE FOR SCENARIO A (ANNUAL VALUES), GWh

Scenario A

Table 10

Years		2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Energy demand	1	7125	7206	7245	7276	7306	7338	7373	7411	7454	7498	7543
Big power base load power plants	2	4241	4241	4241	4241	4241	4241	4241	4241	4241	3761	3761
Including: Daugava HPPs [1]	2.1	2637	2637	2637	2637	2637	2637	2637	2637	2637	2637	2637
Riga CHP-1 [9]	2.2	480	480	480	480	480	480	480	480	480	0	0
Riga CHP-2 [9]	2.3	1124	1124	1124	1124	1124	1124	1124	1124	1124	1124	1124
Imanta CHP	2.4	0	0	0	0	0	0	0	0	0	0	0
Distributed, small capacity gas cogeneration and RES power plants	3	1595	1659	1724	1789	1854	1918	1983	3533	3598	3662	3727
Including: Natural gas co-generation power stations	3.1	406	392	377	363	349	335	320	306	292	278	263
Hydro power stations	3.2	66	67	67	67	67	67	67	67	67	68	68
Wind power stations	3.3	304	344	384	425	465	506	546	2072	2112	2152	2193
Onshore	3.3.1.	304	344	384	425	465	506	546	586	627	667	707
Offshore	3.3.2.	0	0	0	0	0	0	0	1485	1485	1485	1485
Biomass power stations	3.4	451	465	479	494	508	523	537	551	566	580	595
Biogas power stations	3.5	326	337	348	358	369	380	390	401	411	422	433
Solar power stations	3.6	42	55	69	82	95	109	122	136	149	163	176
Possible annual export/import	4=(2+3)-1	-1287	-1303	-1278	-1245	-1210	-1177	-1148	364	386	-74	-54
Annual adequacy	5=(2+3)/1	82%	82%	82%	83%	83%	84%	84%	105%	105%	99%	99%

POSSIBLE POWER BALANCE FOR SCENARIO B (ANNUAL VALUES), GWh

Scenario B

Table 11

Years		2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Energy demand	1	7169	7270	7329	7381	7432	7485	7543	7604	7670	7739	7810
Big power base load power plants	2	4432	4432	4432	4432	4432	4432	4432	4432	4432	3891	3891
Including: Daugava HPPs [1]	2.1	2637	2637	2637	2637	2637	2637	2637	2637	2637	2637	2637
Riga CHP-1 [9]	2.2	541	541	541	541	541	541	541	541	541	0	0
Riga CHP-2 [9]	2.3	1254	1254	1254	1254	1254	1254	1254	1254	1254	1254	1254
Imanta CHP	2.4	0	0	0	0	0	0	0	0	0	0	0
Distributed, small capacity gas cogeneration and RES power plants	3	1707	1872	2038	2203	2368	2533	2698	4349	4514	4679	4844
Including: Natural gas co-generation power stations	3.1	400	379	359	339	318	298	278	258	237	217	197
Hydro power stations	3.2	72	72	72	72	72	73	73	73	73	73	73
Wind power stations	3.3	359	454	550	645	740	836	931	2512	2607	2702	2798
Onshore	3.3.1.	359	454	550	645	740	836	931	1026	1122	1217	1313
Offshore	3.3.2.	0	0	0	0	0	0	0	1485	1485	1485	1485
Biomass power stations	3.4	454	481	508	535	561	588	615	642	668	695	722
Biogas power stations	3.5	355	379	404	428	452	477	501	525	550	574	598
Solar power stations	3.6	67	106	145	184	223	262	301	340	379	418	457
Possible annual export/import	4=(2+3)-1	-1028	-963	-857	-744	-630	-518	-411	1178	1277	832	926
Annual adequacy	5=(2+3)/1	86%	87%	88%	90%	92%	93%	95%	115%	117%	111%	112%

POSSIBLE POWER BALANCE FOR SCENARIO EU2030 (ANNUAL VALUES), GWh

Scenario EU2030

Table 12

Years		2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Energy demand	1	7243	7363	7440	7511	7582	7656	7734	7817	7906	7998	8093
Big power base load power plants	2	10938	9703	9703	9703	9703	9703	9703	2637	2637	2637	2637
Including: Daugava HPPs [1]	2.1	3872	2637	2637	2637	2637	2637	2637	2637	2637	2637	2637
Riga CHP-1 [9]	2.2	1114	1114	1114	1114	1114	1114	1114	0	0	0	0
Riga CHP-2 [9]	2.3	5952	5952	5952	5952	5952	5952	5952	0	0	0	0
Imanta CHP	2.4	0	0	0	0	0	0	0	0	0	0	0
Distributed, small capacity gas cogeneration and RES power plants	3	1818	2043	2271	2472	2769	3066	3363	6789	6973	7383	7581
Including: Natural gas co-generation power stations	3.1	397	373	350	327	303	280	257	233	210	187	163
Hydro power stations	3.2	77	75	75	75	75	75	75	76	76	76	76
Wind power stations	3.3	352	442	531	594	752	911	1069	4356	4402	4673	4733
Onshore	3.3.1.	352	442	531	594	752	911	1069	1386	1545	1703	1762
Offshore	3.3.2.	0	0	0	0	0	0	0	2970	2857	2970	2970
Biomass power stations	3.4	505	540	575	610	645	680	715	750	785	820	855
Biogas power stations	3.5	362	393	423	454	485	516	547	578	609	639	670
Solar power stations	3.6	124	220	316	412	508	604	700	796	892	988	1084
Possible annual export/import	4=(2+3)-1	5512	4386	4535	4667	4893	5116	5334	1611	1706	2023	2127
Annual adequacy	5=(2+3)/1	176%	160%	161%	162%	165%	167%	169%	121%	122%	125%	126%

POWER DEMAND AND POSSIBLE SOURCES OF GUARANTEEING, HOURLY BALANCE FOR SCENARIO A (PEAK LOAD), MW

Year 2023. January (working day, Wednesday of the third week, peak load)

Table 13

Hour	Riga CHP-1	Riga CHP-2 [11)]	Imanta CHP	Biomass and biogas	Gas fuelled co-generation	Small HPPs	Wind power stations	Solar power stations	Daugava HPPs [10)]	Import	Load
01:00	153	489	0	99	47	6	15	0.00	23	0	831
02:00	153	459	0	99	47	6	15	0.00	13	0	791
03:00	153	459	0	99	47	6	15	0.00	19	0	797
04:00	153	446	0	99	47	6	15	0.00	23	0	788
05:00	153	471	0	99	47	6	15	0.00	30	0	821
06:00	153	532	0	99	47	6	15	0.00	42	0	893
07:00	153	621	0	99	47	6	15	0.00	108	0	1049
08:00	153	673	0	99	47	6	15	0.00	171	0	1164
09:00	153	674	0	99	47	6	15	0.00	253	0	1246
10:00	153	694	0	99	47	6	15	0.00	262	0	1275
11:00	153	608	0	99	47	6	15	56	270	0	1252
12:00	153	653	0	99	47	6	15	56	188	0	1216
13:00	153	657	0	99	47	6	15	56	181	0	1213
14:00	153	622	0	99	47	6	15	56	188	0	1185
15:00	153	588	0	99	47	6	15	56	211	0	1174
16:00	153	613	0	99	47	6	15	56	217	0	1205
17:00	153	667	0	99	47	6	15	0.00	239	0	1225
18:00	153	638	0	99	47	6	15	0.00	255	0	1213
19:00	153	592	0	99	47	6	15	0.00	251	0	1163
20:00	153	605	0	99	47	6	15	0.00	195	0	1119
21:00	153	605	0	99	47	6	15	0.00	134	0	1059
22:00	153	572	0	99	47	6	15	0.00	118	0	1009
23:00	153	527	0	99	47	6	15	0.00	74	0	921
00:00	153	475	0	99	47	6	15	0.00	46	0	841
Produced amount of energy MWh	**3660**	**13940**	**0**	**2369**	**1136**	**133**	**364**	**334**	**3513**	**0**	**25449**

Year 2028. January (working day, Wednesday of the third week, peak load)

Table 14

Hour	Riga CHP-1	Riga CHP-2 [11]	Imanta CHP	Biomass and biogas	Gas fuelled co-generation	Small HPPs	Wind power stations	Solar power stations	Daugava HPPs [10]	Import	Load
01:00	153	543	0	115	39	6	25	0.00	23	0	903
02:00	153	510	0	115	39	6	25	0.00	13	0	860
03:00	153	510	0	115	39	6	25	0.00	19	0	865
04:00	153	496	0	115	39	6	25	0.00	23	0	856
05:00	153	524	0	115	39	6	25	0.00	30	0	892
06:00	153	591	0	115	39	6	25	0.00	42	0	970
07:00	153	694	0	115	39	6	25	0.00	108	0	1139
08:00	153	756	0	115	39	6	25	0.00	171	0	1264
09:00	153	764	0	115	39	6	25	0.00	253	0	1354
10:00	153	786	0	115	39	6	25	0.00	262	0	1386
11:00	153	609	0	115	39	6	25	145	270	0	1361
12:00	153	650	0	115	39	6	25	145	188	0	1321
13:00	153	654	0	115	39	6	25	145	181	0	1317
14:00	153	617	0	115	39	6	25	145	188	0	1287
15:00	153	582	0	115	39	6	25	145	211	0	1275
16:00	153	610	0	115	39	6	25	145	217	0	1309
17:00	153	755	0	115	39	6	25	0.00	239	0	1331
18:00	153	725	0	115	39	6	25	0.00	255	0	1317
19:00	153	675	0	115	39	6	25	0.00	251	0	1263
20:00	153	683	0	115	39	6	25	0.00	195	0	1215
21:00	153	679	0	115	39	6	25	0.00	134	0	1150
22:00	153	641	0	115	39	6	25	0.00	118	0	1096
23:00	153	589	0	115	39	6	25	0.00	74	0	1001
00:00	153	530	0	115	39	6	25	0.00	46	0	913
Produced amount of energy MWh	**3660**	**15175**	**0**	**2750**	**937**	**133**	**607**	**871**	**3513**	**0**	**27646**

Year 2033. January (working day, Wednesday of the third week, peak load)

Table 15

Hour	Riga CHP-1	Riga CHP-2 [11]	Imanta CHP	Biomass and biogas	Gas fuelled co-generation	Small HPPs	Wind power stations	Solar power stations	Daugava HPPs [10]	Import	Load
01:00	0	622	0	130	31	6	170	0	23	0	982
02:00	0	585	0	130	31	6	170	0	13	0	935
03:00	0	586	0	130	31	6	170	0	19	0	941
04:00	0	571	0	130	31	6	170	0	23	0	931
05:00	0	603	0	130	31	6	170	0	30	0	969
06:00	0	676	0	130	31	6	170	0	42	0	1055
07:00	0	794	0	130	31	6	170	0	108	0	1239
08:00	0	803	0	130	31	6	170	0	171	64	1374
09:00	0	803	0	130	31	6	170	0	253	80	1472
10:00	0	803	0	130	31	6	170	0	262	105	1507
11:00	0	638	0	130	31	6	170	235	270	0	1479
12:00	0	677	0	130	31	6	170	235	188	0	1436
13:00	0	680	0	130	31	6	170	235	181	0	1432
14:00	0	640	0	130	31	6	170	235	188	0	1399
15:00	0	604	0	130	31	6	170	235	211	0	1387
16:00	0	635	0	130	31	6	170	235	217	0	1424
17:00	0	803	0	130	31	6	170	0	239	69	1447
18:00	0	803	0	130	31	6	170	0	255	38	1432
19:00	0	786	0	130	31	6	170	0	251	0	1373
20:00	0	790	0	130	31	6	170	0	195	0	1321
21:00	0	780	0	130	31	6	170	0	134	0	1251
22:00	0	738	0	130	31	6	170	0	118	0	1192
23:00	0	677	0	130	31	6	170	0	74	0	1088
00:00	0	610	0	130	31	6	170	0	46	0	993
Produced amount of energy MWh	**0**	**16708**	**0**	**3132**	**737**	**133**	**4074**	**1408**	**3513**	**355**	**30059**

POWER DEMAND AND POSSIBLE SOURCES OF GUARANTEEING, HOURLY BALANCE FOR SCENARIO B (MINIMUM LOAD), MW

Year 2023. January (working day, Wednesday of the third week, peak load)

Table 16

Hour	Riga CHP-1	Riga CHP-2 [11)]	Imanta CHP	Biomass and biogas	Gas fuelled co-generation	Small HPPs	Wind power stations	Solar power stations	Daugava HPPs [10)]	Import	Load
01:00	153	476	0	102	47	6	18	0	30	0	831
02:00	153	449	0	102	47	6	18	0	17	0	791
03:00	153	447	0	102	47	6	18	0	24	0	797
04:00	153	433	0	102	47	6	18	0	30	0	788
05:00	153	456	0	102	47	6	18	0	39	0	821
06:00	153	514	0	102	47	6	18	0	54	0	893
07:00	153	583	0	102	47	6	18	0	140	0	1049
08:00	153	617	0	102	47	6	18	0	222	0	1164
09:00	153	593	0	102	47	6	18	0	328	0	1246
10:00	153	610	0	102	47	6	18	0	340	0	1275
11:00	153	488	0	102	47	6	18	90	350	0	1252
12:00	153	557	0	102	47	6	18	90	244	0	1216
13:00	153	563	0	102	47	6	18	90	235	0	1213
14:00	153	526	0	102	47	6	18	90	244	0	1185
15:00	153	485	0	102	47	6	18	90	274	0	1174
16:00	153	509	0	102	47	6	18	90	282	0	1205
17:00	153	590	0	102	47	6	18	0	310	0	1225
18:00	153	557	0	102	47	6	18	0	331	0	1213
19:00	153	512	0	102	47	6	18	0	326	0	1163
20:00	153	541	0	102	47	6	18	0	253	0	1119
21:00	153	560	0	102	47	6	18	0	174	0	1059
22:00	153	531	0	102	47	6	18	0	152	0	1009
23:00	153	500	0	102	47	6	18	0	96	0	921
00:00	153	455	0	102	47	6	18	0	60	0	841
Produced amount of energy MWh	**3660**	**12553**	**0**	**2445**	**1136**	**133**	**430**	**538**	**4554**	**0**	**25449**

Year 2028. January (working day, Wednesday of the third week, peak load)

Table 17

Hour	Riga CHP-1	Riga CHP-2 [11]	Imanta CHP	Biomass and biogas	Gas fuelled co-generation	Small HPPs	Wind power stations	Solar power stations	Daugava HPPs [10]	Import	Load
01:00	153	501	0	134	39	6	42	0	30	0	903
02:00	153	470	0	134	39	6	42	0	17	0	860
03:00	153	469	0	134	39	6	42	0	24	0	865
04:00	153	453	0	134	39	6	42	0	30	0	856
05:00	153	480	0	134	39	6	42	0	39	0	892
06:00	153	543	0	134	39	6	42	0	54	0	970
07:00	153	627	0	134	39	6	42	0	140	0	1139
08:00	153	670	0	134	39	6	42	0	222	0	1264
09:00	153	654	0	134	39	6	42	0	328	0	1354
10:00	153	673	0	134	39	6	42	0	340	0	1386
11:00	153	289	0	134	39	6	42	349	350	0	1361
12:00	153	355	0	134	39	6	42	349	244	0	1321
13:00	153	361	0	134	39	6	42	349	235	0	1317
14:00	153	340	0	134	39	6	42	349	244	−18	1287
15:00	153	340	0	134	39	6	42	349	274	−60	1275
16:00	153	340	0	134	39	6	42	349	282	−34	1309
17:00	153	649	0	134	39	6	42	0	310	0	1331
18:00	153	614	0	134	39	6	42	0	331	0	1317
19:00	153	565	0	134	39	6	42	0	326	0	1263
20:00	153	590	0	134	39	6	42	0	253	0	1215
21:00	153	604	0	134	39	6	42	0	174	0	1150
22:00	153	571	0	134	39	6	42	0	152	0	1096
23:00	153	532	0	134	39	6	42	0	96	0	1001
00:00	153	480	0	134	39	6	42	0	60	0	913
Produced amount of energy MWh	**3660**	**12169**	**0**	**3208**	**937**	**133**	**1003**	**2095**	**4554**	**−113**	**27646**

Year 2033. January (working day, Wednesday of the third week, peak load)

Table 18

Hour	Riga CHP-1	Riga CHP-2 [11]	Imanta CHP	Biomass and biogas	Gas fuelled co-generation	Small HPPs	Wind power stations	Solar power stations	Daugava HPPs [10]	Import	Load
01:00	0	584	0	101	31	6	230	0	30	0	982
02:00	0	550	0	101	31	6	230	0	17	0	935
03:00	0	549	0	101	31	6	230	0	24	0	941
04:00	0	533	0	101	31	6	230	0	30	0	931
05:00	0	563	0	101	31	6	230	0	39	0	969
06:00	0	633	0	101	31	6	230	0	54	0	1055
07:00	0	731	0	101	31	6	230	0	140	0	1239
08:00	0	785	0	101	31	6	230	0	222	0	1374
09:00	0	777	0	101	31	6	230	0	328	0	1472
10:00	0	799	0	101	31	6	230	0	340	0	1507
11:00	0	340	0	101	31	6	230	609	350	-187	1479
12:00	0	340	0	101	31	6	230	609	244	-124	1436
13:00	0	340	0	101	31	6	230	609	235	-119	1432
14:00	0	340	0	101	31	6	230	609	244	-161	1399
15:00	0	340	0	101	31	6	230	609	274	-204	1387
16:00	0	340	0	101	31	6	230	609	282	-174	1424
17:00	0	770	0	101	31	6	230	0	310	0	1447
18:00	0	734	0	101	31	6	230	0	331	0	1432
19:00	0	680	0	101	31	6	230	0	326	0	1373
20:00	0	701	0	101	31	6	230	0	253	0	1321
21:00	0	709	0	101	31	6	230	0	174	0	1251
22:00	0	672	0	101	31	6	230	0	152	0	1192
23:00	0	624	0	101	31	6	230	0	96	0	1088
00:00	0	565	0	101	31	6	230	0	60	0	993
Produced amount of energy MWh	**0**	**14000**	**0**	**2426**	**737**	**133**	**5526**	**3652**	**4554**	**-968**	**30059**

POWER DEMAND AND POSSIBLE SOURCES OF GUARANTEEING, HOURLY BALANCE FOR SCENARIO EU 2030 (PEAK LOAD), MW

Year 2023. January (working day, Wednesday of the third week, peak load)

Table 19

Hour	Riga CHP-1	Riga CHP-2 [11)]	Imanta CHP	Biomass and biogas	Gas fuelled co-generation	Small HPPs	Wind power stations	Solar power stations	Daugava HPPs [10)]	Import	Load
01:00	153	471	0	103	47	6	18	0	34	0	831
02:00	153	446	0	103	47	6	18	0	20	0	791
03:00	153	443	0	103	47	6	18	0	27	0	797
04:00	153	427	0	103	47	6	18	0	35	0	788
05:00	153	450	0	103	47	6	18	0	45	0	821
06:00	153	505	0	103	47	6	18	0	62	0	893
07:00	153	562	0	103	47	6	18	0	160	0	1049
08:00	153	584	0	103	47	6	18	0	253	0	1164
09:00	153	546	0	103	47	6	18	0	374	0	1246
10:00	153	560	0	103	47	6	18	0	389	0	1275
11:00	153	523	0	103	47	6	18	4	400	0	1252
12:00	153	607	0	103	47	6	18	4	279	0	1216
13:00	153	615	0	103	47	6	18	4	268	0	1213
14:00	153	576	0	103	47	6	18	4	278	0	1185
15:00	153	531	0	103	47	6	18	4	313	0	1174
16:00	153	554	0	103	47	6	18	4	322	0	1205
17:00	153	545	0	103	47	6	18	0	354	0	1225
18:00	153	508	0	103	47	6	18	0	378	0	1213
19:00	153	464	0	103	47	6	18	0	372	0	1163
20:00	153	504	0	103	47	6	18	0	289	0	1119
21:00	153	534	0	103	47	6	18	0	199	0	1059
22:00	153	508	0	103	47	6	18	0	174	0	1009
23:00	153	485	0	103	47	6	18	0	110	0	921
00:00	153	445	0	103	47	6	18	0	69	0	841
Produced amount of energy MWh	**3660**	**12393**	**0**	**2479**	**1136**	**133**	**423**	**21**	**5204**	**0**	**25449**

Year 2028. January (working day, Wednesday of the third week, peak load)

Table 20

Hour	Riga CHP-1	Riga CHP-2 [11]	Imanta CHP	Biomass and biogas	Gas fuelled co-generation	Small HPPs	Wind power stations	Solar power stations	Daugava HPPs [10]	Import	Load
01:00	153	484	0	142	39	6	46	0	34	0	903
02:00	153	455	0	142	39	6	46	0	20	0	860
03:00	153	453	0	142	39	6	46	0	27	0	865
04:00	153	437	0	142	39	6	46	0	35	0	856
05:00	153	462	0	142	39	6	46	0	45	0	892
06:00	153	523	0	142	39	6	46	0	62	0	970
07:00	153	594	0	142	39	6	46	0	160	0	1139
08:00	153	626	0	142	39	6	46	0	253	0	1264
09:00	153	595	0	142	39	6	46	0	374	0	1354
10:00	153	612	0	142	39	6	46	0	389	0	1386
11:00	153	340	0	142	39	6	46	421	400	-186	1361
12:00	153	340	0	142	39	6	46	421	279	-104	1321
13:00	153	340	0	142	39	6	46	421	268	-97	1317
14:00	153	340	0	142	39	6	46	421	278	-138	1287
15:00	153	340	0	142	39	6	46	421	313	-184	1275
16:00	153	340	0	142	39	6	46	421	322	-159	1309
17:00	153	592	0	142	39	6	46	0	354	0	1331
18:00	153	555	0	142	39	6	46	0	378	0	1317
19:00	153	506	0	142	39	6	46	0	372	0	1263
20:00	153	542	0	142	39	6	46	0	289	0	1215
21:00	153	567	0	142	39	6	46	0	199	0	1150
22:00	153	537	0	142	39	6	46	0	174	0	1096
23:00	153	506	0	142	39	6	46	0	110	0	1001
00:00	153	459	0	142	39	6	46	0	69	0	913
Produced amount of energy MWh	**3660**	**11546**	**0**	**3412**	**937**	**133**	**1093**	**2529**	**5204**	**-868**	**27646**

Year 2033. January (working day, Wednesday of the third week, peak load))

Table 21

Hour	Riga CHP-1	Riga CHP-2 [11]	Imanta CHP	Biomass and biogas	Gas fuelled co-generation	Small HPPs	Wind power stations	Solar power stations	Daugava HPPs [10]	Import	Load
01:00	0	0	0	181	31	6	187	0	34	543	982
02:00	0	0	0	181	31	6	187	0	20	511	935
03:00	0	0	0	181	31	6	187	0	27	509	941
04:00	0	0	0	181	31	6	187	0	35	492	931
05:00	0	0	0	181	31	6	187	0	45	520	969
06:00	0	0	0	181	31	6	187	0	62	589	1055
07:00	0	0	0	181	31	6	187	0	160	674	1239
08:00	0	0	0	181	31	6	187	0	253	717	1374
09:00	0	0	0	181	31	6	187	0	374	693	1472
10:00	0	0	0	181	31	6	187	0	389	713	1507
11:00	0	0	0	181	31	6	187	1061	400	-386	1479
12:00	0	0	0	181	31	6	187	1061	279	-308	1436
13:00	0	0	0	181	31	6	187	1061	268	-301	1432
14:00	0	0	0	181	31	6	187	1061	278	-345	1399
15:00	0	0	0	181	31	6	187	1061	313	-392	1387
16:00	0	0	0	181	31	6	187	1061	322	-363	1424
17:00	0	0	0	181	31	6	187	0	354	689	1447
18:00	0	0	0	181	31	6	187	0	378	650	1432
19:00	0	0	0	181	31	6	187	0	372	597	1373
20:00	0	0	0	181	31	6	187	0	289	628	1321
21:00	0	0	0	181	31	6	187	0	199	647	1251
22:00	0	0	0	181	31	6	187	0	174	613	1192
23:00	0	0	0	181	31	6	187	0	110	573	1088
00:00	0	0	0	181	31	6	187	0	69	520	993
Produced amount of energy MWh	**0**	**0**	**0**	**4345**	**737**	**133**	**4491**	**6366**	**5204**	**8784**	**30059**

POWER DEMAND AND POSSIBLE SOURCES OF GUARANTEEING, HOURLY BALANCE FOR SCENARIO A (MINIMUM LOAD), MW

Year 2023 June – minimum monthly load

Table 22

	Riga CHP-1	Imanta CHP	Biomasa un Biogāze	Dabasgāzes koģ. Stac.	Small HPPs	Wind power stations	Solar power stations	Riga CHP-2 [11)]	Daugava HPPs [10)]	Load	Export
00:00	0	0	99	47	6	15	0	478	59	703	0
01:00	0	0	99	47	6	15	0	400	40	607	0
02:00	0	0	99	47	6	15	0	363	36	565	0
03:00	0	0	99	47	6	15	0	353	23	543	0
04:00	0	0	99	47	6	15	0	340	23	527	2
05:00	0	0	99	47	6	15	0	340	21	502	26
06:00	0	0	99	47	6	15	0	340	49	513	42
07:00	0	0	99	47	6	15	0	340	110	546	71
08:00	0	0	99	47	6	15	56	340	175	597	140
09:00	0	0	99	47	6	15	56	340	246	670	138
10:00	0	0	99	47	6	15	56	340	268	729	101
11:00	0	0	99	47	6	15	56	340	270	765	68
12:00	0	0	99	47	6	15	56	340	251	775	39
13:00	0	0	99	47	6	15	56	340	241	770	33
14:00	0	0	99	47	6	15	56	340	240	770	32
15:00	0	0	99	47	6	15	56	340	215	764	14
16:00	0	0	99	47	6	15	56	347	191	760	0
17:00	0	0	99	47	6	15	56	376	159	757	0
18:00	0	0	99	47	6	15	56	396	144	763	0
19:00	0	0	99	47	6	15	0	464	135	765	0
20:00	0	0	99	47	6	15	0	460	136	763	0
21:00	0	0	99	47	6	15	0	481	110	757	0
22:00	0	0	99	47	6	15	0	482	89	738	0
23:00	0	0	99	47	6	15	0	469	82	718	0
Produced amount of energy MWh	**0**	**0**	**2369**	**1136**	**134**	**364**	**612**	**9148**	**3313**	**16369**	**707**

Year 2028 June – minimum monthly load

Table 23

	Riga CHP-1	Imanta CHP	Biomass and biogas	Gas fuelled co-generation	Small HPPs	Wind power	Solar power	Riga CHP-2 [11)]	Daugava HPPs [10)]	Load	Export
0:00	0	0	115	39	6	25	0	521	59	764	0
1:00	0	0	115	39	6	25	0	435	40	660	0
2:00	0	0	115	39	6	25	0	394	36	614	0
3:00	0	0	115	39	6	25	0	382	23	590	0
4:00	0	0	115	39	6	25	0	366	23	573	0
5:00	0	0	115	39	6	25	0	340	21	545	1
6:00	0	0	115	39	6	25	0	340	49	558	16
7:00	0	0	115	39	6	25	0	340	110	593	42
8:00	0	0	115	39	6	25	145	340	175	649	195
9:00	0	0	115	39	6	25	145	340	246	728	188
10:00	0	0	115	39	6	25	145	340	268	792	146
11:00	0	0	115	39	6	25	145	340	270	831	109
12:00	0	0	115	39	6	25	145	340	251	841	80
13:00	0	0	115	39	6	25	145	340	241	837	74
14:00	0	0	115	39	6	25	145	340	240	837	73
15:00	0	0	115	39	6	25	145	340	215	830	55
16:00	0	0	115	39	6	25	145	340	191	826	35
17:00	0	0	115	39	6	25	145	340	159	822	6
18:00	0	0	115	39	6	25	145	355	144	829	0
19:00	0	0	115	39	6	25	0	512	135	831	0
20:00	0	0	115	39	6	25	0	508	136	829	0
21:00	0	0	115	39	6	25	0	528	110	823	0
22:00	0	0	115	39	6	25	0	528	89	801	0
23:00	0	0	115	39	6	25	0	513	82	780	0
Produced amount of energy MWh	**0**	**0**	**2750**	**937**	**137**	**607**	**1597**	**9463**	**3313**	**17782**	**1021**

Year 2033 June – minimum monthly load

Table 24

	Riga CHP-1	Imanta CHP	Biomasa un Biogāze	Dabasgāzes koģ. stac.	Small HPPs	Wind power stations	Solar power stations	Riga CHP-2 [11)]	Daugava HPPs [10)]	Load	Export
00:00	0	0	130	31	6	170	0	435	59	831	0
01:00	0	0	130	31	6	170	0	340	40	717	0
02:00	0	0	130	31	6	170	0	340	36	668	44
03:00	0	0	130	31	6	170	0	340	23	641	58
04:00	0	0	130	31	6	170	0	340	23	623	76
05:00	0	0	130	31	6	170	0	340	21	592	105
06:00	0	0	130	31	6	170	0	340	49	606	119
07:00	0	0	130	31	6	170	0	340	110	645	142
08:00	0	0	130	31	6	170	235	340	175	706	380
09:00	0	0	130	31	6	170	235	340	246	792	365
10:00	0	0	130	31	6	170	235	340	268	862	318
11:00	0	0	130	31	6	170	235	340	270	903	278
12:00	0	0	130	31	6	170	235	340	251	915	248
13:00	0	0	130	31	6	170	235	340	241	910	242
14:00	0	0	130	31	6	170	235	340	240	910	241
15:00	0	0	130	31	6	170	235	340	215	902	224
16:00	0	0	130	31	6	170	235	340	191	898	204
17:00	0	0	130	31	6	170	235	340	159	894	176
18:00	0	0	130	31	6	170	235	340	144	901	154
19:00	0	0	130	31	6	170	0	433	135	904	0
20:00	0	0	130	31	6	170	0	429	136	901	0
21:00	0	0	130	31	6	170	0	448	110	895	0
22:00	0	0	130	31	6	170	0	446	89	871	0
23:00	0	0	130	31	6	170	0	429	82	848	0
Produced amount of energy MWh	**0**	**0**	**3132**	**737**	**133**	**4074**	**2581**	**8741**	**3313**	**19334**	**3376**

POWER DEMAND AND POSSIBLE SOURCES OF GUARANTEEING, HOURLY BALANCE FOR SCENARIO B (MINIMUM LOAD), MW

Year 2023 June – minimum monthly load

Table 25

	Riga CHP-1	Imanta CHP	Biomasa un Biogāze	Dabasgāzes koģ. stac.	Small HPPs	Wind power stations	Solar power stations	Riga CHP-2 [11)]	Daugava HPPs [10)]	Load	Export
00:00	0	0	102	47	6	18	0	454	76	703	0
01:00	0	0	102	47	6	18	0	382	52	607	0
02:00	0	0	102	47	6	18	0	346	46	565	0
03:00	0	0	102	47	6	18	0	340	30	543	0
04:00	0	0	102	47	6	18	0	340	30	527	15
05:00	0	0	102	47	6	18	0	340	27	502	38
06:00	0	0	102	47	6	18	0	340	63	513	63
07:00	0	0	102	47	6	18	0	340	143	546	110
08:00	0	0	102	47	6	18	90	340	227	597	231
09:00	0	0	102	47	6	18	90	340	319	670	251
10:00	0	0	102	47	6	18	90	340	348	729	221
11:00	0	0	102	47	6	18	90	340	350	765	187
12:00	0	0	102	47	6	18	90	340	326	775	153
13:00	0	0	102	47	6	18	90	340	312	770	144
14:00	0	0	102	47	6	18	90	340	311	770	143
15:00	0	0	102	47	6	18	90	340	279	764	117
16:00	0	0	102	47	6	18	90	340	248	760	90
17:00	0	0	102	47	6	18	90	340	206	757	51
18:00	0	0	102	47	6	18	90	340	187	763	26
19:00	0	0	102	47	6	18	0	418	174	765	0
20:00	0	0	102	47	6	18	0	414	177	763	0
21:00	0	0	102	47	6	18	0	442	143	757	0
22:00	0	0	102	47	6	18	0	450	115	738	0
23:00	0	0	102	47	6	18	0	439	106	718	0
Produced amount of energy MWh	**0**	**0**	**2445**	**1136**	**133**	**430**	**986**	**8786**	**4294**	**16369**	**1842**

Year 2028 June – minimum monthly load

Table 26

	Riga CHP-1	Imanta CHP	Biomasa un Biogāze	Dabasgāzes koģ. stac.	Small HPPs	Wind power stations	Solar power stations	Riga CHP-2 [11]	Daugava HPPs [10]	Load	Export
00:00	0	0	134	39	6	42	0	467	76	764	0
01:00	0	0	134	39	6	42	0	387	52	660	0
02:00	0	0	134	39	6	42	0	348	46	614	0
03:00	0	0	134	39	6	42	0	340	30	590	0
04:00	0	0	134	39	6	42	0	340	30	573	17
05:00	0	0	134	39	6	42	0	340	27	545	43
06:00	0	0	134	39	6	42	0	340	63	558	66
07:00	0	0	134	39	6	42	0	340	143	593	110
08:00	0	0	134	39	6	42	349	340	227	649	487
09:00	0	0	134	39	6	42	349	340	319	728	500
10:00	0	0	134	39	6	42	349	340	348	792	465
11:00	0	0	134	39	6	42	349	340	350	831	428
12:00	0	0	134	39	6	42	349	340	326	841	393
13:00	0	0	134	39	6	42	349	340	312	837	385
14:00	0	0	134	39	6	42	349	340	311	837	384
15:00	0	0	134	39	6	42	349	340	279	830	358
16:00	0	0	134	39	6	42	349	340	248	826	331
17:00	0	0	134	39	6	42	349	340	206	822	293
18:00	0	0	134	39	6	42	349	340	187	829	267
19:00	0	0	134	39	6	42	0	437	174	831	0
20:00	0	0	134	39	6	42	0	432	177	829	0
21:00	0	0	134	39	6	42	0	460	143	823	0
22:00	0	0	134	39	6	42	0	467	115	801	0
23:00	0	0	134	39	6	42	0	453	106	780	0
Produced amount of energy MWh	**0**	**0**	**3208**	**937**	**133**	**1003**	**3841**	**8892**	**4294**	**17782**	**4525**

Year 2033 June – minimum monthly load

Table 27

	Riga CHP-1	Imanta CHP	Biomasa un Biogāze	Dabasgāzes koģ. stac.	Small HPPs	Wind power stations	Solar power stations	Riga CHP-2 [11)]	Daugava HPPs [10)]	Load	Export
00:00	0	0	101	31	6	230	0	387	76	831	0
01:00	0	0	101	31	6	230	0	297	52	717	0
02:00	0	0	101	31	6	230	0	254	46	668	0
03:00	0	0	101	31	6	230	0	244	30	641	0
04:00	0	0	101	31	6	230	0	226	30	623	0
05:00	0	0	101	31	6	230	0	197	27	592	0
06:00	0	0	101	31	6	230	0	176	63	606	0
07:00	0	0	101	31	6	230	0	170	143	645	36
08:00	0	0	101	31	6	230	609	170	227	706	667
09:00	0	0	101	31	6	230	609	170	319	792	673
10:00	0	0	101	31	6	230	609	170	348	862	633
11:00	0	0	101	31	6	230	609	170	350	903	593
12:00	0	0	101	31	6	230	609	170	326	915	557
13:00	0	0	101	31	6	230	609	170	312	910	549
14:00	0	0	101	31	6	230	609	170	311	910	548
15:00	0	0	101	31	6	230	609	170	279	902	523
16:00	0	0	101	31	6	230	609	170	248	898	496
17:00	0	0	101	31	6	230	609	170	206	894	458
18:00	0	0	101	31	6	230	609	170	187	901	432
19:00	0	0	101	31	6	230	0	362	174	904	0
20:00	0	0	101	31	6	230	0	357	177	901	0
21:00	0	0	101	31	6	230	0	384	143	895	0
22:00	0	0	101	31	6	230	0	389	115	871	0
23:00	0	0	101	31	6	230	0	374	106	848	0
Produced amount of energy MWh	**0**	**0**	**2426**	**737**	**133**	**5526**	**6695**	**5687**	**4294**	**19334**	**6164**

POWER DEMAND AND POSSIBLE SOURCES OF GUARANTEEING, HOURLY BALANCE FOR SCENARIO EU2030 (MINIMUM LOAD), MW

Year 2023 June – minimum monthly load

Table 28

	Riga CHP-1	Imanta CHP	Biomasa un Biogāze	Dabasgāzes koģ. stac.	Small HPPs	Wind power stations	Solar power stations	Riga CHP-2 [11)]	Daugava HPPs [10)]	Load	Export
00:00	0	0	103	47	6	18	0	442	87	703	0
01:00	0	0	103	47	6	18	0	374	60	607	0
02:00	0	0	103	47	6	18	0	340	53	565	1
03:00	0	0	103	47	6	18	0	340	34	543	5
04:00	0	0	103	47	6	18	0	340	34	527	20
05:00	0	0	103	47	6	18	0	340	31	502	43
06:00	0	0	103	47	6	18	0	340	72	513	73
07:00	0	0	103	47	6	18	0	340	164	546	132
08:00	0	0	103	47	6	18	166	340	259	597	341
09:00	0	0	103	47	6	18	166	340	364	670	374
10:00	0	0	103	47	6	18	166	340	398	729	348
11:00	0	0	103	47	6	18	166	340	400	765	315
12:00	0	0	103	47	6	18	166	340	372	775	277
13:00	0	0	103	47	6	18	166	340	357	770	266
14:00	0	0	103	47	6	18	166	340	356	770	265
15:00	0	0	103	47	6	18	166	340	318	764	234
16:00	0	0	103	47	6	18	166	340	283	760	202
17:00	0	0	103	47	6	18	166	340	235	757	158
18:00	0	0	103	47	6	18	166	340	213	763	130
19:00	0	0	103	47	6	18	0	392	199	765	0
20:00	0	0	103	47	6	18	0	388	202	763	0
21:00	0	0	103	47	6	18	0	421	163	757	0
22:00	0	0	103	47	6	18	0	433	131	738	0
23:00	0	0	103	47	6	18	0	422	122	718	0
Produced amount of energy MWh	**0**	**0**	**2479**	**1136**	**133**	**423**	**1822**	**8651**	**4908**	**16369**	**3183**

Year 2028 June – minimum monthly load

Table 29

	Riga CHP-1	Imanta CHP	Biomass and biogas	Gas fuelled co-generation	Small HPPs	Wind power	Solar power	Riga CHP-2 [11)]	Daugava HPPs [10)]	Load	Export
0:00	0	0	142	39	6	46	0	444	87	764	0
1:00	0	0	142	39	6	46	0	368	60	660	0
2:00	0	0	142	39	6	46	0	340	53	614	11
3:00	0	0	142	39	6	46	0	340	34	590	17
4:00	0	0	142	39	6	46	0	340	34	573	33
5:00	0	0	142	39	6	46	0	340	31	545	59
6:00	0	0	142	39	6	46	0	340	72	558	87
7:00	0	0	142	39	6	46	0	340	164	593	143
8:00	0	0	142	39	6	46	46	340	259	649	228
9:00	0	0	142	39	6	46	46	340	364	728	254
10:00	0	0	142	39	6	46	46	340	398	792	223
11:00	0	0	142	39	6	46	46	340	400	831	187
12:00	0	0	142	39	6	46	46	340	372	841	149
13:00	0	0	142	39	6	46	46	340	357	837	138
14:00	0	0	142	39	6	46	46	340	356	837	137
15:00	0	0	142	39	6	46	46	340	318	830	107
16:00	0	0	142	39	6	46	46	340	283	826	75
17:00	0	0	142	39	6	46	46	340	235	822	31
18:00	0	0	142	39	6	46	46	340	213	829	3
19:00	0	0	142	39	6	46	0	399	199	831	0
20:00	0	0	142	39	6	46	0	395	202	829	0
21:00	0	0	142	39	6	46	0	428	163	823	0
22:00	0	0	142	39	6	46	0	438	131	801	0
23:00	0	0	142	39	6	46	0	426	122	780	0
Produced amount of energy MWh	**0**	**0**	**3412**	**937**	**137**	**1093**	**501**	**8678**	**4908**	**17782**	**1884**

Year 2033 June – minimum monthly load

Table 30

	Riga CHP-1	Imanta CHP	Biomasa un Biogāze	Dabasgāzes koģ. stac.	Small HPPs	Wind power stations	Solar power stations	Riga CHP-2 [11)]	Daugava HPPs [10)]	Load	Import/ Export
00:00	0	0	181	31	6	187	0	0	87	831	–339
01:00	0	0	181	31	6	187	0	0	60	717	–253
02:00	0	0	181	31	6	187	0	0	53	668	–211
03:00	0	0	181	31	6	187	0	0	34	641	–203
04:00	0	0	181	31	6	187	0	0	34	623	–185
05:00	0	0	181	31	6	187	0	0	31	592	–157
06:00	0	0	181	31	6	187	0	0	164	606	–38
07:00	0	0	181	31	6	187	0	0	247	645	7
08:00	0	0	181	31	6	187	1445	0	200	706	1343
09:00	0	0	181	31	6	187	1445	0	289	792	1346
10:00	0	0	181	31	6	187	1445	0	359	862	1347
11:00	0	0	181	31	6	187	1445	0	398	903	1344
12:00	0	0	181	31	6	187	1445	0	372	915	1306
13:00	0	0	181	31	6	187	1445	0	357	910	1296
14:00	0	0	181	31	6	187	1445	0	356	910	1295
15:00	0	0	181	31	6	187	1445	0	318	902	1265
16:00	0	0	181	31	6	187	1445	0	283	898	1234
17:00	0	0	181	31	6	187	1445	0	235	894	1190
18:00	0	0	181	31	6	187	1445	0	213	901	1161
19:00	0	0	181	31	6	187	0	0	199	904	–300
20:00	0	0	181	31	6	187	0	0	202	901	–295
21:00	0	0	181	31	6	187	0	0	163	895	–327
22:00	0	0	181	31	6	187	0	0	131	871	–336
23:00	0	0	181	31	6	187	0	0	122	848	–322
Produced amount of energy MWh	**0**	**0**	**4345**	**737**	**133**	**4491**	**15891**	**0**	**4908**	**19334**	**11171**