AS "AUGSTSPRIEGUMA TĪKLS"

ANNUAL STATEMENT OF TRANSMISSION SYSTEM OPERATOR

2024

CONTENT

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 and 2023 on the week-by-week basis

The total annual electricity consumption excluding electric energy losses is 6 870 755 MWh Compared to 2022, system consumption has decreased by 4%.

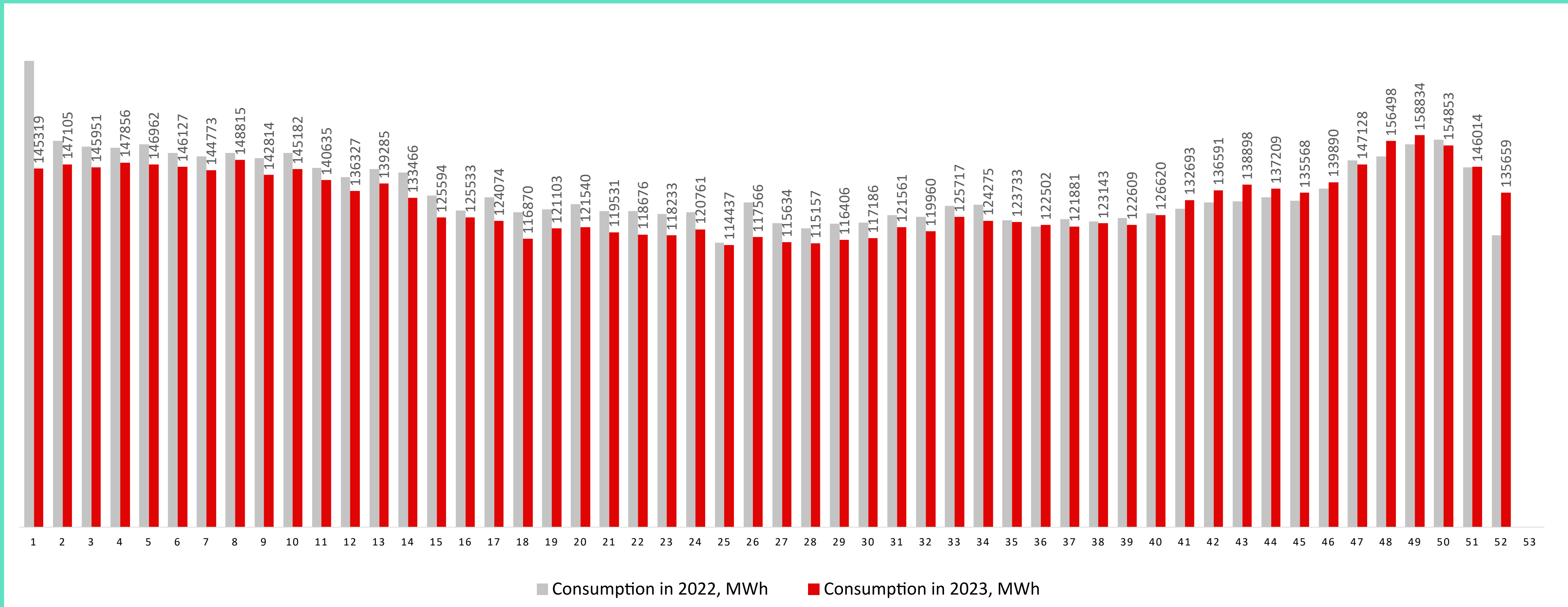
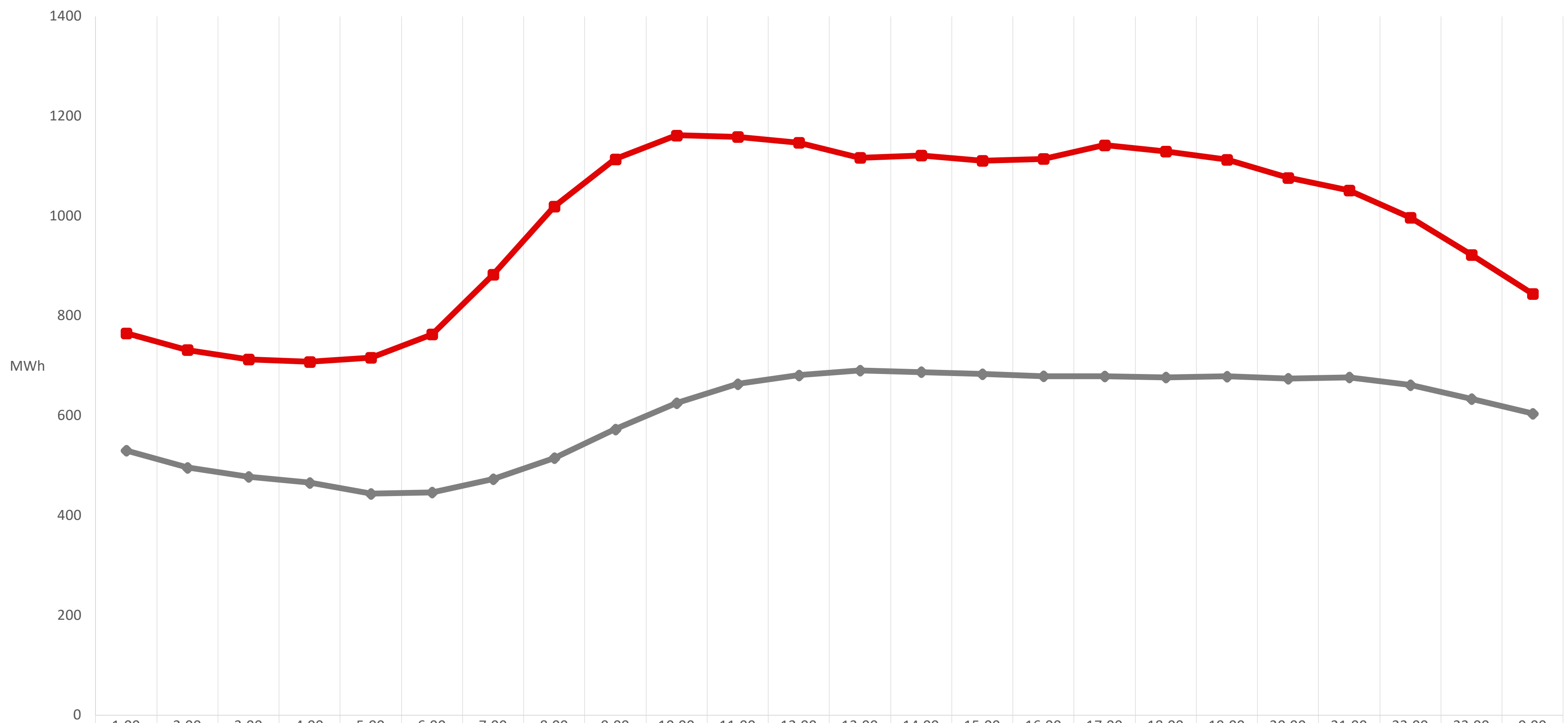


Fig. 1 Weekly electric energy consumption in Latvia (net), MWh

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

Minimum load:	**444 MWh/h**	25.06.2023	05.00
Maximum load:	**1161 MWh/h**	06.12.2023	10.00

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



	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	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	0:00
December 6, MWh	765	732	713	708	716	763	883	1019	1114	1161	1159	1147	1117	1121	1111	1115	1142	1129	1113	1076	1051	997	922	844
June 25, MWh	530	496	478	466	444	447	473	515	573	625	663	681	691	688	683	679	679	677	679	674	677	661	634	604

Fig. 2. Electricity consumption during 24 hours

2. ENERGY AND CAPACITY DEMAND FORECAST IN THE COMING YEARS
(MINIMUM FORECAST PERIOD – 10 YEARS)

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

Electricity system consumption is predicted based on the results of the KPMG study on consumption development trends in Latvia [2], where consumption is predicted for three economic development scenarios of Latvia – Conservative development (Scenario A), Base scenario (Scenario B) and Optimistic development (EU2030 Scenario). The development scenarios use information from the electricity system participants, distribution system operators, as well as considering the increase of consumption from the planned development of electric transport and future technologies, such as Power to X (P2X) and hydrogen technologies (see Fig. 3). The results of KPMG consumption development study can be found on the AST website.

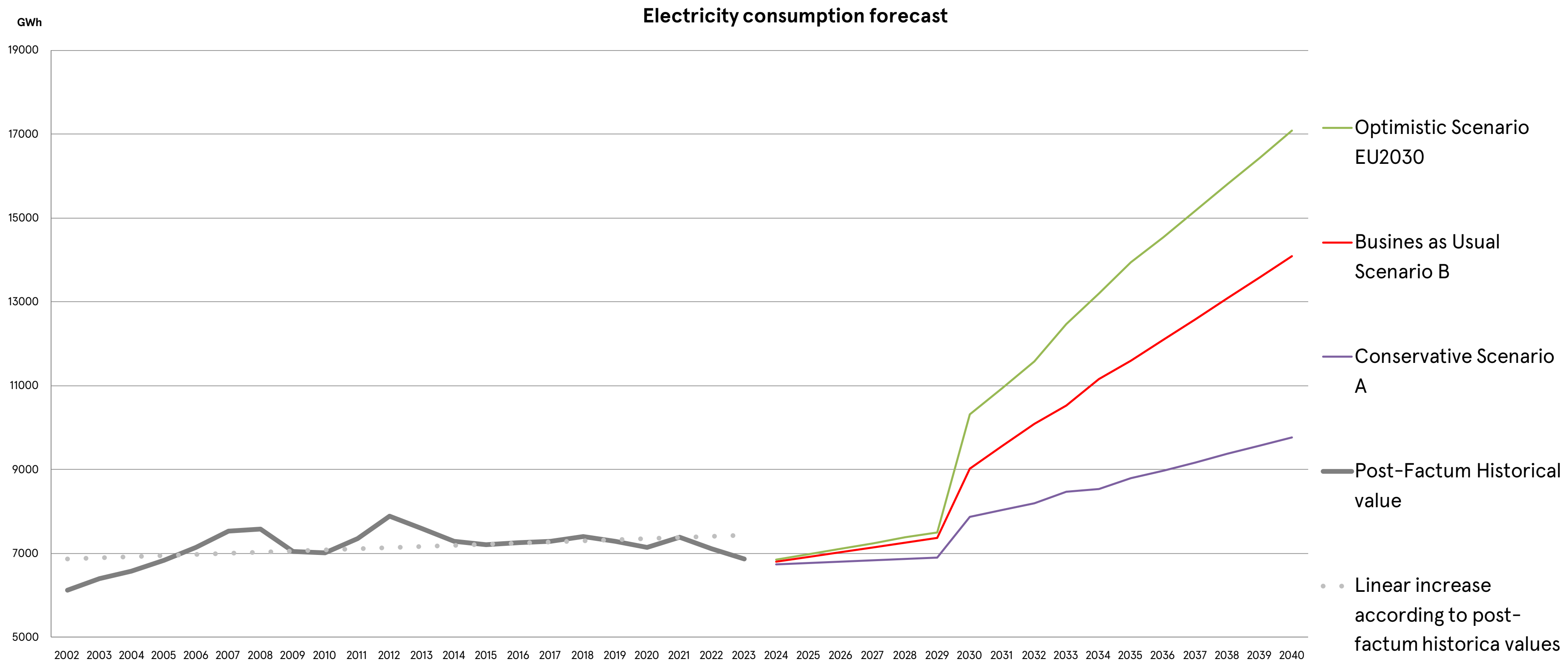


Fig. 3. Forecast of electricity consumption growth until 2040

[1] https://prognozes.em.gov.lv/lv/ekonomikas-izaugsmes-scenarijs
https://www.ast.lv/en/content/study-faster-electricity-consumption-increase-expected-latvia

Year	Conservative development scenario (A)		Base development scenario (B)		Optimistic development scenario (EU2030)		Peak load
	Consumption	Hydrogen consumption	Consumption	Hydrogen consumption	Consumption	Hydrogen consumption	
	GWh	GWh	GWh	GWh	GWh	GWh	MW
2024	6734	0	6811	0	6846	0	1187
2025	6771	0	6925	0	6982	0	1243
2026	6801	0	7033	0	7113	0	1308
2027	6830	0	7143	0	7247	0	1378
2028	6861	0	7256	0	7385	0	1446
2029	6895	0	7376	0	7507	0	1531
2030	7167	700	7630	1400	8015	2300	1647
2031	7231	800	7756	1800	8130	2800	1733
2032	7297	900	7887	2200	8374	3200	1804
2033	7365	1100	8021	2500	8765	3700	1903
2034	7433	1100	8259	2900	9002	4200	2002

Table 1

3. DEVELOPMENT OF GENERATION CAPACITIES IN LATVIA

The planned development of generation capacities by scenarios is shown in Fig. 4. The high-power base load plants and distributed generation low-power gas power plants and renewable energy resources (hereinafter – RES) plants are shown separately. The picture shows separately the battery energy storage systems (hereinafter – BESS), which include the 80 MW BESS capacity for the TSO needs – to provide regulation and balancing services, whereas the development of private BESS will be based on the free electricity market conditions.

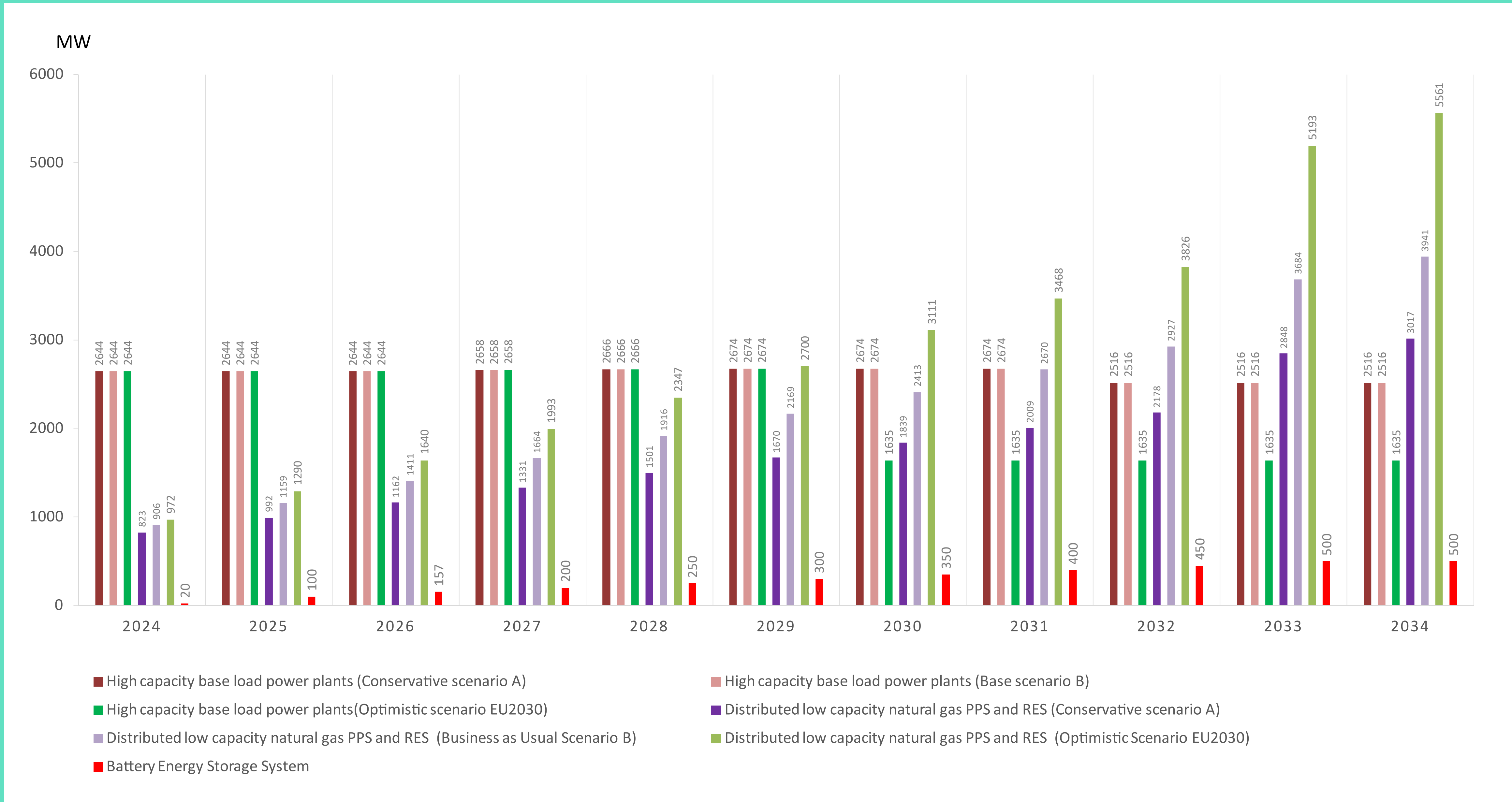


Fig. 4. Development of electricity generation capacities by scenarios (gross)

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 Baltic synchronous operation mode 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 June 28, 2018, and approved political synchronisation roadmap of the Baltic electricity networks with the electricity network of Continental Europe, as well as on the basis of connection agreement between the Baltic and European electricity TSOs signed on May 27 2019, to add the Baltic States to the synchronous zone of Continental Europe, as well as on the basis of 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 have a stagnant character and electricity consumption develops slowly. The generation capacity development forecast is based on the AST expert opinion, considering the information on development plans from Latvian electricity system producers and RES producers associations. In the conservative scenario, the operation of natural gas power plants is planned according to the free electricity market conditions, 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 scheme. 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 installed capacity. 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 GDP growth forecast for Latvia, provided by the Ministry of Economics of Latvia, as well as based on the information provided by the electricity system participants, including information from the electricity system users who are developing the introduction of electric transport and new P2X or hydrogen technologies, as well as information submitted by Latvian DSOs on the development of load and electricity consumption. In the base scenario, the rate of development of consumption is moderate. The generation capacity development forecast takes into account the power plants that are planned to be commissioned or closed according to the information submitted by the 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 HPP hydroelectric power plants is based on the average annual power plant development, and the production of both Riga CHPs is planned according to the electricity market conditions and state support for high-power gas cogeneration plants. Taking into account Latvenergo plans to equip Riga CHP-1 with a cooling system[3] to the power plant possibility also be operated in condensation mode, it will continue operation during the evaluation period. The development of wind stations, biomass and biogas stations and solar power stations is planned based on the last three years' interest in the development rates of generation sources in Latvia and stable long-term economic development trends in the country. The development of offshore wind farms is progressing moderately and successfully, and TSO assumes that offshore wind farm projects, including ELWIND, will be implemented by 2033 with an installed capacity of 500 MW. The development of small natural gas cogeneration power plants is not planned, and considering increase of natural gas prices and the policy of gas emission quotas, the volume of small natural gas cogeneration stations will decrease.

Scenario EU2030 "Optimistic development":

The forecast of the generating capacity development and the increase of the electricity system load is planned, based on the GDP growth forecast for Latvia, provided by the Ministry of Economics of Latvia, on the information from the electricity system participants, including information from the users of the electricity system, who develops the electric transport and new P2X or hydrogen technologies, taking into account the desired rate of development of generation and load, in order to achieve the goals set by the European Union in 2030-2050, which is based on the long-term 2030 Energy Strategy of Latvia and the National Energy and Climate Plan 2021-2030 developed and updated by the Ministry of Climate and Energy. In compare with scenarios A and B, it is planned that electricity consumption in the optimistic scenario will grow faster due to increased interest in electric cars and electromobility sector, which will replace existing internal combustion engine vehicles. This assumption is based on the support scheme, adopted by the Latvian government for the purchase of electric cars. In addition, the optimistic scenario a faster development of hydrogen, electrolysis and P2X technologies is expected and this will contribute to a faster growth of Latvia's electricity consumption after 2030. In this scenario, in addition to the development rates of electricity generation in scenarios A and B, future power plants are also taken into account, which commissioning, according to the TSO available information, is considered possible, mainly developing of solar and wind power plants, based on the proposals submitted by the relevant associations information and required technical requirements from developers. In this scenario a faster development of wind, solar, biomass and biogas power plants is expected, and RES will be able to replace the capacity of Riga CHP-1 and Riga CHP-2, as a result, a transition from fossil fuels to RES would take place in Latvia. It is assumed that in optimistic scenario, from 2030 Riga CHP-1 and Riga CHP-2 will not be able to compete with RES due to the termination of the state support scheme, therefore they will stop producing electricity and will not participate in covering the peak load. The development of offshore wind farms is moving faster, and TSO assumes that offshore wind farm projects development will be more successfully, according to the state's easiest conditions for the development of offshore wind farm projects. It is assumed that the offshore wind farm project (for example, ELWIND) will be implemented in the planned full scope, i.e. with installed capacity of 1000 MW in Latvia for the year 2033.

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

[3] https://www.eis.gov.lv/EKEIS/Supplier/Procurement/94919

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 Baltic electricity systems will start 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 assumed 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 monthly power adequacy evaluation, is necessary to consider the water inflow on the Daugava HPP. In the conservative scenario (A), the lowest average monthly water inflow in January since 2000 was in 2003 (150 m3/s, which corresponds to 270 MW power to cover the peak hour 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 tables, 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 from 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 Climate and Energy.

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 Climate and Energy.

9) The electricity balance tables in conservative scenario (A) and 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 with hourly values 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 Baltic synchronization 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 (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 provision 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 2023 with the years 2022 and 2021

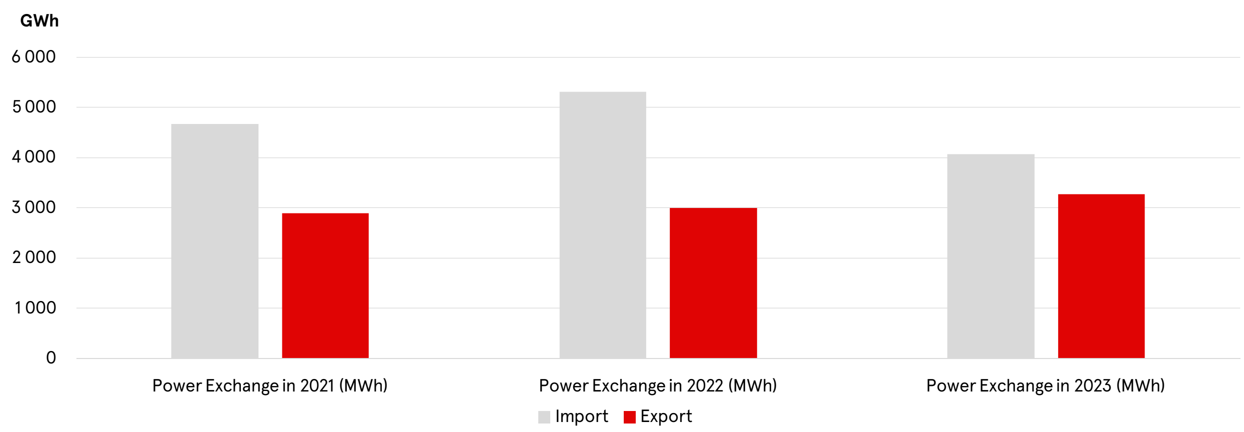


Fig. 5. Cross-border electricity trade amounts

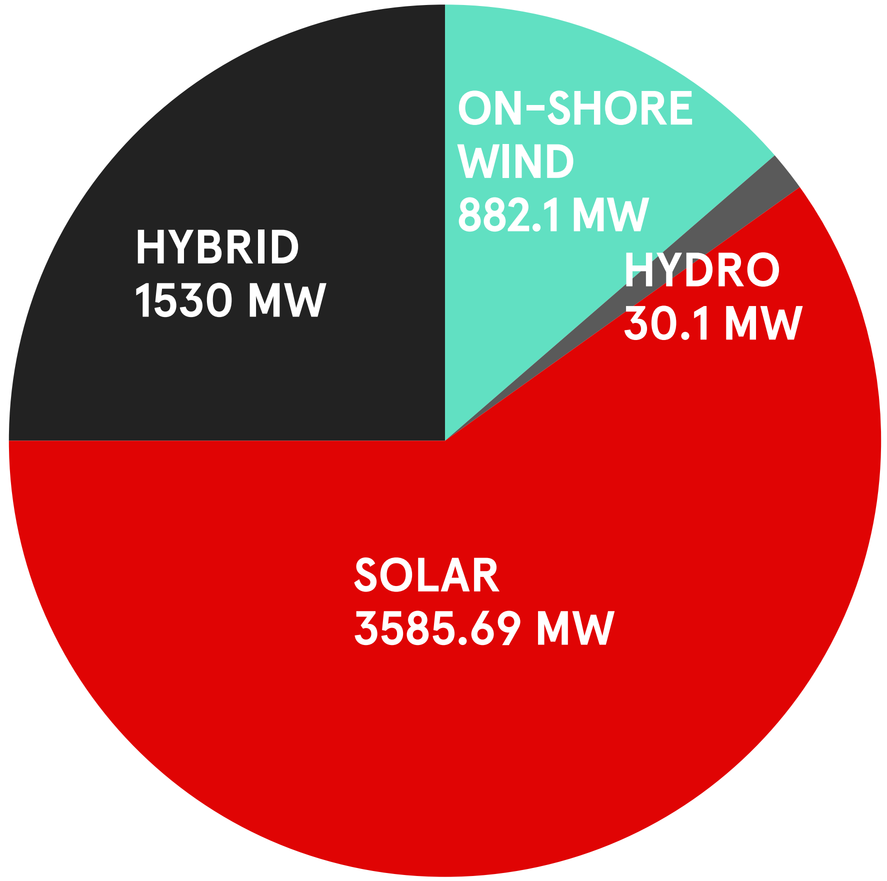
	Electricity trade amounts 2021 (MWh)	Electricity trade amounts 2022 (MWh)	Electricity trade amounts 2023 (MWh)
Import	4 666 370	5 308 232	4 075 231
Export	2 893 735	2 996 705	3 271 037

Table 2

Table 2 shows that the electricity export is increasing during the last three years. In 2021, compared to 2020, exports increased by 4%, while in 2023, compared to 2022, the expert increase was 9%. The amount of electricity import from 2021 to 2023 ranges from 4 to 5.3 TWh. In 2023, the difference between export and import reached 0.8 TWh.

Starting from 2020, the interest of RES power plants developing significantly increased in the territory of Latvia, mainly onshore wind and solar parks, what is reflected in the technical requirements issued by AST for the development of new generating capacities. A dramatic increase of issued technical requirements began in the spring and summer of 2022. With huge interest of the construction of RES power plans and their impact to the transmission system security and stability, on January 12, 2023, with the Public Utilities Commission (hereinafter - PUC) Council decision no. 1 "On the fee for one unit of capacity reservation in the electricity sector" the PUC regulation were approved, which obliged the electricity producer to pay the system operator a fee for capacity reservation in the electricity system within 60 days from the moment of receiving the technical requirements.

Fig. 5. Distribution of RES reserved capacities in the transmission network in Latvia, MW



The goal of the capacity reservation payment is to promote the competitiveness of developers, because in the middle of 2023 the amount of reserved capacity in the transmission network, including made payments, exceeded 6000 MW. Currently, according to the amount of technical requirements issued by AST, the interest for solar parks connections is significantly higher than for wind parks, the proportional distribution of which is shown in figure 5. The interest of hybrid type connections, where the battery energy storage system is connected to the grid in addition to wind or solar generation, also has been significantly increased.

According to the AST available information, the demand for RES generating power connections to the distribution network, is approximately up to 1500 MW, which creates new technological challenges in the electricity system, because in some modes, mainly during the sunny weather, the power flow of the power system from the traditional direction from the transmission network to the distribution network turns in the opposite direction in some modes, i.e. from the distribution network to the transmission network. Both in the transmission network and in the distribution network, the amount for connections of solar power plants is several times higher than amount of wind power plants. This, as mentioned above, is a less efficient solution, but network capacity is reserved equally in both cases.

The optimal RES generation portfolio is than most even distribution of generation on a dayly and annual basis can be provided, since uneven generation distribution results in inefficient use of network capacity. For example, if the grid is dominated by solar generation, then the grid will be efficiently used only during the generation peak moments when the sun is shining, but there are not many such modes, especially in the autumn and winter months, but not at all at night. During the rest of the time, the network will be unloaded. The current legislation requires the reservation of full network capacity for any type of generation connection. This assumption applies both to the entire system as a whole and to individual network elements, such as 330 kV or 110 kV electricity transmission lines.

With an uneven distribution of solar and wind generation, there is more often overproduction that exceeds Latvia's consumption and over energy should be exported to the neighbouring countries, but there is no guarantee that there will not be a similar situation in geographically close countries at specific hours, in which case it will be necessary to restrict the output of electricity producers. Therefore, it is necessary to find solutions for a more even distribution of generation between solar and wind, regardless of the amount of total installed capacity, so that in the future the capacities and functionality of the transmission network are used most efficiently.

Although requests for connection to the transmission network of solar power plants dominate at the moment, AST, together with the Ministry of Climate and Energy, is looking for solutions and ways to stimulate the equalization of the share of solar and wind power plants in the total RES generation portfolio. At the same time, various types of hybrid projects combining solar and wind power plants, BESS, hydrogen or other P2X production plants should be developed. Taking into account, a more optimal generation portfolio would be formed, as well as technologies that could be used for system balancing and provision of power reserve service would be developed.

Assuming that RES capacities will be installed according to information, shown in figure 5, and using historical generation profiles for each type of generation in Latvia, AST found that 75% of the annual time, the total RES production will not exceed 1000 MW, and RES power plants will work at maximum capacity for a short time 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, to guarantee power system security and stability, if necessary, the transmission system operator, who is responsible for the security and stability of the system, will have to curtail over generation capacity. In accordance with the existing legislation, TSO does not have the right to curtail the electricity generation in normal network operation mode.
As already mentioned, currently AST together with Ministry of Climate and Energy, as the ministry responsible for the energy sector and energy policy maker, is working on the development of the most suitable solution to develop the new regulation or changes to the existing regulation in order to connect the largest possible RES amount in Latvia to the transmission network, but at the same time, it would ensure the continuous security and stability of the electricity system, which would allow the TSO to curtail the percentage output of new RES stations during the year without compensation, if it is necessary to reduce transmission system overloads during operating modes. This becomes more and more actual as the total installed capacity of RES power plants increases, which operates according to meteorological conditions and can change radically within a few hours.

The development of new generating capacities and connection to the transmission network is planning by TSO in the long term period and accordingly reserves the transmission network capacities, as a result TSO will be necessary to reinforce the internal transmission network of Latvia, reinforce the existing interconnections and create new ones with the electricity systems of neighbouring countries, stimulate and support the increase of electricity consumption in the region, to provide quick power reserves and to provide the necessary amount of inertia in the electricity system.

In 2024, interest of new hydrogen technologeies development projects with a total capacity of approximately 2000 MW has appeared in Latvia. These projects are planned to be implemented until 2040. Such implementation of new P2X projects will significantly increase the total consumption of the Latvian electricity system, as a result AST will need to prepare a series of reinforcements of the internal transmission network and develop cross-border interconnections to neighbouring countries, which are mentioned in section 5.2. of this report.

4.3. TSO's assessment of the periods where capacities are 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 electricity system security and supply under electricity market conditions, working together with Baltic Sea region countries according to the open electricity market "Nord Pool" principles, ensures the execution of market transactions in the Latvian bidding zone, provides power balance between Latvian consumption and generation , as well as controls and publishes the available cross-border capacities for trade with the neighbouring electricity systems. Since the ammendment of EU legislation with "Fit-for-55" energy package of the European Union (EU), which states that generation development and national power adequacy should be focused on areas with RES potential to stimulate the reduction of CO2 and other greenhouse gas emissions, as well as the development of more efficient, competitive power plants, the base power adequacy within one country is not an unambiguous indicator of the adequacy of generating capacities, but it must be taken into account in combination with the available transmission capacities to/from the country or region.

In normal operating modes of the Latvian electricity transmission system, the cross-border transfer capacity with electricity systems of neighbouring countries is sufficient to ensure the forecasted import or export of electricity. In previous years, there have been no situations where it would have been necessary to disconnect electricity user, part of the system or region in Latvia due to insufficient generating capacity or insufficient cross-border capacity with neighbouring countries. Until now, working synchronously with the IPS/UPS (independent Power System / Unified Power System) 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 operational modes, regardless of the generating units operating in the territory of Latvia.

Analysing the power adequacy for the upcoming years, in the conservative scenario (A) capacity (MW) adequacy analysis table (Annex, Table 2) can be seen that the generating capacities are sufficient to cover the peak load, provide power reserves and meet the system regulation and security requirements for the winter months in the evaluated period from 2024 to 2029. Power deficit from 2030-2034 is in the range of 30-57 MW. Latvia's electricity system is almost self-sufficient and capacity adequacy is between 96-98%. In the conservative scenario (A), a relatively small RES development of Latvia's electricity system is planned, a slow rate of economic growth is expected, and the existing cogeneration power plants Riga CHP-1 (until 2029) and Riga CHP-2 participate in covering of the power balance.

TSO forecast shows that the amount of electricity produced by Riga CHP-2 and Riga CHP -1 is lower than the historical average. Riga CHP-1 (until 2029) and Riga CHP-2 power plants will be in operation to participate in covering the peak load, but the generation of electricity will be relatively small. In the conservative scenario (A), based on generation development trends, the power profit will reach between 7% and 17% by 2029. It is planned that in 2033, 495 MW of the total net capacity of wind power plants could be covered by offshore wind farms, the real development rates of which are currently difficult to predict, taking into account that still no wind power plants have been installed in the territorial waters of the Baltic States. Due to lower development of offshore wind power stations, in the conservative scenario (A) is planned that the development of offshore wind farms could start no earlier than in 2033 (the minimum term for the construction of wind farm with studies and permits is approximately 4-6 years), when the planned offshore wind farm project ELWIND could be partially implemented or instead some other wind farm project with an installed capacity of up to 500 MW.

During evaluated period (2024-2034), power adequacy is close to 100%, which indicates that generating capacities are sufficient to cover electricity consumption. The conservative scenario (A) indicates that in order to ensure the electricity balance in the Latvian electricity 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), the electricity production from Riga CHP-1 and Riga CHP-2 is planned with assumption, that both power plants will work under electricity market principles and, under free competition conditions, and are able to produce only a part of the maximum possible production. From 2030, Riga CHP-1 will no longer be competitive with RES production, so Riga CHP-1 could be closed. From the electricity balance table (Annexes, Table 5) can be seen that the electricity deficit of Latvian electricity system in the conservative scenario (A) ranges from approximately 687 GWh to 2046 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 2033, the electricity deficit could decrease due to the development of offshore wind farms.

In the base scenario (B), the power (MW) adequacy table (Annexes, Table 3) shows that the Latvian electricity system is able to cover the peak load during the evaluated period. The electricity system profit during the evaluating period is between 4% and 27%. 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 gradually start with the year 2033. This assumption is based on the fact that ELWIND or any other offshore wind farm project could be partially realized from 2033, when the installed capacity of the offshore wind farm would reach at least 500 MW.

The electricity balance table (Annexes, Table 6) shows that in the base scenario (B) the supply of electricity will not be sufficient in the period from 2024 to 2032 (89-95%), but after commissioning of ELWIND or another offshore wind farm project in 2033, the provision of electricity will exceed 100%. Until 2033, Latvia will import electricity from the neighbouring electricity systems to ensure the electricity system balance, 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 and Riga CHP-1 work according to the market conditions.

In the optimistic scenario (EU 2030), the capacity (MW) adequacy analysis table (Annexes, Table 4) shows that the Latvian electricity system is able to cover the peak load until 2029 (113% to 124%). After closing of Riga CHP-1 and Riga CHP-2, the electricity deficit from 2030 to 2034 will be from 44% to 55% (903 to 950 MW). In this scenario is assumed that due to the rapid RES development, the Riga CHP-1 and Riga CHP-2 gas power plants will be stopped of operation in 2030, because the RES are capable of replacing them and Latvia will be able to import the electricity from the neighbouring electricity systems. It is essential not to lose/reduce the existing Latvian base load generation (Daugava HPP, Riga CHP-1 and Riga CHP-2). The power surplus until 2029 in Latvia indicates that it is possible to export electricity to the neighbouring electricity systems to help cover the peak loads of the neighbouring countries.

In the optimistic scenario (EU 2030), it is assumed that the development of offshore wind farms could gradually start from 2033 and the capacity of offshore wind farms could reach 1000 MW - ELWIND offshore wind farm project with a installed capacity of up to 1000 MW. The electricity balance table (Annexes, Table 7) that in the optimistic scenario (EU 2030) the adequacy of electricity will be sufficient from 2024 to 2029 (165-166%). In the optimistic scenario (EU2030), it is assumed that Riga CHP-1 and Riga CHP-2 will no longer be competitive with RES capacities in the region from 2030, therefore these stations need to be closed or reconstructed to utilise some other renewable energy resource (for example, hydrogen).

In the optimistic EU2030 scenario, it is assumed that the development of gas power plants is not based on the 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 plants. In the optimistic scenario (EU2030), increasing the share of onshore wind power plants in the Latvian electricity system even more rapidly, the need for a regulation reserve will increase. The cross-border transmission capacity will be sufficient to export and import electricity from/to the neighbouring countries.

The total reserve of the Latvian electricity system is not included in the analysis of the winter peak load coverage for the 24h period shows,. The development of solar and wind power plants of 24h power adequacy evaluation is modelled based on the ENTSO-E (PECD 4.1 – Pan European Climate Database) climatic time series for three-year time intervals (2019-2021). In the conservative scenario (A), it can be concluded that by 2034, the Latvian electricity system will be able to cover the daily load s, and there will be no need to import electricity to cover the daily peak load (Annexes, Tables 8-10). In the base scenario (B), the Latvian TSO will be able to fully cover the peak daily load from 2024 to 2034 (Annexes, Tables 11-13).

The daily load schedule can be covered by 100%, if required power reserves is not included in the above-mentioned tables, as it is currently not known exactly which stations will participate in the capacity reserve market and offer the reserve service. In the base scenario (B), if necessary, electricity export to neighbouring power systems will be possible to help neighbours to cover peak load during the winter months, as interconnectors allow export/import of over electricity. In the optimistic scenario (EU 2030), the Latvian TSO will be able to fully cover the daily load both in 2024 (Annexes, Table 14) and in 2029

(Annexes, Table 15), but in 2034 (Annexes, Table 16), if Riga CHP-1 and Riga CHP-2 are closed, there will be a large electricity deficit during the day. Such scenario shows that with the development of RES and offshore wind farms, it is necessary to keep flexible gas power plants in operation, which are able to maintain the power balance in Latvia and cover the load in those hours when solar and wind power plants do not produce electricity or produce it with limited amount. The main influencing factors for covering the winter peak load are the water inflow to the Daugava HPP and the development characteristics of wind and solar power plants.

To cover the summer daily minimum load in the conservative scenario (A), Riga CHP-1 is stopped in 2024 (Annexes, Table 17), and the power balance is basically provided by RES – biomass and biogas, wind power plants, Daugava HPP, small HPPs, solar power plants and distributed natural gas cogeneration power plants, and regulation of the electricity system is performed by Riga CHP-2. The minimum production of Riga CHP-2 has been 170 MW, for provision of power adequacy during the whole day. In the conservative scenario (A) in 2029, 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 is regulated (Anexxes, Table 18). The minimum production of Riga CHP-2 is 170 MW, for provision of power adequacy during the whole day.

In such scenario, the electricity export to the neighbouring electricity systems is planned from 06:00 to 12:00 and will range from 5 MW to 124 MW. In 2034, the base load power plant Riga CHP-1 is stopped of operation and the power balance is provided by RES, as well as system is balanced by Riga CHP-2. The minimum production of Riga CHP-2 is the minimum production of one block of 170 MW. The Latvian electricity system will export 2017 MWh of electricity per day (Annexes, Table 19). For daily minimum load coverage in the base scenario (B) in 2024, Riga CHP-1 has been stopped (Annexes, Table 20), and the power balance is basically provided by RES – biomass and biogas, wind power plants, Daugava HPP, small HPP, solar power plants , and small natural gas cogeneration stations, and regulation is provided by Riga CHP-2. The minimum production of Riga CHP-2 is assumed to be 170 MW. Electricity export to the neighbouring countries is not planned.

In the base scenario (B), in 2029, 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 is regulated (Annexes, Table 21). The minimum production of Riga CHP-2 will be 170 MW, for provision of power adequacy during the whole day.

The electricity export to the neighbouring electricity systems ranges from 18 MW to 252 MW, the total amount of electricity is 2143 MWh. In 2034 (Annexes, Table 22), the base load power plants will not change, only, due to the increase of RES production, the power balance can basically be provided by RES, but Riga CHP-2 is in operation as base load generation with a constant development of 170 MW. In 2034, electricity exports will increase from 23 MW to 582 MW, and totally 5058 MWh of electricity will be exported during the year.

Daily minimum load coverage in the optimistic scenario (EU 2030), when the fastest development and use of RES is planned, the daily power balance in 2024 is provided by RES – biomass and biogas, wind power plants, Daugava HPP, small HPP, solar power plants, and small natural gas cogeneration plants, and Riga CHP-2 works with a minimum power of 170 MW as base load generation (Annexes, Table 23). Power export is approximately 17-19 MW, relatively unimportant. In the optimistic scenario (EU2030) in 2029, 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 works as base load generation with minimal production 170 MW (Annexes, table 24). electricity export is from 84-506 MW, total daily exported electricity is 4828 MWh. In 2034, the base load power plants will not change (Annexes, Table 25), it will be RES power plants, but due to high gas and CO2 prices, the gas power plants Riga CHP-1 and Riga CHP-2 will be closed, as a result the Latvian electricity system will be able to cover load in the summer period during whole day, and additionally the Latvian electricity system will export 4828 MWh of electricity. Electricity export range will be from 14-807 MW. Power export is planned during the day, when electricity is produced by solar power plants.

By increasing the RES production, problems arise with covering the daily minimum and maximum load. At the minimum load, it is necessary to keep the high-speed gas stations in operation (minimum power output) to ensure the regulation service to the electricity system, which then ensures the coverage of the daily peak load on the evening hours (no solar and wind energy). In this way, in order to ensure the security, stability and provision of the electricity balance of the system, at minimum load, it is necessary to export the electricity produced by the RES to the neighbouring electricity systems, but during the peak load, RES capacity is insufficient and it is necessary to additionally keep in operation high-speed regulated gas-fired power stations to ensure the regulation service.

Month	Maximum required power reserve	Available power reserve	
		in Latvia	inter TSO agreement for up to 12 hours
	MW	MW	MW
January	442	100	342
February	442	100	342
March	442	100	342
April	442	100	342
May	442	100	342
June	442	100	342
July	442	100	342
August	442	100	342
September	442	100	342
October	442	100	342
November	442	100	342
December	442	100	342

Table 3

With the RES development, there is a bigger need for a rapidly adjustable power reserve that is able to regulate the power balance according to the system daily needs. To provide a quickly adjustable power reserve, TSO can buy service from already existing power plants in Latvia, from electricity producers in neighbouring countries, or to provide the mentioned service with installed Battery Energy Storage Systems (BESS), for which, a decision No. 674 of the Cabinet of Ministers of Latvia [4] has been made on September 24, 2021. BESS will be installed in 330/110 kV substations in Rēzekne and Tume. Information about the required and available power reserves (MW) in 2023 is given in Table 3.

[4] https://www.vestnesis.lv/op/2021/187.3

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 (Annexes, Table 2), it can be seen that in 2024, in the conservative scenario (A), power self-sufficiency of the Latvian electricity system will reach approximately 107-117% from 2024 to 2029, but from 2030 to 2034, power self-sufficiency will be between 96% and 98% and a power deficit is expected. Self-sufficiency in electricity from 75-92% (Annexes, Table 5). In the conservative scenario (A), the deficit of generating capacities is expetcted after 2029, if Riga CHP-1 with a capacity 158 MW is closed. In this scenario, it is not planned to close the high-power gas power plants in Riga until 2029. In the base scenario (B), provision with power above 100% will be from 2024 to 2034 (Annexes, Table 3). In the base scenario (B), the generating capacities are sufficient throughout the evaluation period. In the base scenario (B), provision of electricity from 2024 to 2034 will be between 74% and 94% (Annexes, Table 6).

The missing amount of electricity will be imported through interconnections from the neighbouring electricity systems. In the optimistic scenario (EU 2030), which focused on favorable economic conditions in the development of RES generation, it is indicated that power self-sufficiency until 2029 ranges from 113% to 124%, but after the closure of Riga CHP-1 and Riga CHP-2 from 2030, a significant power deficit appears. From 2030 to 2034, self-sufficiency with power in Latvia is between 45% and 56% (Annex, Table 4). In the optimistic scenario (EU2030), assuming the closure of Riga CHP-1 and Riga CHP-2, a significant power deficit is expected in Latvia, which is approximately up to 1000 MW.

After the implementation of the ELWIND project in 2033, the electricity balance for Latvia will be approximately 76%. The amount of electricity produced from 2024 to 2029 will be 166%, which indicates that the Latvian electricity system will be able to cover the balance of electricity consumption in the considered time interval and will help cover the electricity balances of neighbouring countries (Annexes, Table 7).

In the case of maximum delectricity production, the Latvian electricity system will be able to export electricity to the neighbouring electricity systems. Electricity deficit in the Latvian electricity system is expected from 2030 to 2034, approximately 27-46% due to the closure of the Riga gas fired power plants.

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

The development and commissioning of new fossil-fuel base load power plants in Latvia is not planned until 2034 and, according to the AST available information, no decisions have been made regarding the implementation of big power plant projects in the Baltic States. At the same time, the Ministry of Economics of Republic of Latvia and the Ministry of Climate and Energy of Republic of Latvia, providing information on potential big load power plant projects in Latvia, indicate that the renewed National Energy and Climate Plan (NECP) sets goals for the development of wind energy until 2030, with plans to develop at least 800 MW of installed wind energy capacities in Latvia.

Currently, as already mentioned, there is a huge interest by RES developers in Latvia for connections to the transmission network, which requires TSO plan the reinforcement, modernization and development of the transmission network. The amount of technical requirements issued by AST for connections to the transmission network is more than 6 GW, which is approximately five times more than existing peak load of the Latvian electricity system. Therefore, TSO is also planning the development of own transmission network in order to export the surplus electricity produced by RES to the neighbouring countries. Taking into account mentioned above and based on the memorandum of understanding signed jointly by the governments of Estonia and Latvia on September 18, 2020 on the development of a joint wind park project in the Baltic Sea, as well as information in the maritime spatial planning documents of the Latvia and Estonia, Latvia and Estonia continue to work on joint Latvian-Estonian offshore wind par development in the Baltic Sea.

The jointly developed offshore wind farm project – ELWIND is planned as a hybrid type project, building both the offshore wind farm itself and the transmission infrastructure together with the interconnection between Estonia and Latvia. The developer of the ELWIND project in Estonia is the investment centre KIK together with the Estonian Ministry of Economics and Communications, while the project developer in Latvia is the Latvian Investment and Development Agency (hereinafter - LIAA) together with the Ministry of

Economics of Republic of Latvia. Taking into account the technological development of offshore wind farms, it is planned that the installed capacity of the Estonian-Latvian joint wind farm could reach up to 2000 MW (1000 MW in Latvia and 1000 MW in Estonia). Latvian and Estonian transmission system operators AS "Augstsprieguma tīkls" and AS "Elering" respectively are currently involved in the project as observers and are planning to be involved in the project in case the state decides that TSOs are responsible for the construction of the infrastructure connection to the transmission network in each country. AST, together with Elering, continues to work on the development of the fourth Latvian-Estonian interconnection, which is planned to be built in the Baltic Sea in order to increase the transmission trade capacity between Latvia and Estonia.

The ELWIND project is included in the Pan European Ten Years Network Development Plan (TYNDP) together with infrastructure development and is included in the list of European Projects of Common Interest (PCI), which will allow the project to apply for European Union co-financing from CEF-Energy RES (The Connecting Europe Facility of Energy of Renewable Energy Source) structural funds for wind park support, as well as from CEF-Energy structural funds for the construction of cross-border transmission infrastructure. The auction of wind park project for the potential investors is planned for 2026-2027, and the implementation of the project itself together with the construction of the infrastructure is planned until 2033-2035. In connection with the implementation of ELWIND or another offshore wind farm project, strengthening of Latvia's internal and external transmission network is necessary, incl. reconstruction of the existing interconnection Grobiņa (LV) - Darbenai (LT) between Latvia and Lithuania, construction of the new internal transmission line Ventspils - Brocēni and construction of a new interconnection between Latvia and Lithuania "Brocēni - Varduva". It is planned that the existing electricity transmission infrastructure will also stimulate the construction of other wind farms in the region, as the network infrastructure for the common park would enable other potential wind farms to be connected in the same region.

Taking into account the potential of Latvian offshore wind, which is estimated at ~15 GW, it is important to develop interconnections to the electricity systems of neighbouring countries in the development of high-capacity offshore wind parks in order to meet the European Union goal of integrating the electricity market and ensuring the security and stability of the system, as well as contribute the use of RES in the region. Therefore, Latvia needs to develop interconnections not only with the Baltic States, but also with other European Union countries.

Latvia continues to develop the direct current (HVDC – High Voltage Direct Current) interconnection construction project with Sweden. The expected implementation time of the project is until 2040. The Latvian-Swedish 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 context of the Baltic synchronization with the electricity system of continental Europe, as well as the growing amount of RES. Taking into account the planned increase in electricity consumption, the development of the electricity market, as well as the provision of n-1 reliability criteria, the reinforcement of the transmission network and the development of new interconnections between the Baltic Sea region countries are necessary in the long term. Latvia currently, in compare with other Baltic States, is only one without electrical interconnections with the Nordic countries or the electricity system of continental Europe. As one of the possible development options to the countries of the European Union, there is the Latvian-Swedish interconnection option, in the form of a submarine HVDC cable. Currently, the interconnection is named LaSGo (Latvia – Sweden – Gotland) project in Latvian development documents, taking into account the geographical location. Currently, AST, together with the Ministry of Climate and Energy, which is responsible for the energy sector in Latvia, is working on the further development of the project's vision 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 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 strengthening of Sweden's internal transmission network priorities, for which SvK has been allocated the appropriate State funds.

For now, the development of offshore wind farms around the island of Gotland in Sweden and the Kurzeme coast in Latvia is planned in a radial solution, 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-type transmission interconnection in the sea between Latvia and Sweden. This project could be supported by Latvia and Sweden, and it is in accordance with the goals of the 2024 ENTSO-E offshore grid development plan and the planned Baltic Offshore Grid Initiative (BOGI), which is currently in the initial stage of development among TSOs of the Baltic

Sea region. The transmission capacity of the interconnection between Latvia and Sweden is planned to be up to 700 MW. The project has opportunity to receive EU co-financing both for implementation and for studies, as well as for the development of a costs benefit analysis. In December 2023, AST initiated detailed study of the project technical and economical possibilities for the Baltic Sea region. The study currently is in progress and is planned to be completed in 2024.

Taking into account the dramatic growth of RES in the Baltic States and the possibility of produced electricity to deficit countries, on May 9, 2023, the TSOs of the Baltic States (Elering, AST and Litgrid) signed a letter of intent with the German TSO 50Hertz on the development of electricity transmission interconnection in the Baltic Sea between the Baltic States and Germany in order to strengthen mutual cooperation and take joint steps towards the energy independence of the EU member states. The project is named "Baltic Wind Connector". The implementation of the electricity transmission interconnection "Baltic Wind Connector" foresees the construction of a transmission cable up to 800 km long in the Baltic Sea between Germany and Estonia or Latvia, which will ensure the possibility of connecting high-power 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. Currently, the development of the project is only at the beginning development stage.
In the initial development stage of the project, it is planned to carry out a joint technical and economic analysis. The "Baltic Wind Connector" interconnection from Estonia to Germany, with Latvia joining the interconnection, will be an important transmission infrastructure object for the whole Baltic Sea region, which is in the context of the already mentioned European Offshore Network Development Plan and the Baltic Offshore Grid Initiative. Negotiations between Baltic States and German TSOs are currently on-going on the design development and technical execution of the project.

In the synchronous operation mode of the Baltic States with the continental Europe, where the synchronous connection of the Baltic States will be provided through the Polish-Lithuanian High Voltage Alternative Current (HVAC) interconnection, additional trade capacities could be provided with high-voltage direct current (HVDC) or HVAC interconnections with continental Europe, incl. Poland and Germany. The development of the project would be important in the context of the increasing share of RES in the whole Baltic Sea region, including planned increase of electricity consumption, the development of the electricity market, as well as provision of n-1 security criterion in all system operating modes. In the long term prospective, it will be necessary to reinforce the transmission network and develop new interconnections between the Baltic Sea region countries, promoting the common goals of the European Union for a unified and integrated electricity system.

Estonia, Lithuania and the other countries of the Baltic Sea region also plan to develop large offshore wind farm projects until 2030-2035, as well as a big development trend of offshore wind farms can be observed in the next decade. Based on this, the TSOs of the Baltic Sea region countries, including AST, continue work on the development of the Baltic Sea region offshore transmission infrastructure (Baltic offshore grid initiative – BOGI), contributing the development of offshore wind farms. The goal of the BOGI initiative is to develop common planning principles for the Baltic Sea electricity network, as well as to prepare the study that will create a common vision for the development and creation of the transmission network in the Baltic Sea and allow it to be included in the Pan European TYNDP and in other European and national planning and development documents. The goals and tasks set by BOGI group in the future also envisage closer cooperation with the state institutions responsible for energy, for the implementation of development projects.

The cooperation between TSOs of the Baltic Sea region was started in compliance with the declaration signed by the Baltic Sea countries in the European Union on September 30, 2020, which requires the participating parties to jointly plan sea areas where offshore wind farms could be located, allowing the maximum use of wind energy potential. European development documents note that the Baltic Sea region has significant potential to achieve green energy policy goals with construction of offshore wind farms and using existing and potential Baltic Sea grid interconnections. The development of the offshore transmission network will also require many radials, not only interconnections, to connect wind farms to the transmission network.

According to a study carried out by the Baltic Energy Market and Infrastructure Plan (BEMIP), the wind potential of offshore wind capacity in 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 electricity TSOs of the

Baltic Sea region: Finland – Fingrid, Sweden – Svenska Kraftnät, Denmark – Energinet, Germany – 50 Hertz, Estonia – Elering, Latvia – Augtsprieguma tīkls, Lithuania – Litgrid. The Polish TSO "PSE", and Norwegian TSO "Statnett" are participating in the initiative as observers. Potential development projects in Latvia, i.e. the LaSGo project, the Fourth Estonia-Latvia interconnection, Baltic Wind Connector project, as well as other potential long-term projects of the Baltic Sea region (Fig. 6) have been identified as part of the BOGI initiative. Some projects could be implemented in a joint solution, therefore, more detailed technical-economic solutions of the projects should be studied in the near future.

As part of BOGI initiative, the Baltic Sea region TSOs in June 2024 signed a joint letter to the representatives of the Baltic Sea region ministries, in which they emphasized cooperation in the development of offshore infrastructure and indicated the next steps for the successful development of offshore wind. The TSOs agreed to coordinate the development of offshore infrastructure and promote the achievement of the goals set by the member states, showing the TSOs unity and willingness to cooperate and moving towards the decarbonization of the European Union and reduce dependence on electricity import.

The EU has approved a strategy document Clean Energy Package (COM/2015/080) [5], which foresees the production of a certain amount of electricity from RES until 2030 and targets for 2050. As a result, cooperation between TSOs of neighbouring countries is necessary to ensure efficient and cost-effective development of the transmission network with establishment of the connection points. The EU member states have developed their National Energy and Climate Plans [6], which expect the long-term development of wind energy production, therefore the cooperation should be started immediately. The aim of the initiative is to simultaneously contribute the construction of interconnections, which will provide the transmission of electricity produced by wind power plants to consumption centres and the construction of new interconnections. The aim of the Baltic Sea region offshore wind farm initiative is to exchange of 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,

[5] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2015:80:FIN
[6] https://www.kem.gov.lv/lv/nacionalais-energetikas-un-klimata-plans-2021-2030-gadam

to include projects in European and national ten years network development plans and to prepare studies that promotes the development of wind farms in the Baltic Sea. The development of offshore wind farms and the development of the transmission network must be economically viable, profitable and based on market-oriented solutions.

In January 2024, in accordance to European legislation, ENTSO-E approved the Offshore Network Development Plan (ONDP), prepared by the European TSO, where the development goals and trends of offshore wind farms of all European member states are taken into account. The ONDP is focused on the development of the offshore infrastructure of the member states, which will be further developed, evaluated and considered in the transmission network long-term planning. The ONDP plan will include BOGI projects from the Baltic Sea Region Development Plan. The ONDP is developed every two years, similarly as TYNDP for the development of the European transmission network, but in future it will be included in the Pan European TYNDP, and the development of onshore and offshore infrastructure will be coordinated jointly under Pan European TYNDP document.

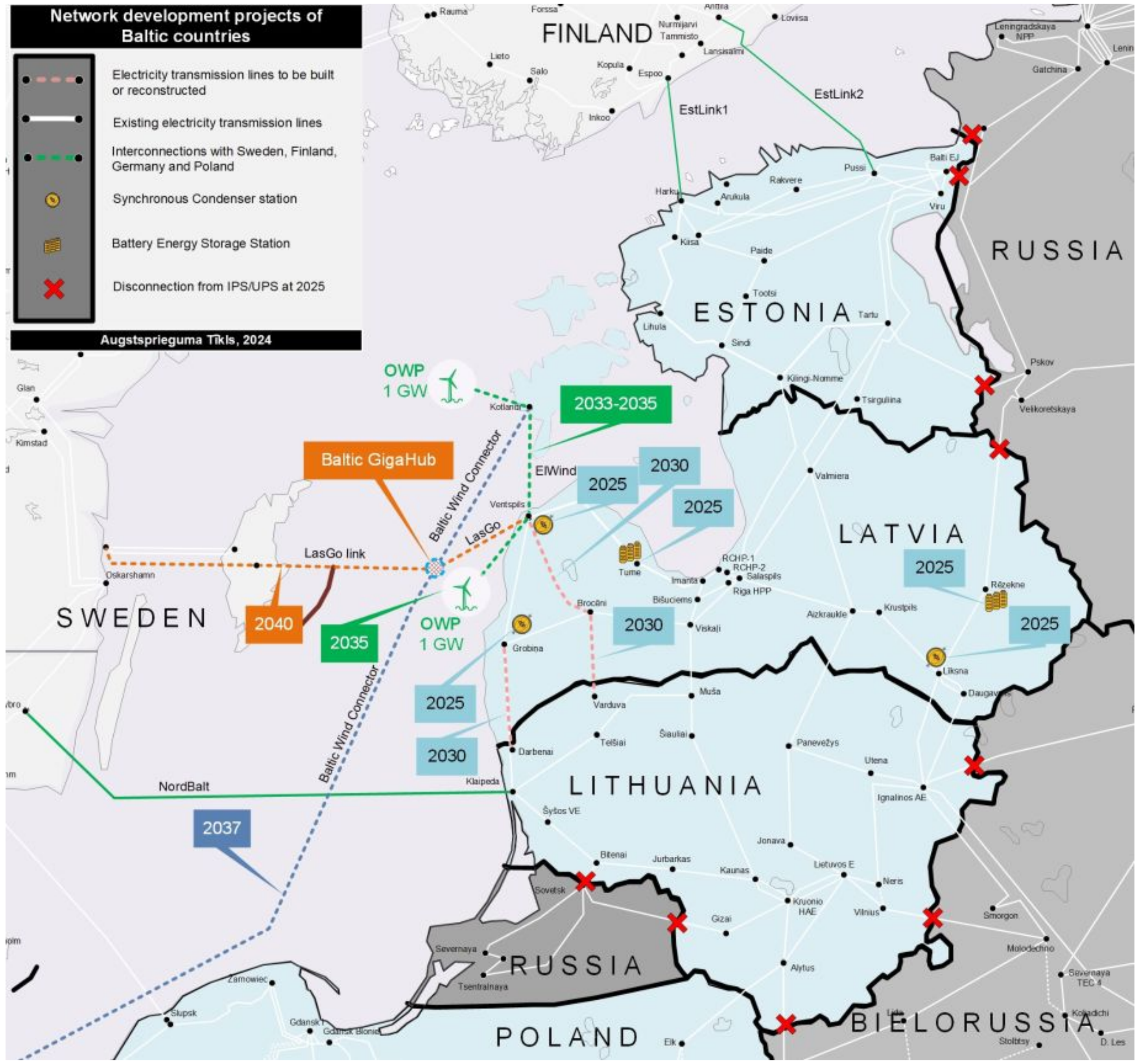


Fig. 6. The common development projects of transmission network of the Baltic Sea Region

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

In 2023, the adequacy of electricity generation capacities at the regional level was evaluated by the ENTSO-E, and AST, as a full member of the association and the responsible state institution for power adequacy, participated in the preparation of a report by submitting input data of Latvian electricity system.

The European Resource Adequacy Assessment 2023 (ERAA 2023) report is prepared with market modelling in one common market model for 39 countries. The assessment was done for four target years: 2025, 2028, 2030 and 2033. The evaluation of ERAA power adequacy is divided into two stages, in which the Monte Carlo mathematical analysis method is applied to the analysis. First of all, Economic Viability Assessment (EVA) is evaluated, solving the problem of optimal long-term planning. In the second stage, the power adequacy situation is evaluated for 30 different scenarios of climate years for the four target years mentioned above, to more successfully identify scenarios when non delivered electricity to consumers could occur. The full European Resource Adequacy Assessment report is available on the ENTSO-E website [7].

ERAA 2023 showed that with the developed scenarios and applied methodology, a large amount of fossil fuel power plants could become economically unprofitable during the next five years. In context of power adequacy, neighbouring countries are dependent on each other, and additional installed capacity can help not only the country in which it is installed, but also the neighbouring country. Coming next ten years, the installed RES capacity in Europe will increase, while the number of fossil fuel power plants will decrease, which will lead to a much bigger need for flexible power solutions to balance the electricity system.

[7] https://www.entsoe.eu/outlooks/eraa/2023/eraa-downloads/

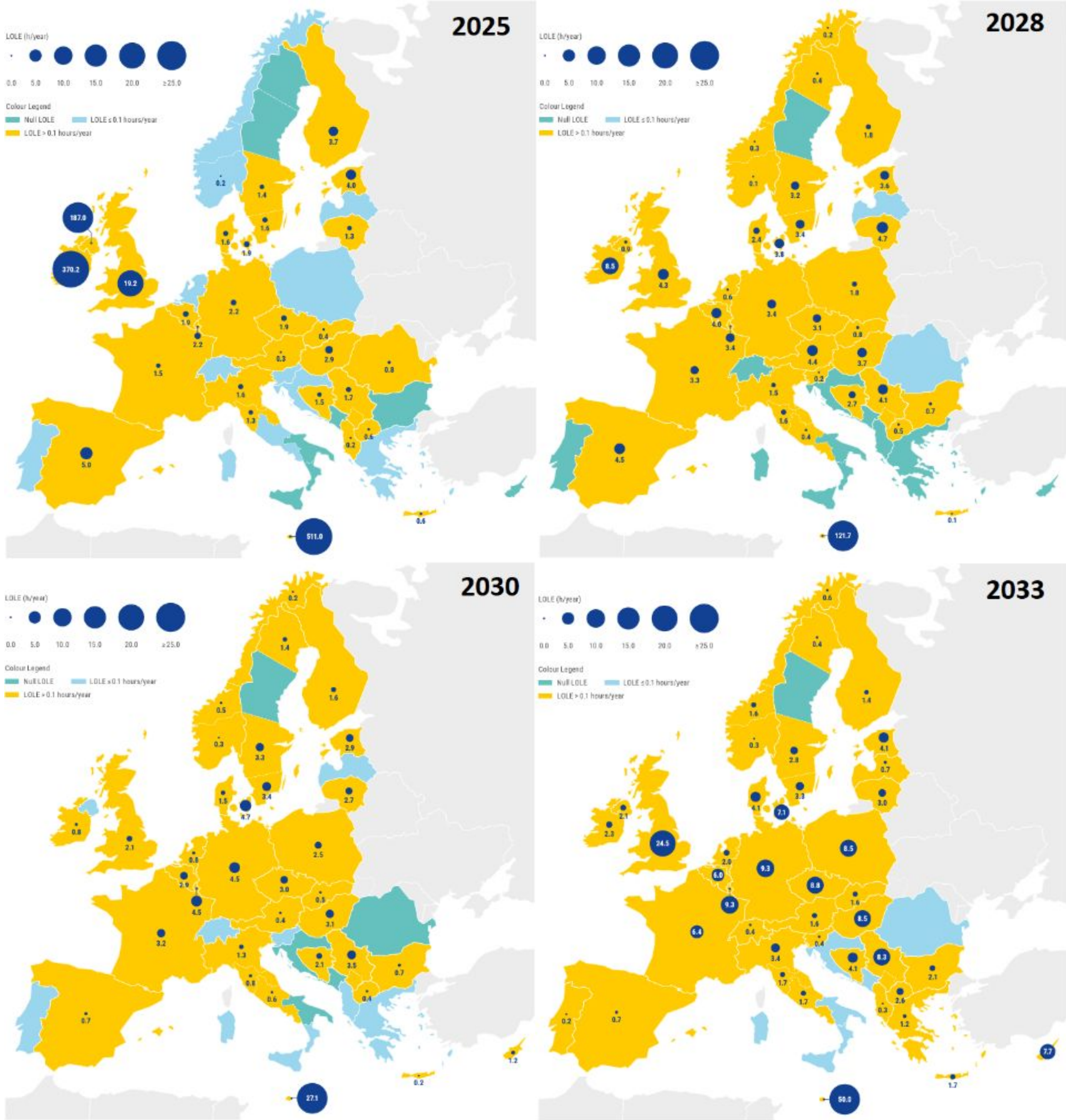


Fig. 7 LOLE values for 2025, 2028 and 2033

The results of the Economic Viability Assessment (EVA) showed that a significant amount of fossil fuel power plants, approximately 50 GW, in Europe are at risk of decommissioning due to economic reasons. Meanwhile, in the later target years 2030 and 2033, the system needs additional new regulated generation, for instance closed-cycle gas turbines or high-capacity BESS. The results for Latvian power system showed that 90 MW of natural gas power plant capacity could be at risk starting in 2025. In Estonia, such risk affects the 420 MW capacity of oil shale power plants.

In Lithuania, no scenarios were identified where operation of power plants would be threatened, as Lithuania has a relatively large deficit of generating capacities. EVA is a long-term economical assessment, which results show the amount of installed capacity of power plants that becomes unprofitable and is not capable of long-term existence in the preliminary economic conditions. The EVA analysis did not identify the need for new technologies in the Baltic States in any year.

Power adequacy is characterized by the LOLE (Loss of Load Expectation) value, which is calculated for each bidding zone. It is characterized by the expected number of insufficient electricity generation and capacity shortage hours. The LOLE value allowed in the European Union guidelines may vary depending on the country and is in the range of 3-9 hours/year. The allowed value for Latvia is 3 hours/year, while in Estonia and Lithuania it is higher, 9 and 8 hours/year, respectively, which is based on internal state studies (see Fig. 7). The images show that the possibility of LOLE in Latvia is only in the scenario 2033 with amounts 0.7 hours per year, which corresponds to the guidelines of the European Union. In Estonia, in 2025, the LOLE value is 4 hours per year, which is related to the reduction of the 420 MW power plants capacity. In the following target years, the LOLE value decreases, however, it increases till 4.1 hours per year in 2033. The Lithuanian LOLE value ranges from 1.3 to 4.7 hours. The highest value is in 2028, later it decreases, as the number of RES power plants increases.

The deficit of power adequacy in one country also affects the power balance of neighbouring countries, therefore, in the case of a large deficit in Lithuania and Estonia, the Latvian electricity system will also be affected, and this may create risks of unsupplied electricity. To reduce the power deficit and meet the goals of Lithuania's national climate plan, Lithuania plans to develop onshore and offshore wind farms, which could reach up to 7 GW in the next 10 years. From the ENTSO-E ERAA 2023 study, it can be concluded that Latvia's generation capacity at the regional level is sufficient in 2025, 2028, and 2030, but a very small and insignificant capacity deficit is expected in 2033.

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)

Co-funded by the European Union

Currently, the top priority project in Latvia and in Baltic States is the Baltic synchronization with continental Europe and desynchronization from the IPS/UPS system of Russia. The Baltic States plan is to synchronize with continental Europe in February 2025. The synchronization project is divided into 2 phases, where the first phase is related to the reinforcement of Baltic transmission network and the increase of management and control systems, whereas the second phase is related to the construction of additional Baltic-European interconnection and the construction of infrastructure that would provide the reliable and stable operation of the Baltic States in the synchronization mode with continental Europe. Within the framework of the first phase of synchronization project, the reinforcement of the internal Baltic transmission network continues, due to which the cross-border transmission capacity between Latvia and Estonia is still reduced in various modes of the transmission networks of the Baltic countries. The capacity reduction is expected to be eliminated by the end of 2024. Considering the load of the interconnections between Baltic States and 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 could be limited with possible power flow limitation.

The third electricity interconnection between Estonia and Latvia was put into operation in March 2021, which significantly increased transmission capacity on the Estonian-Latvian cross border. The 330 kV interconnection between Valmiera (Latvia) and Tartu (Estonia) was finalised and commissioned in November 2024 after recontruction. The 330kV Latvian-Estonian interconnection Valmiera (Latvia) – Tsirguliina (Estonia) was reconstructed and energised in June 2024, and commissioning is planned by the end of 2024, after receiving the commissioning act from State Construction Bureau. The transmission capacity of the Latvian-Estonian cross-border will be fully increased by the end of 2024, when the reconstruction of the internal Estonian 330kV transmission line Tsirguliina-Viru will be completed and the restrictions will be much lower than until 2021. In the future, the situation may be affected by the load for connections from RES producers, which will additionally affect the reinforcement of the cross-border between Estonia and Latvia.

The electricity transmission capacity for trade in the Latvian-Lithuanian cross border is currently sufficient and does not cause additional problems for electricity transmission in normal operating modes, except the case of the planned development of ELWIND offshore wind farm, when the cross-border capacity reinforcement is necessary in order to be able to transfer the electricity produced by RES to consumers in Latvia and Lithuania. In order to clarify the need for reinforcement of the Latvian-Lithuania cross-border, AST and Litgrid performed a technical analysis with network and market modelling of both electricity systems at the end of 2023 and found that the priority directions for strengthening the network are the reconstruction of the interconnection Grobiņa-Darbenai and the construction of a new interconnection Brocēni-Varduva.

Due to the desynchronization from the IPS/UPS system, further development of the interconnections between Latvia and Russia are not planned, and currently all electricity trade transactions with Russia have been stopped.

After synchronization with continental Europe, the Russian - Latvian 330 kV interconnection Rēzekne - Velikoreckaya will be disconnected. Taking into account the geopolitical situation in the world, desynchronization of the Baltic States from BRELL and synchronization with continental Europe will take place in February 2025, which was agreed on August 1, 2023 by the TSOs of the Baltic States by signing a cooperation agreement, and on August 3, 2023, decided by Latvian, Lithuanian and Estonian Prime Ministers, with signining a joint declaration on accelerated Baltic power systems synchronization with the continental 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-funded by
the European Union

Very active works are ongoing with the Baltic electricity systems synchronization project with continental Europe and desynchronization from IPS/UPS system of Russia. The synchronisation projects are implementing with European co-financing and financially supported from the Connecting European Facility (CEF) fund. The synchronization project is implementing in two phases, where the first phase is related to the activities of internal Baltic transmission network reinforcement, while the synchronisation second phase activities are related to the construction of the additional Baltic-Europe interconnection "Harmony link" between Lithuania and Poland, as well as other activities related to the security and stability of the electricity system of the Baltic States and for providing frequency control in the system.

The planned completion date of both phases is end of 2025. Due to the decision to start synchronization/desynchronization in February 2025, most of the critically important projects in the Baltic States will be implemented by February 2025 (see Fig. 8) and rest till end of 2025. The exception is the Lithuanian-Polish interconnection, where due to the significant increase of project costs and uncertain HVDC technologies construction times, the best technical-economic solution of the interconnection construction is under consideration, what will extend the project implementation period. Currently, TSOs of the Baltic States and Poland, together with an energy consultant from the Gdańsk Energy Institute of Poland, are preparing the dynamic stability and technical performance study for the selection of the most suitable Harmony link solution.

Fig. 8. Baltic synchronisation projects.

Under synchronization project first phase, which is currently is in final stage, the internal reinforcement of the Baltic transmission network is ongoing, including the installation of equipment that will ensure the necessary amount of inertia and frequency regulation during synchronization mode with continental Europe. Under synchronisation first phase, the reconstruction of the two existing Estonian-Latvian interconnections Valmiera-Tartu and Valmiera-Tsirguliina, the installation of one synchronous condenser, as well as the modernization and installation of power control and automation is implementing in Latvia - activities identified in the catalogue of technical requirements, issued by ENTSO-E. All Baltic synchronisation phase 1 investments received 75% EU co-financing, based on that on March 19, 2019, a Grant Agreement between TSOs of Baltic States and the European Innovation and Network Executive Agency was signed on the conditions for using the allocated co-financing.

The reconstruction of the existing 330 kV interconnection Valmiera (LV) – Tsirguliina (EE), despite the geopolitical situation in the world and the increase of prices in all energy sectors, was completed in May 2024, and on June 13, 2024 the interconnection was officially opened (see Fig. 9).

Fig. 9. Official opening of Valmiera – Tsirguliina interconnection.

The interconnection official commissioning in Latvia is planned until the end of 2024. By the end of 2024, as part of the synchronization phase 1 project, the Estonian TSO also plans to reconstruct internal transmission line Viru - Tsirguliina, which will provide the planned transmission capacity of the Estonian - Latvian cross-border after reconstruction and which is one of the preconditions for the Baltic States synchronization in February 2025. The reconstruction of the Valmiera (LV) – Tartu (EE) interconnection was completed in May 2023 and commissioned in November 2023. Both projects are included in the list of EU projects of common interest under Baltic synchronization project, and both projects are included in all national and European development documents.

As part of the synchronization phase 1 project, power system management and remote control systems were upgraded by installing power control and management equipment (PMU – Phasor Measurement Units and WAMS – Wide Area Monitoring System) in all the most important nodes, as well as by installing frequency control and network remote control equipment. The installation of the PMU and WAMS, as equipment critical for synchronization, has been completed and commissioned in 2022, while the deadline for the implementation of the other mentioned measures is until the end of 2025.

In addition to frequency control measures, for the stable power system operation in synchronization mode, Baltic TSOs 24/7 must jointly provide a sufficient amount of system inertia (17,100 MW/s for Baltic system). Therefore, as part of the synchronization phase 1 project, the installation of one 200 MVA synchronous condenser in Ventspils substation is planned for provision of system inertia, based on what the contract with constructor EM&SE Syncons for supply and installation of synchronous condenser was signed on October 5, 2022. The installation of the synchronous condenser in the Ventspils substation is ongoing according to the planned schedule. The synchronous condenser was manufactured, the necessary factory tests of the equipment have been done and synchronous condensed is delivered to the Ventspils substation in August 2024. The substation extension works are ongoing, and the installation of the synchronous condenser together with the substation expansion is planned to be completed in June 2025.

As part of the Baltic synchronization phase 2 project, the construction of a new interconnection between Poland and Lithuania (Harmony link), the construction of necessary infrastructure for connecting the interconnection to the transmission network, the reinforcement of the transmission network in Lithuania and Poland, the installation of six synchronous condensers in the Baltic countries, for secure and stable operation of the system, is planned.

Installation of Battery Energy Storage Systems (BESS), as well as installation of frequency control equipment and IT infrastructure also is a part of synchronisation phase 2 project. In 2020, 75% of the European co-financing from the CEF structural funds was allocated to the activities of the synchronisation phase 2 part I project, which consists of "Harmony link" construction, the construction of 6 synchronous condensers in Baltics and the reinforcement of the internal Polish transmission network, where co-financing of two synchronous condensers in Latvia are included. Based on this Grant agreement among Baltic TSOs, Polish TSO and European Climate, Infrastructure and Environment Executive Agency (CINEA) was signed on December 2020. Whereas, in January 2022, 75% European co-financing from the CEF structural funds was allocated to the synchronisation phase 2 part 2 projects, based on that the Grant Agreement with CINEA was signed on June 3, 2022. As part of the phase 2 part 2 projects AST is developing BESS project, install a frequency control system, modernize the meetering system and protection and emergency automation equipment, as well as modernize the dispatch control and information technology systems.

The active work of construction of two synchronous condensers units in Grobiņa and Līksna substations is ongoing under synchronisation phase 2 part 1 project. On October 5, 2022, AS "Augstsprieguma tīkls" signed a contract with the constructor comunity "EM&SE Syncons" for delivery and installation of three synchronous condensers in Latvia, one in Ventspils substation, which is planned to be installed under synchronization phase 1 project, and two in substations Grobina and Liksna under synchronisation phase 2 part 1. After all necessary factory tests, the first synchronous condenser was successfully delivered to the Grobina substation in May 2024, where installation and connection works of the condenser to the 330 kV network is ongoing. The construction, connection to the power grid and testing works of the synchronous condenser are planned to be completed during December 2024 - February 2025, before the synchronization of the Baltic states with continental Europe. Whereas commissioning of the Liksna synchronous condenser is scheduled to be implemented in October 2025. At the moment, the Liksna synchronous condenser is manufacturing at the factory and construction work has started at the Liksna substation for the installation and connection of the mentioned equipment to the network. Delivery of synchronous condenser to the Liksna is expected at the end of 2024.


TS aussen
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AS "Augstsprieguma tīkls" under synchronization phase 2 part 2 project implements the BESS project in Latvia for provision of regulation reserves in sinhronisation mode. The planned BESS amount of 80MW/160MWh will be installed in two substations in Latvia - one 20MW/40MWh BESS at the Tume substation and other 60MW/120MWh – in the substation Rezekne, in paraller reconstructing both substations for connecting BESS to the transmission network. The installation of BESS is necessary, because in synchronization mode with continental Europe and desynchronization from the Russian electricity system, for the secure and stable operation of Latvian electricity system, frequency regulation and balancing power reserve measures will have to be provided, and frequency maintenance and restoration reserves must be provided as well. In the Baltics, the balancing market was not introduced yet, and there is a considerable risk that the availability of such reserves from existing market participants will be insufficient.

Therefore, in order not to delay the implementation of the synchronization project, the Cabinet of Ministers on September 24, 2021 with decision No. 674[8], authorized AST to develop, install, manage and operate BESS systems for guaranteeing the necessary reserves during the implementation of the synchronization project and as long as the availability of such reserves will become provided by the market at a reasonable price. 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 operating and capital costs, which was also confirmed by the electricity market study, prepared jointly by TSOs of Latvia, Lithuania and Estonia, where was concluded, that it will not be possible to provide automatic frequency curtailment reserves (FCR), automatic frequency restoration reserves (aFRR) and manual frequency restoration reserves (mFRR) neither in Latvia nor in the Baltics with the existing power resources. At the beginning of 2024, the procurement procedure for the purchase and installation of BESS for the Latvian electricity system was successfully completed, where the German company Rolls-Royce Solutions GmbH was announced as the tender winner, which will deliver and install BESS in substations in Tume and Rezekne. The contract with Rolls-Royce Solutions GmbH was signed on February 16, 2024, where, according to the terms of the contract, both BESS projects in Rezekne and Tume should be implemented by October 2025.

[8]https://www.vestnesis.lv/op/2021/187.3

As part of the synchronization project, the IT infrastructure and system management and emergency automation projects are also being implemented. The most important of these projects, which must also be implemented by the Baltic TSOs before start of synchronisation, in accordance to technical requirements from Catalog of Measures and connection agreement, concluded in May 2019. The mentioned projects are the frequency stability assessment system project (FSAS) and the Load and Frequency Controller (LFC) project. The LFC project is critical to the synchronization and must be implemented by February 2025. Work is ongoing according to the plan, at the end of 2023 a contract with developer has been signed and the implementation of the LFC module has been started, which is planned to be completed by the end of 2024. Whereas, regarding FSAS project, which was initially planned to be implemented as a joint Baltic project, the Baltic TSOs each decided to implement their own local solution. Implementation of the FSAS project in AST has started, the concept has been approved and the procurement has been announced. The project is planned to be implemented in 2025.

In 2023, the Baltic TSOs AST, Litgrid and Elering carried out several accelerated synchronization studies, where it was concluded that there are risks to the security and stability of the system until the end of 2024, defined by the criteria of dynamic stability and power adequacy, but since 1st quarter of 2025 synchronization with continental Europe and desynchronization from the IPS/UPS system 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 guarantee readiness for synchronization with continental European transmission system from February 2025. Based on TSOs agreement the governments of the Baltic states on August 3, 2023 signed a joint declaration of Baltic synchronisation from February 2025. The cooperation agreement establishes a plan agreed between TSOs on the steps to be realised, to provide readiness of the Baltic electricity system for accelerated synchronization with continental Europe, which is essential for ensuring the secure operation of power system in the region. Currently Baltic TSOs are actively working and fulfilling all necessary technical requirements from Catalogue of Measures, which are checked and accepted by European TSOs. All requirements must be realised by November 2024, when the Regional Group Continental Europe (RGCE) will decide on the compliance of Baltic electricity systems to synchronise with continental Europe synchronous zone. On July 16, 2024, AST, Litgrid and Elering signed common letter to the Russian and Belarus TSOs with notification of non-renewal of BRELL agreement and desynchronisation from Russian IPS/UPS system in February 2025.

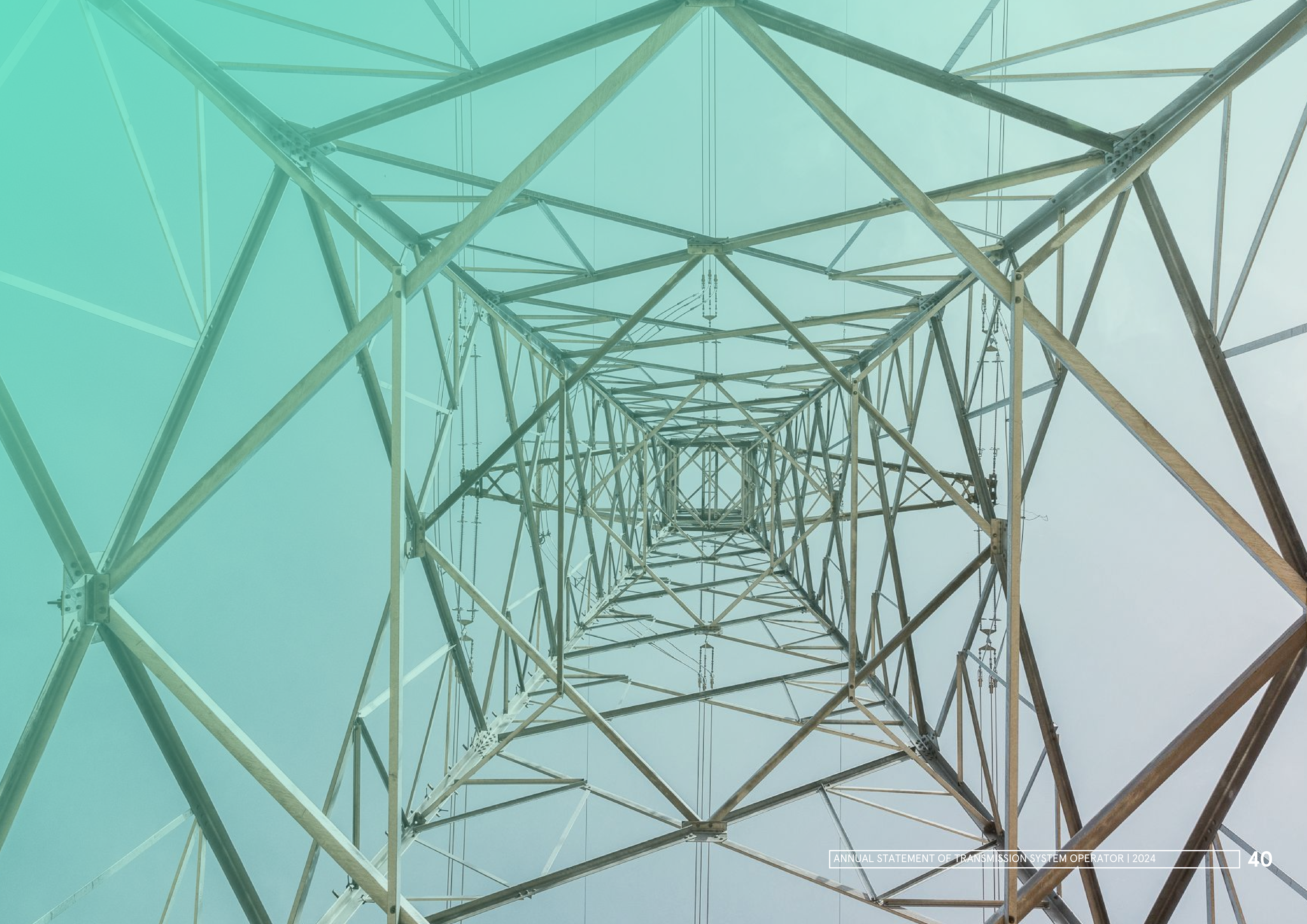
5.3. TSO conclusions on the electricity transmission system reliability and adequacy of all consumers to provide secure power supply in the previous year and the following years (minimum forecast period – 10 years).

Implementation of the projects mentioned in the paragraph 4.2 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.

5.4. Existing power generation capacities bigger than 1 MW, for January 1, 2024

Nr.	Name of the station	Installed capacity (MW)
	Natural gas fired co-generation stations– 52.5 MW	
1	Small co-generation natural gas fired stations from DSO	37.6
2	Juglas jauda, SIA	14.9
	Biomass and biogas power stations -149.72 MW	
1	*Biomass and biogas power stations from DSO*	125.9
2	Gren Latvija SIA	23.82
	Wind power stations– 130.3 MW	
1	Wind power stations from DSO	50.8
2	WINERGY, SIA	20.7
3	SIA TCK	58.8
	Hydro power stations – 28.6 MW	
1	Small HPPs from DSO	28.6
	Solar power stations – 287.9 MW	
1	Distributed PhV from DSO	287.9
	Latvenergo power stations– 2600 MW	
1	Ķegums HPP	248
2	Riga HPP	402
3	Plavinas HPP	908
4	Riga CHP_1	158
5	Riga CHP-2	832/881
6	Aiviekste HPP	1.47
7	Ainaži WPP	1



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.

- Desynchronisation from the geopolitically risky Russian power system, synchronization with the continental Europe electricity system and closer integration into the European electricity market will improve the security of electricity supply in Latvia.

- 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, which will also require the development of RES connections to the transmission network. In order to ensure the power system security and stability, this will ask precise long term planning with more detailed information from RES developers about project implementation deadlines, as well as 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 and covering of peak load in Latvia.

- 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. Due to this, the increase of interconnections capacity with Estonia and Lithuania will increase, as well as development of new interconnections to Sweden and/or Germany is expected.

- 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.

- The development of hydrogen and other P2X technologies can significantly increase the consumption of the Latvian electricity system in the future. To contribute this, in parallel to keep the security and stability of the Latvian electricity system, investments for reinforcements of the electricity transmission network will be necessary.

A. Daugulis

AS „Augstsprieguma tīkls"
Board Member

7. ANNEXES

INSTALLED CAPACITIES (GROSS) OF POWER STATIONS, MW

Table 1

Years		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Big power base load power plants [6)]	**1**	**2644**	**2644**	**2644**	**2658**	**2666**	**2674**	**1588/2469**	**1588/2469**	**1588/2469**	**1588/2469**	**1588/2469**
Including: Daugava HPPs	*1.1*	*1558*	*1558*	*1558*	*1572*	*1580*	*1588*	*1588*	*1588*	*1588*	*1588*	*1588*
Riga CHP-1 [11)]	*1.2*	*158*	*158*	*158*	*158*	*158*	*158*	*158/0*	*158/0*	*158/0*	*158/0*	*158/0*
Riga CHP-2 [11)]	*1.3*	*881*	*881*	*881*	*881*	*881*	*881*	*881/0*	*881/0*	*881/0*	*881/0*	*881/0*
Installed capacity of small gas cogeneration and RES power stations (Conservative Scenario A)	**2**	**823**	**992**	**1162**	**1331**	**1501**	**1670**	**1839**	**2009**	**2178**	**2848**	**3017**
Including: Natural gas co-generation stations	*2.1*	*50*	*47*	*44*	*41*	*38*	*35*	*32*	*29*	*26*	*23*	*20*
Hydro power stations	*2.2*	*30*	*30*	*30*	*30*	*30*	*30*	*30*	*30*	*30*	*30*	*30*
Wind power stations [7)]	*2.3*	*170*	*207*	*244*	*281*	*318*	*355*	*392*	*429*	*467*	*1004*	*1041*
On-shore	*2.3.1*	*170*	*207*	*244*	*281*	*318*	*355*	*392*	*429*	*467*	*504*	*541*
Off-shore	*2.3.2*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*500*	*500*
Biomass power stations [8)]	*2.4*	*95*	*97*	*98*	*100*	*101*	*103*	*104*	*106*	*107*	*108*	*110*
Biogas power stations [8)]	*2.5*	*57*	*58*	*58*	*59*	*60*	*61*	*61*	*62*	*63*	*64*	*65*
Solar power stations	*2.6*	*421*	*554*	*687*	*820*	*953*	*1086*	*1219*	*1353*	*1486*	*1619*	*1752*
Installed capacity of small gas cogeneration and RES power stations (Base Scenario B)	**3**	**906**	**1159**	**1411**	**1664**	**1916**	**2169**	**2413**	**2670**	**2927**	**3684**	**3941**
Including: Natural gas co-generation stations	*3.1*	*48*	*44*	*40*	*35*	*31*	*27*	*15*	*15*	*15*	*15*	*15*
Hydro power stations	*3.2*	*30*	*30*	*30*	*30*	*30*	*30*	*30*	*30*	*30*	*30*	*30*
Wind power stations [7)]	*3.3*	*198*	*263*	*328*	*392*	*457*	*522*	*587*	*652*	*717*	*1281*	*1346*
On-shore	*3.3.1*	*198*	*263*	*328*	*392*	*457*	*522*	*587*	*652*	*717*	*781*	*846*
Off-shore	*3.3.2*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*500*	*500*
Biomass power stations [8)]	*3.4*	*96*	*98*	*100*	*102*	*104*	*106*	*108*	*110*	*112*	*114*	*116*
Biogas power stations [8)]	*3.5*	*57*	*59*	*60*	*61*	*63*	*64*	*65*	*67*	*68*	*69*	*71*
Solar power stations	*3.6*	*477*	*665*	*854*	*1042*	*1231*	*1420*	*1608*	*1797*	*1986*	*2174*	*2363*

INSTALLED CAPACITIES (GROSS) OF POWER STATIONS, MW

Table 1

Years		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Installed capacity of small gas cogeneration and RES power stations (Optimistic Scenario EU 2030)	**4**	**972**	**1290**	**1640**	**1993**	**2347**	**2700**	**3111**	**3468**	**3826**	**5193**	**5561**
Including: Natural gas co-generation stations	*4.1*	*48*	*44*	*40*	*35*	*31*	*27*	*0*	*0*	*0*	*0*	*0*
Hydro power stations	*4.2*	*30*	*30*	*30*	*30*	*30*	*30*	*30*	*30*	*30*	*30*	*30*
Wind power stations [7)]	*4.3*	*178*	*223*	*300*	*380*	*460*	*540*	*700*	*780*	*860*	*1950*	*2040*
On-shore	*4.3.1*	*178*	*223*	*300*	*380*	*460*	*540*	*700*	*780*	*860*	*950*	*1040*
Off-shore	*4.3.2*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*1000*	*1000*
Biomass power stations [8)]	*4.4*	*97*	*100*	*103*	*106*	*110*	*113*	*116*	*119*	*122*	*125*	*128*
Biogas power stations [8)]	*4.5*	*58*	*61*	*63*	*66*	*68*	*71*	*73*	*76*	*78*	*80*	*83*
Solar power stations	*4.6*	*560*	*832*	*1104*	*1376*	*1648*	*1920*	*2192*	*2464*	*2736*	*3008*	*3280*
Battery Energy Storage Systems (BESS)	**5**	**20**	**150**	**170**	**200**	**250**	**300**	**350**	**400**	**450**	**500**	**500**
Independent producers BESS	*5.1*	**20**	**70**	**90**	**120**	**170**	**220**	**270**	**320**	**370**	**420**	**420**
BESS for TSO needs for reserve and balancing service [13)]	*5.2*	0	**80**	**80**	**80**	**80**	**80**	**80**	**80**	**80**	**80**	**80**

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

Table 2

Years		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Maximum load	**1**	**1169**	**1180**	**1196**	**1213**	**1231**	**1260**	**1316**	**1342**	**1359**	**1398**	**1427**
Big power base load power plants	**2**	**2506**	**2506**	**2506**	**2520**	**2528**	**2536**	**2383**	**2383**	**2383**	**2383**	**2383**
Including: Daugava HPPs	*2.1*	*1550*	*1550*	*1550*	*1564*	*1572*	*1580*	*1580*	*1580*	*1580*	*1580*	*1580*
Riga CHP-1	*2.2*	*153*	*153*	*153*	*153*	*153*	*153*	*0*	*0*	*0*	*0*	*0*
Riga CHP-2	*2.3*	*803*	*803*	*803*	*803*	*803*	*803*	*803*	*803*	*803*	*803*	*803*
Distributed, small capacity gas cogeneration and RES power plants	**3**	**759**	**915**	**1071**	**1227**	**1383**	**1538**	**1694**	**1850**	**2006**	**2657**	**2813**
Including: Natural gas co-generation power stations	*3.1*	*45*	*42*	*40*	*37*	*34*	*32*	*29*	*27*	*24*	*21*	*19*
Hydro power stations	*3.2*	*29*	*29*	*29*	*29*	*29*	*29*	*29*	*29*	*29*	*29*	*29*
Wind power stations	*3.3*	*168*	*205*	*242*	*278*	*315*	*352*	*389*	*425*	*462*	*994*	*1030*
Onshore	*3.3.1.*	*168*	*205*	*242*	*278*	*315*	*352*	*389*	*425*	*462*	*499*	*535*
Offshore	*3.3.2.*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*495*	*495*
Biomass power stations	*3.4*	*87*	*88*	*89*	*91*	*92*	*93*	*95*	*96*	*97*	*99*	*100*
Biogas power stations	*3.5*	*52*	*52*	*53*	*54*	*54*	*55*	*56*	*57*	*57*	*58*	*59*
Solar power stations	*3.6*	*379*	*499*	*618*	*738*	*858*	*978*	*1098*	*1217*	*1337*	*1457*	*1577*
Available capacities for peak load and reserve provisions	**4**	**1439**	**1459**	**1560**	**1580**	**1600**	**1620**	**1488**	**1508**	**1528**	**1597**	**1618**
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*	*0*	*0*	*0*	*0*	*0*
Riga CHP-2	*4.03*	*803*	*803*	*803*	*803*	*803*	*803*	*803*	*803*	*803*	*803*	*803*
Natural gas co-generation power stations	*4.05*	*32*	*30*	*28*	*26*	*24*	*22*	*20*	*19*	*17*	*15*	*13*
Hydro power stations	*4.06*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*
Wind power stations	*4.07*	*44*	*53*	*63*	*72*	*82*	*91*	*101*	*111*	*120*	*258*	*268*
Biomass power stations	*4.08*	*97*	*98*	*100*	*101*	*103*	*104*	*105*	*107*	*108*	*110*	*111*
Biogas power stations	*4.09*	*35*	*46*	*58*	*69*	*80*	*91*	*102*	*113*	*124*	*135*	*147*
Battery Energy Storage System [13)]	*4.10*	*0*	*80*	*80*	*80*	*80*	*80*	*80*	*80*	*80*	*80*	*80*
Power system emergency reserve [2)]	**5**	**100**	**164**	**195**	**203**	**212**	**220**	**242**	**247**	**260**	**276**	**288**
Power system regulating reserve [4)]	**6**	**87**	0	0	0	0	0	0	0	0	0	0
Total reserve in Latvia[3)]	**7=5+6**	**187**	**164**	**195**	**203**	**212**	**220**	**242**	**247**	**260**	**276**	**288**
Power surplus (+), deficit (-)	**8=4-1-7**	**83**	**156**	**209**	**203**	**197**	**180**	**-30**	**-41**	**-51**	**-36**	**-57**
Power adequacy	**9=(4-7)/1**	**107%**	**113%**	**117%**	**117%**	**116%**	**114%**	**98%**	**97%**	**96%**	**97%**	**96%**

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

Table 3

Years		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Maximum load	1	1171	1198	1240	1298	1321	1376	1459	1529	1562	1634	1716
Big power base load power plants	2	2506	2506	2506	2520	2528	2536	2383	2383	2383	2383	2383
Including: Daugava HPPs	2.1	1550	1550	1550	1564	1572	1580	1580	1580	1580	1580	1580
Riga CHP-1	2.2	153	153	153	153	153	153	153	153	153	153	153
Riga CHP-2	2.3	850	850	850	850	850	850	850	850	850	850	850
Distributed, small capacity gas cogeneration and RES power plants	3	837	1070	1303	1536	1769	2002	2228	2465	2702	3434	3671
Including: Natural gas co-generation power stations	3.1	44	40	36	32	28	24	14	14	14	14	14
Hydro power stations	3.2	29	29	29	29	29	29	29	29	29	29	29
Wind power stations	3.3	196	260	324	388	453	517	581	645	709	1269	1333
Onshore	3.3.1.	196	260	324	388	453	517	581	645	709	774	838
Offshore	3.3.2.	0	0	0	0	0	0	0	0	0	495	495
Biomass power stations	3.4	87	89	91	93	95	96	98	100	102	104	105
Biogas power stations	3.5	52	53	55	56	57	58	59	61	62	63	64
Solar power stations	3.6	429	599	768	938	1108	1278	1448	1617	1787	1957	2127
Available capacities for peak load and reserve provisions	4	1579	1611	1724	1757	1790	1822	1855	1888	1920	2002	2035
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	153	153
Riga CHP-2	4.03	850	850	850	850	850	850	850	850	850	850	850
Natural gas co-generation power stations	4.05	32	30	28	26	24	22	20	19	17	15	13
Hydro power stations	4.06	6	6	6	6	6	6	6	6	6	6	6
Wind power stations	4.07	51	68	84	101	118	134	151	168	184	330	347
Biomass power stations	4.08	98	100	102	104	106	108	110	112	115	117	119
Biogas power stations	4.09	40	56	71	87	103	119	135	150	166	182	198
Battery Energy Storage System [13)]	4.10	0	80	80	80	80	80	80	80	80	80	80
Power system emergency reserve [2)]	5	100	164	195	203	212	220	242	247	260	276	288
Power system regulating reserve [4)]	6	90	0	0	0	0	0	0	0	0	0	0
Total reserve in Latvia[3)]	7=5+6	190	164	195	203	212	220	242	247	260	276	288
Power surplus (+), deficit (-)	8=4-1-7	218	289	329	296	296	266	194	151	139	132	71
Power adequacy	9=(4-7)/1	119%	124%	127%	123%	122%	119%	113%	110%	109%	108%	104%

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

Table 4

Years		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Maximum load	**1**	**1187**	**1243**	**1308**	**1378**	**1446**	**1531**	**1647**	**1733**	**1804**	**1903**	**2002**
Big power base load power plants	**2**	**2506**	**2506**	**2506**	**2520**	**2528**	**2536**	**2383**	**2383**	**2383**	**2383**	**2383**
Including: Daugava HPPs	*2.1*	*1550*	*1550*	*1550*	*1564*	*1572*	*1580*	*1580*	*1580*	*1580*	*1580*	*1580*
Riga CHP-1	*2.2*	*153*	*153*	*153*	*153*	*153*	*153*	*0*	*0*	*0*	*0*	*0*
Riga CHP-2	*2.3*	*850*	*850*	*850*	*850*	*850*	*850*	*0*	*0*	*0*	*0*	*0*
Distributed, small capacity gas cogeneration and RES power plants	**3**	**894**	**1184**	**1507**	**1832**	**2157**	**2482**	**2866**	**3195**	**3524**	**4853**	**5192**
Including: Natural gas co-generation power stations	*3.1*	*44*	*40*	*36*	*32*	*28*	*24*	*0*	*0*	*0*	*0*	*0*
Hydro power stations	*3.2*	*29*	*29*	*29*	*29*	*29*	*29*	*29*	*29*	*29*	*29*	*29*
Wind power stations	*3.3*	*176*	*221*	*297*	*376*	*455*	*535*	*693*	*772*	*851*	*1931*	*2020*
Onshore	*3.3.1.*	*176*	*221*	*297*	*376*	*455*	*535*	*693*	*772*	*851*	*941*	*1030*
Offshore	*3.3.2.*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*990*	*990*
Biomass power stations	*3.4*	*88*	*91*	*94*	*97*	*100*	*102*	*105*	*108*	*111*	*114*	*117*
Biogas power stations	*3.5*	*53*	*55*	*58*	*60*	*62*	*64*	*66*	*69*	*71*	*73*	*75*
Solar power stations	*3.6*	*504*	*749*	*993*	*1238*	*1483*	*1728*	*1973*	*2217*	*2462*	*2707*	*2952*
Available capacities for peak load and reserve provisions	**4**	**1626**	**1660**	**1782**	**1824**	**1867**	**1909**	**946**	**990**	**1034**	**1305**	**1351**
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*	*0*	*0*	*0*	*0*	*0*
Riga CHP-2	*4.03*	*850*	*850*	*850*	*850*	*850*	*850*	*0*	*0*	*0*	*0*	*0*
Natural gas co-generation power stations	*4.05*	*32*	*30*	*28*	*26*	*24*	*22*	*0*	*0*	*0*	*0*	*0*
Hydro power stations	*4.06*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*
Wind power stations	*4.07*	*40*	*50*	*67*	*85*	*103*	*121*	*157*	*175*	*192*	*436*	*456*
Biomass power stations	*4.08*	*99*	*103*	*106*	*110*	*113*	*117*	*120*	*124*	*127*	*131*	*134*
Biogas power stations	*4.09*	*47*	*70*	*92*	*115*	*138*	*161*	*183*	*206*	*229*	*252*	*274*
Battery Energy Storage System [13)]	*4.10*	*0*	*80*	*80*	*80*	*80*	*80*	*80*	*80*	*80*	*80*	*80*
Power system emergency reserve [2)]	**5**	**100**	**164**	**195**	**203**	**212**	**220**	**242**	**247**	**260**	**276**	**288**
Power system regulating reserve [4)]	**6**	**89**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total reserve in Latvia[3)]	**7=5+6**	**189**	**164**	**195**	**203**	**212**	**220**	**242**	**247**	**260**	**276**	**288**
Power surplus (+), deficit (-)	**8=4-1-7**	**250**	**293**	**319**	**284**	**248**	**198**	**-903**	**-950**	**-990**	**-835**	**-898**
Power adequacy	**9=(4-7)/1**	**121%**	**124%**	**124%**	**121%**	**117%**	**113%**	**45%**	**45%**	**45%**	**56%**	**55%**

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

Table 5

Years		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Energy demand	**1**	**6734**	**6771**	**6801**	**6830**	**6861**	**6895**	**7867**	**8031**	**8197**	**8465**	**8533**
Big power base load power plants	**2**	**3961**	**3961**	**3961**	**3961**	**3961**	**3961**	**3761**	**3761**	**3761**	**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*	*200*	*200*	*200*	*200*	*200*	*200*	*0*	*0*	*0*	*0*	*0*
Riga CHP-2 [9]	*2.3*	*1124*	*1124*	*1124*	*1124*	*1124*	*1124*	*1124*	*1124*	*1124*	*1124*	*1124*
Distributed, small capacity gas cogeneration and RES power plants	**3**	**1555**	**1659**	**1764**	**1868**	**1973**	**2077**	**2182**	**2286**	**2390**	**3980**	**4084**
Including: Natural gas co-generation power stations	*3.1*	*270*	*255*	*239*	*223*	*207*	*191*	*175*	*159*	*143*	*127*	*111*
Hydro power stations	*3.2*	*71*	*71*	*71*	*71*	*71*	*71*	*71*	*71*	*71*	*71*	*71*
Wind power stations	*3.3*	*337*	*410*	*483*	*557*	*630*	*704*	*777*	*850*	*924*	*2482*	*2556*
Onshore	*3.3.1.*	*337*	*410*	*483*	*557*	*630*	*704*	*777*	*850*	*924*	*997*	*1071*
Offshore	*3.3.2.*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*1485*	*1485*
Biomass power stations	*3.4*	*442*	*449*	*456*	*463*	*469*	*476*	*483*	*489*	*496*	*503*	*509*
Biogas power stations	*3.5*	*320*	*324*	*329*	*333*	*338*	*342*	*346*	*351*	*355*	*359*	*364*
Solar power stations	*3.6*	*114*	*150*	*186*	*221*	*257*	*293*	*329*	*365*	*401*	*437*	*473*
Possible annual export/import	**4=(2+3)-1**	**-1218**	**-1151**	**-1076**	**-1001**	**-927**	**-857**	**-1925**	**-1984**	**-2046**	**-724**	**-687**
Annual adequacy	**5=(2+3)/1**	**82%**	**83%**	**84%**	**85%**	**86%**	**88%**	**76%**	**75%**	**75%**	**91%**	**92%**

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

Table 6

Years		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Energy demand	**1**	**6811**	**6925**	**7033**	**7143**	**7256**	**7376**	**9030**	**9556**	**10087**	**10521**	**11159**
Big power base load power plants	**2**	**4432**	**4432**	**4432**	**4432**	**4432**	**4432**	**4432**	**4432**	**4432**	**4432**	**4432**
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*	*541*	*541*
Riga CHP-2 [9]	*2.3*	*1254*	*1254*	*1254*	*1254*	*1254*	*1254*	*1254*	*1254*	*1254*	*1254*	*1254*
Distributed, small capacity gas cogeneration and RES power plants	**3**	**1633**	**1806**	**1979**	**2152**	**2325**	**2497**	**2629**	**2825**	**3022**	**4703**	**4899**
Including: Natural gas co-generation power stations	*3.1*	*263*	*240*	*216*	*193*	*170*	*146*	*82*	*82*	*82*	*82*	*82*
Hydro power stations	*3.2*	*74*	*74*	*74*	*74*	*74*	*74*	*74*	*74*	*74*	*74*	*74*
Wind power stations	*3.3*	*392*	*520*	*649*	*777*	*905*	*1034*	*1162*	*1290*	*1419*	*3032*	*3161*
Onshore	*3.3.1.*	*392*	*520*	*649*	*777*	*905*	*1034*	*1162*	*1290*	*1419*	*1547*	*1676*
Offshore	*3.3.2.*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*1485*	*1485*
Biomass power stations	*3.4*	*436*	*445*	*454*	*464*	*473*	*482*	*491*	*500*	*509*	*518*	*527*
Biogas power stations	*3.5*	*339*	*347*	*355*	*362*	*370*	*378*	*386*	*394*	*402*	*410*	*418*
Solar power stations	*3.6*	*129*	*180*	*231*	*281*	*332*	*383*	*434*	*485*	*536*	*587*	*638*
Possible annual export/import	**4=(2+3)-1**	**-746**	**-687**	**-622**	**-559**	**-500**	**-447**	**-1968**	**-2298**	**-2633**	**-1386**	**-1827**
Annual adequacy	**5=(2+3)/1**	**89%**	**90%**	**91%**	**92%**	**93%**	**94%**	**78%**	**76%**	**74%**	**87%**	**84%**

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

Table 7

Years		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Energy demand	**1**	**6846**	**6982**	**7113**	**7247**	**7385**	**7507**	**10315**	**10930**	**11574**	**12465**	**13202**
Big power base load power plants	**2**	**9703**	**9703**	**9703**	**9703**	**9703**	**9703**	**2637**	**2637**	**2637**	**2637**	**2637**
Including: Daugava HPPs [1]	*2.1*	*2637*	*2637*	*2637*	*2637*	*2637*	*2637*	*2637*	*2637*	*2637*	*2637*	*2637*
Riga CHP-1 [9]	*2.2*	*1114*	*1114*	*1114*	*1114*	*1114*	*1114*	*0*	*0*	*0*	*0*	*0*
Riga CHP-2 [9]	*2.3*	*5952*	*5952*	*5952*	*5952*	*5952*	*5952*	*0*	*0*	*0*	*0*	*0*
Distributed, small capacity gas cogeneration and RES power plants	**3**	**1675**	**1844**	**2076**	**2315**	**2553**	**2792**	**3066**	**3328**	**3589**	**6841**	**7123**
Including: Natural gas co-generation power stations	*3.1*	*263*	*240*	*216*	*193*	*170*	*146*	*0*	*0*	*0*	*0*	*0*
Hydro power stations	*3.2*	*77*	*77*	*77*	*77*	*77*	*77*	*77*	*77*	*77*	*77*	*77*
Wind power stations	*3.3*	*352*	*442*	*594*	*752*	*911*	*1069*	*1386*	*1545*	*1703*	*4851*	*5030*
Onshore	*3.3.1.*	*352*	*442*	*594*	*752*	*911*	*1069*	*1386*	*1545*	*1703*	*1881*	*2059*
Offshore	*3.3.2.*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*2970*	*2970*
Biomass power stations	*3.4*	*486*	*501*	*517*	*532*	*548*	*563*	*579*	*594*	*610*	*625*	*641*
Biogas power stations	*3.5*	*345*	*360*	*374*	*389*	*403*	*418*	*432*	*446*	*461*	*475*	*490*
Solar power stations	*3.6*	*151*	*225*	*298*	*371*	*445*	*518*	*592*	*665*	*739*	*812*	*885*
Possible annual export/import	**4=(2+3)-1**	**4531**	**4565**	**4666**	**4771**	**4871**	**4988**	**-4612**	**-4966**	**-5348**	**-2986**	**-3442**
Annual adequacy	**5=(2+3)/1**	**166%**	**165%**	**166%**	**166%**	**166%**	**166%**	**55%**	**55%**	**54%**	**76%**	**74%**

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

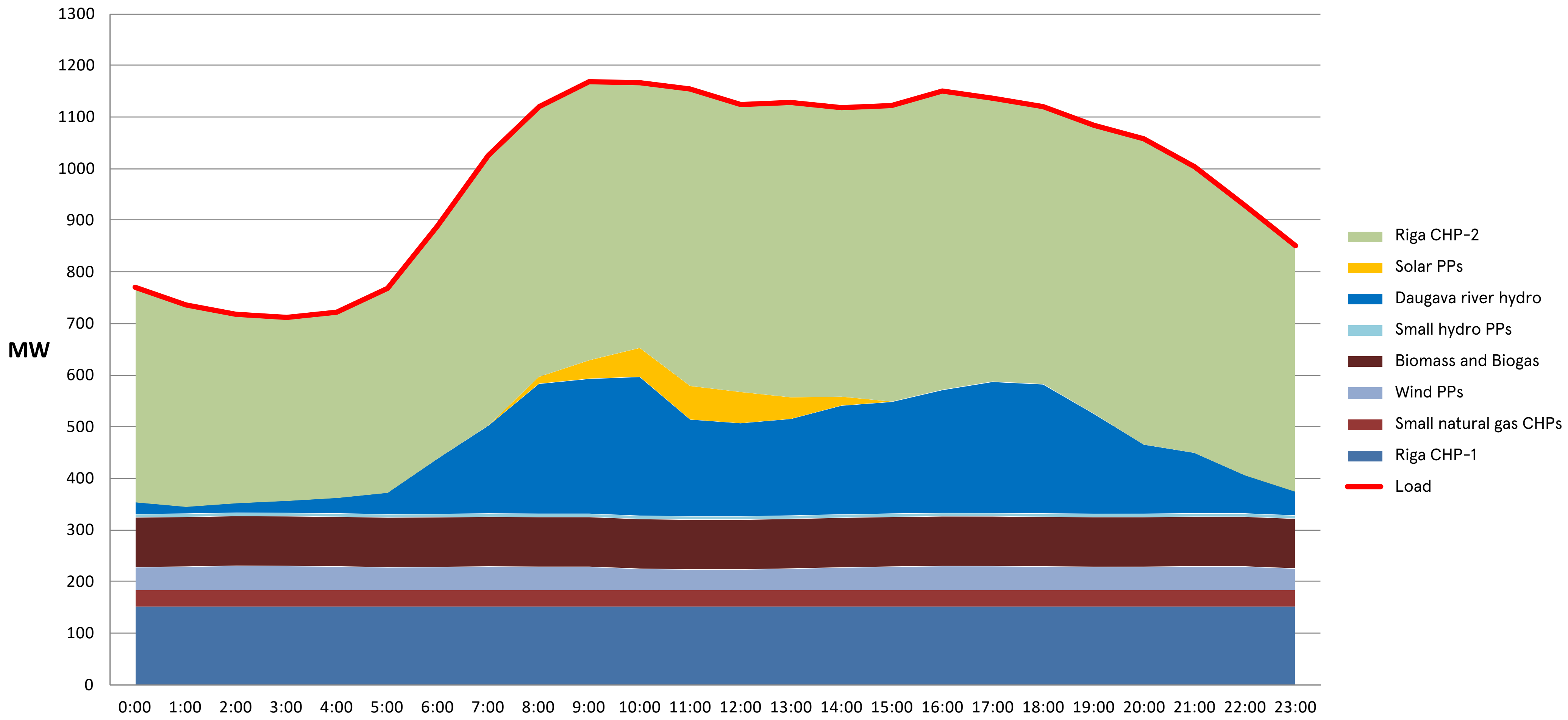
Year 2024. January (working day, Wednesday of the third week, peak load)

Table 8

Hour	Riga CHP-1	Riga CHP-2 [11]	Biomass and biogas	Gas fuelled co-generation	Small HPPs	Wind power	Solar power	Daugava HPPs [10]	Import	Load
01:00	153	417	97	32	6	43	0	23	0	770
02:00	153	392	97	32	6	44	0	13	0	737
03:00	153	366	97	32	6	46	0	19	0	718
04:00	153	357	97	32	6	46	0	23	0	713
05:00	153	360	97	32	6	45	0	30	0	721
06:00	153	397	97	32	6	43	0	42	0	768
07:00	153	450	97	32	6	44	0	108	0	889
08:00	153	524	97	32	6	45	0	171	0	1026
09:00	153	525	97	32	6	44	13	253	0	1121
10:00	153	540	97	32	6	44	35	262	0	1169
11:00	153	514	97	32	6	40	56	270	0	1166
12:00	153	576	97	32	6	39	65	188	0	1155
13:00	153	557	97	32	6	39	60	181	0	1124
14:00	153	572	97	32	6	41	42	188	0	1129
15:00	153	560	97	32	6	43	17	211	0	1118
16:00	153	573	97	32	6	44	0	217	0	1122
17:00	153	578	97	32	6	46	0	239	0	1149
18:00	153	550	97	32	6	46	0	255	0	1137
19:00	153	538	97	32	6	45	0	251	0	1120
20:00	153	558	97	32	6	44	0	195	0	1084
21:00	153	593	97	32	6	44	0	134	0	1058
22:00	153	554	97	32	6	45	0	118	0	1003
23:00	153	523	97	32	6	45	0	74	0	928
00:00	153	476	97	32	6	41	0	46	0	850
Produced amount of energy MWh	**3660**	**12050**	**2325**	**757**	**137**	**1046**	**288**	**3513**	**0**	**23776**

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

Year 2024. January (working day, Wednesday of the third week, peak load)

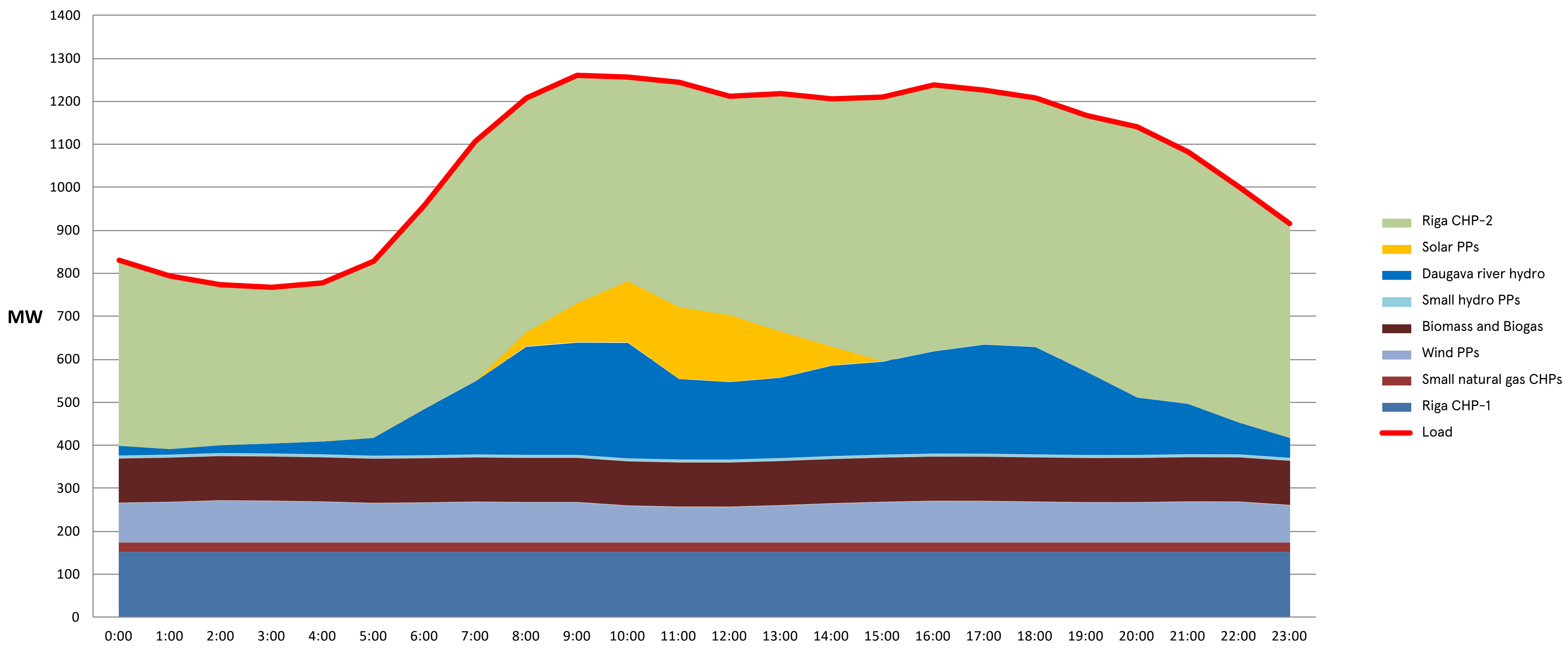


YEAR 2029. JANUARY
(working day, Wednesday of the third week, peak load)

Table 9

Hour	Riga CHP-1	Riga CHP-2 [11)]	Biomass and biogas	Gas fuelled co-generation	Small HPPs	Wind power	Solar power	Daugava HPPs [10)]	Import	Load
01:00	153	432	104	22	6	91	0	23	0	830
02:00	153	404	104	22	6	93	0	13	0	794
03:00	153	374	104	22	6	97	0	19	0	774
04:00	153	365	104	22	6	96	0	23	0	768
05:00	153	369	104	22	6	94	0	30	0	777
06:00	153	412	104	22	6	90	0	42	0	828
07:00	153	474	104	22	6	91	0	108	0	958
08:00	153	557	104	22	6	93	0	171	0	1106
09:00	153	546	104	22	6	92	33	253	0	1209
10:00	153	530	104	22	6	92	91	262	0	1260
11:00	153	476	104	22	6	84	143	270	0	1257
12:00	153	523	104	22	6	82	167	188	0	1245
13:00	153	509	104	22	6	81	156	181	0	1212
14:00	153	553	104	22	6	85	107	188	0	1217
15:00	153	576	104	22	6	90	44	211	0	1206
16:00	153	615	104	22	6	93	0	217	0	1210
17:00	153	620	104	22	6	95	0	239	0	1239
18:00	153	591	104	22	6	95	0	255	0	1226
19:00	153	579	104	22	6	93	0	251	0	1208
20:00	153	597	104	22	6	92	0	195	0	1168
21:00	153	630	104	22	6	92	0	134	0	1141
22:00	153	586	104	22	6	94	0	118	0	1082
23:00	153	549	104	22	6	94	0	74	0	1001
00:00	153	500	104	22	6	85	0	46	0	916
Produced amount of energy MWh	3660	12367	2494	535	137	2185	742	3513	0	25633

YEAR 2029. JANUARY
(working day, Wednesday of the third week, peak load)

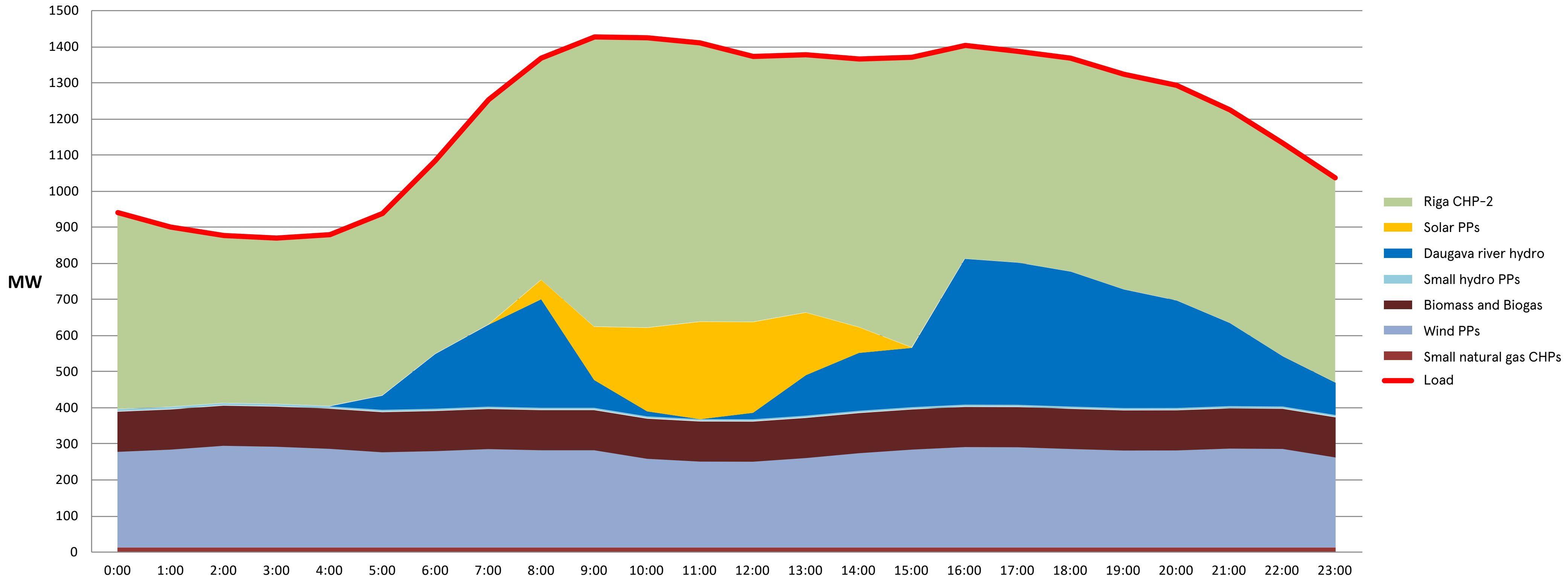


YEAR 2034. JANUARY
(working day, Wednesday of the third week, peak load)

Table 10

Hour	Riga CHP-1	Riga CHP-2 [11]	Biomass and biogas	Gas fuelled co-generation	Small HPPs	Wind power	Solar power	Daugava HPPs [10]	Import	Load
01:00	0	545	111	13	6	266	0	0	0	940
02:00	0	498	111	13	6	272	0	0	0	899
03:00	0	464	111	13	6	283	0	0	0	876
04:00	0	460	111	13	6	280	0	0	0	870
05:00	0	476	111	13	6	274	0	0	0	880
06:00	0	505	111	13	6	265	0	39	0	938
07:00	0	536	111	13	6	268	0	151	0	1085
08:00	0	623	111	13	6	274	0	226	0	1253
09:00	0	615	111	13	6	270	54	300	0	1369
10:00	0	803	111	13	6	270	147	77	0	1427
11:00	0	803	111	13	6	247	231	14	0	1424
12:00	0	772	111	13	6	239	269	0	0	1410
13:00	0	735	111	13	6	239	251	18	0	1373
14:00	0	715	111	13	6	249	173	112	0	1378
15:00	0	742	111	13	6	262	71	160	0	1365
16:00	0	803	111	13	6	272	1	164	0	1370
17:00	0	591	111	13	6	279	0	403	0	1403
18:00	0	587	111	13	6	279	0	393	0	1388
19:00	0	591	111	13	6	274	0	373	0	1368
20:00	0	596	111	13	6	270	0	328	0	1323
21:00	0	596	111	13	6	270	0	297	0	1292
22:00	0	590	111	13	6	275	0	230	0	1225
23:00	0	591	111	13	6	274	0	139	0	1133
00:00	0	568	111	13	6	250	0	89	0	1037
Produced amount of energy MWh	0	14805	2663	312	137	6399	1196	3513	0	29026

YEAR 2034. JANUARY
(working day, Wednesday of the third week, peak load)



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

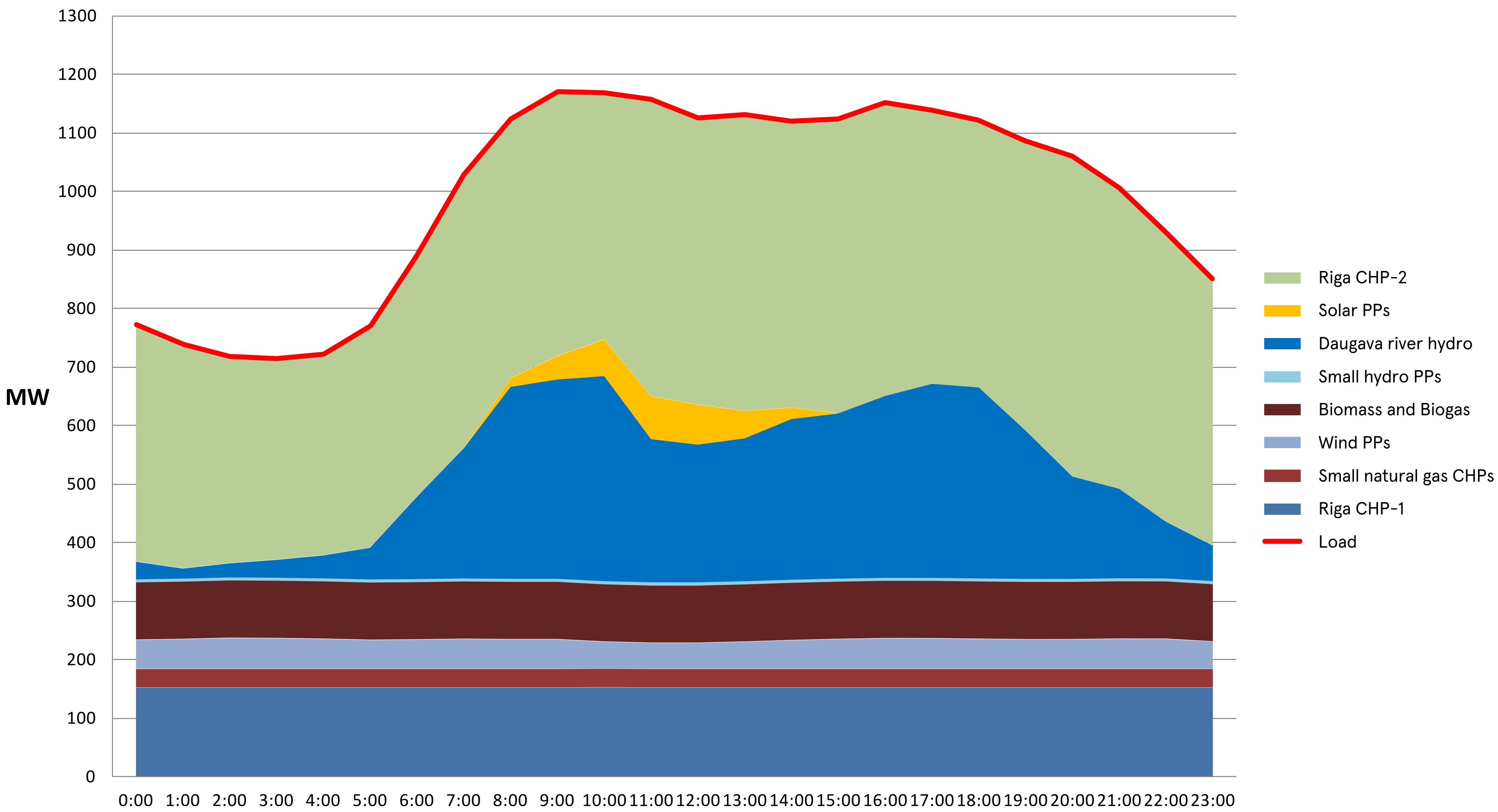
Year 2024. January (working day, Wednesday of the third week, peak load)

Table 11

Hour	Riga CHP-1	Riga CHP-2 [11]	Biomass and biogas	Gas fuelled co-generation	Small HPPs	Wind power	Solar power	Daugava HPPs [10]	Import	Load
01:00	153	404	98	32	6	51	0	30	0	772
02:00	153	382	98	32	6	52	0	17	0	738
03:00	153	354	98	32	6	54	0	24	0	719
04:00	153	343	98	32	6	53	0	30	0	714
05:00	153	344	98	32	6	52	0	39	0	723
06:00	153	378	98	32	6	50	0	54	0	770
07:00	153	412	98	32	6	51	0	140	0	890
08:00	153	467	98	32	6	52	0	222	0	1028
09:00	153	442	98	32	6	51	15	328	0	1123
10:00	153	452	98	32	6	51	40	340	0	1171
11:00	153	421	98	32	6	47	63	350	0	1169
12:00	153	507	98	32	6	45	73	244	0	1157
13:00	153	491	98	32	6	45	68	235	0	1127
14:00	153	506	98	32	6	47	47	244	0	1131
15:00	153	490	98	32	6	50	19	274	0	1120
16:00	153	503	98	32	6	52	0	282	0	1124
17:00	153	501	98	32	6	53	0	310	0	1152
18:00	153	468	98	32	6	53	0	331	0	1139
19:00	153	457	98	32	6	52	0	326	0	1122
20:00	153	495	98	32	6	51	0	253	0	1086
21:00	153	548	98	32	6	51	0	174	0	1060
22:00	153	513	98	32	6	52	0	152	0	1005
23:00	153	494	98	32	6	52	0	96	0	930
00:00	153	456	98	32	6	48	0	60	0	851
Produced amount of energy MWh	**3661**	**10830**	**2342**	**757**	**137**	**1217**	**326**	**4554**	**0**	**23823**

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

Year 2024. January (working day, Wednesday of the third week, peak load)

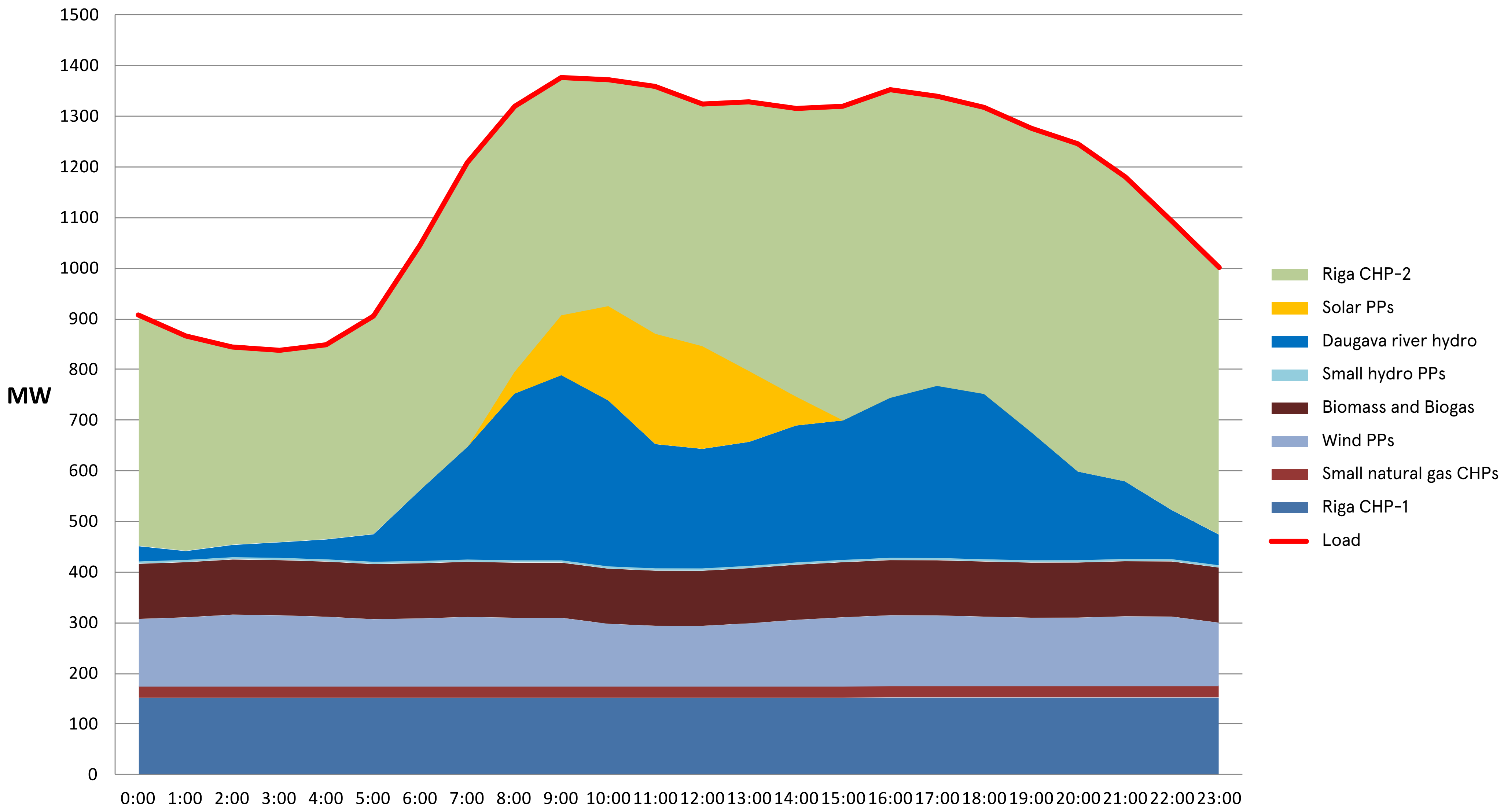


YEAR 2029. JANUARY
(working day, Wednesday of the third week, peak load)

Table 12

Hour	Riga CHP-1	Riga CHP-2 [11]	Biomass and biogas	Gas fuelled co-generation	Small HPPs	Wind power	Solar power	Daugava HPPs [10]	Import	Load
01:00	153	455	108	22	6	133	0	30	0	907
02:00	153	425	108	22	6	136	0	17	0	867
03:00	153	391	108	22	6	142	0	24	0	845
04:00	153	379	108	22	6	140	0	30	0	839
05:00	153	384	108	22	6	138	0	39	0	849
06:00	153	429	108	22	6	133	0	54	0	904
07:00	153	483	108	22	6	134	0	140	0	1046
08:00	153	560	108	22	6	137	0	222	0	1208
09:00	153	524	108	22	6	136	43	328	0	1320
10:00	153	469	108	22	6	136	119	364	0	1376
11:00	153	447	108	22	6	124	187	326	0	1373
12:00	153	488	108	22	6	120	218	244	0	1359
13:00	153	477	108	22	6	120	203	235	0	1324
14:00	153	532	108	22	6	125	140	244	0	1329
15:00	153	570	108	22	6	132	57	269	0	1316
16:00	153	621	108	22	6	137	1	274	0	1321
17:00	153	609	108	22	6	140	0	315	0	1353
18:00	153	570	108	22	6	140	0	339	0	1338
19:00	153	567	108	22	6	137	0	326	0	1319
20:00	153	599	108	22	6	135	0	253	0	1276
21:00	153	647	108	22	6	135	0	174	0	1246
22:00	153	602	108	22	6	138	0	152	0	1181
23:00	153	570	108	22	6	137	0	96	0	1093
00:00	153	525	108	22	6	126	0	60	0	1000
Produced amount of energy MWh	3664	12324	2596	535	137	3210	970	4554	0	27990

YEAR 2029. JANUARY
(working day, Wednesday of the third week, peak load)

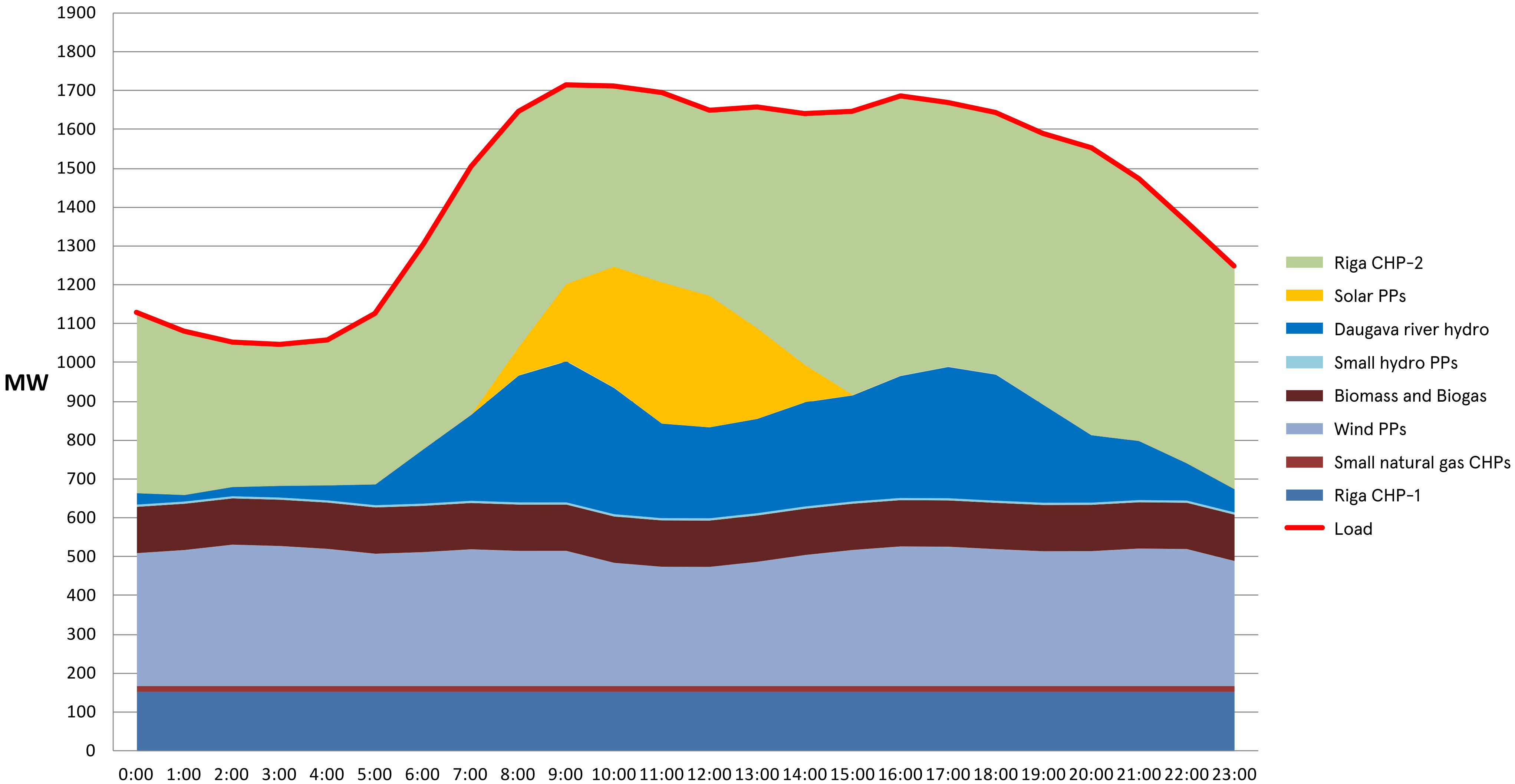


YEAR 2034. JANUARY
(working day, Wednesday of the third week, peak load)

Table 13

Hour	Riga CHP-1	Riga CHP-2 [11]	Biomass and biogas	Gas fuelled co-generation	Small HPPs	Wind power	Solar power	Daugava HPPs [10]	Import	Load
01:00	153	467	119	13	6	344	0	30	0	1130
02:00	153	422	119	13	6	352	0	17	0	1081
03:00	153	374	119	13	6	366	0	24	0	1053
04:00	153	363	119	13	6	362	0	30	0	1046
05:00	153	375	119	13	6	355	0	39	0	1058
06:00	153	441	119	13	6	342	0	54	0	1128
07:00	153	528	119	13	6	347	0	140	0	1304
08:00	153	640	119	13	6	354	0	222	0	1506
09:00	153	606	119	13	6	350	72	328	0	1645
10:00	153	514	119	13	6	350	198	364	0	1716
11:00	153	465	119	13	6	319	311	326	0	1712
12:00	153	488	119	13	6	309	363	244	0	1695
13:00	153	478	119	13	6	309	338	235	0	1650
14:00	153	568	119	13	6	322	233	244	0	1657
15:00	153	647	119	13	6	339	96	269	0	1641
16:00	153	730	119	13	6	352	1	274	0	1647
17:00	153	721	119	13	6	361	0	315	0	1687
18:00	153	679	119	13	6	360	0	339	0	1669
19:00	153	674	119	13	6	354	0	326	0	1644
20:00	153	699	119	13	6	349	0	253	0	1590
21:00	153	740	119	13	6	349	0	174	0	1553
22:00	153	675	119	13	6	356	0	152	0	1473
23:00	153	622	119	13	6	354	0	96	0	1362
00:00	153	573	119	13	6	324	0	60	0	1247
Produced amount of energy MWh	3660	13488	2850	312	137	8278	1614	4554	0	34893

YEAR 2034. JANUARY
(working day, Wednesday of the third week, peak load)



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

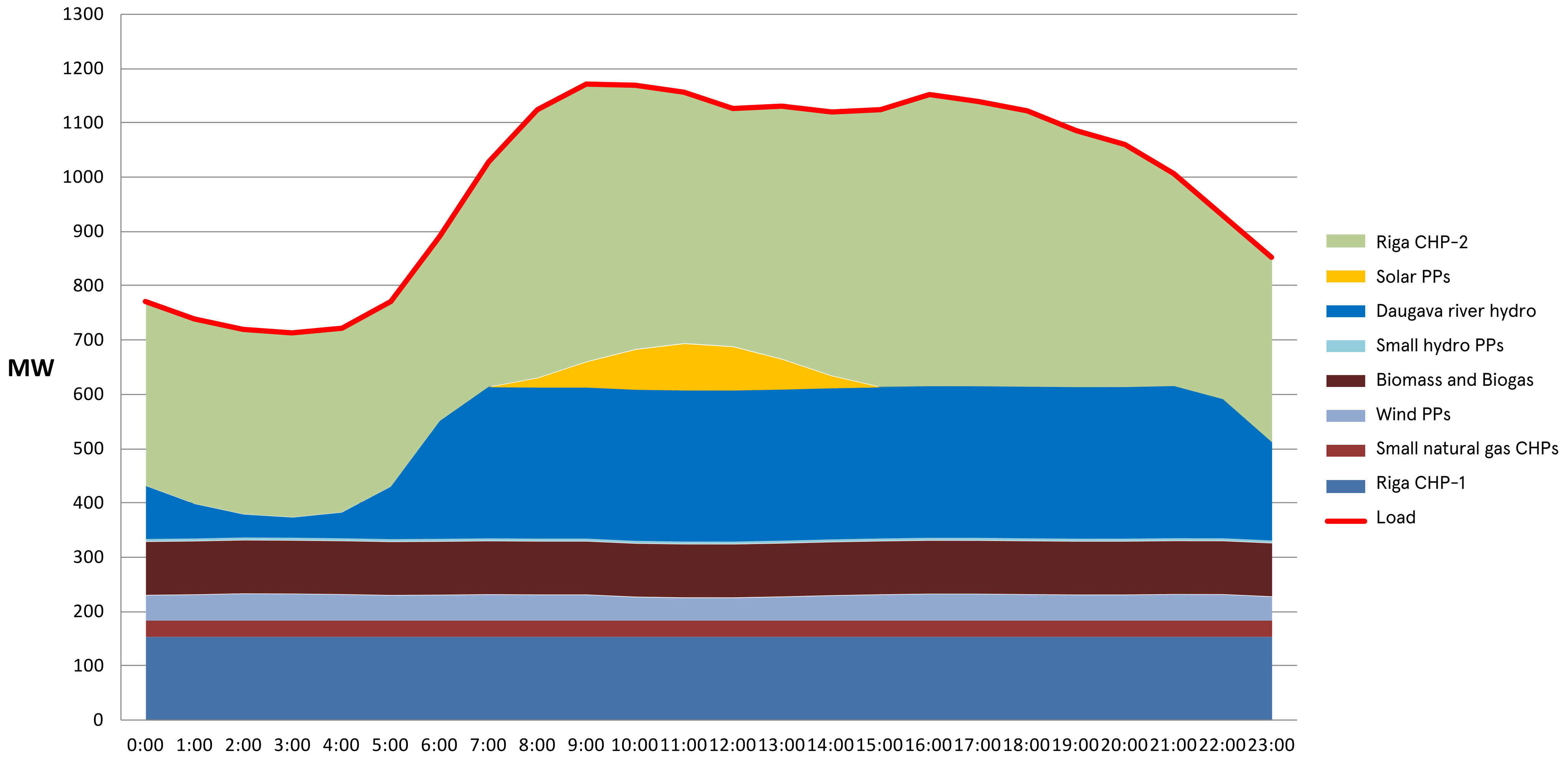
Year 2024. January (working day, Wednesday of the third week, peak load)

Table 14

Hour	Riga CHP-1	Riga CHP-2 [11]	Biomass and biogas	Gas fuelled co-generation	Small HPPs	Wind power	Solar power	Daugava HPPs [10]	Import	Load
01:00	153	341	99	32	6	45	0	97	0	772
02:00	153	340	99	32	6	47	0	63	0	738
03:00	153	340	99	32	6	48	0	42	0	719
04:00	153	340	99	32	6	48	0	37	0	714
05:00	153	340	99	32	6	47	0	47	0	723
06:00	153	340	99	32	6	45	0	96	0	770
07:00	153	340	99	32	6	46	0	216	0	890
08:00	153	414	99	32	6	47	0	278	0	1028
09:00	153	493	99	32	6	46	17	278	0	1123
10:00	153	511	99	32	6	46	47	278	0	1171
11:00	153	486	99	32	6	42	74	278	0	1169
12:00	153	463	99	32	6	41	86	278	0	1157
13:00	153	439	99	32	6	41	80	278	0	1127
14:00	153	467	99	32	6	43	55	278	0	1131
15:00	153	486	99	32	6	45	23	278	0	1120
16:00	153	511	99	32	6	47	0	278	0	1124
17:00	153	537	99	32	6	48	0	278	0	1152
18:00	153	525	99	32	6	48	0	278	0	1139
19:00	153	509	99	32	6	47	0	278	0	1122
20:00	153	473	99	32	6	46	0	278	0	1086
21:00	153	448	99	32	6	46	0	278	0	1060
22:00	153	391	99	32	6	47	0	279	0	1005
23:00	153	340	99	32	6	47	0	255	0	930
00:00	153	340	99	32	6	43	0	180	0	851
Produced amount of energy MWh	3660	10212	2376	757	137	1095	382	5204	0	23823

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

Year 2024. January (working day, Wednesday of the third week, peak load)

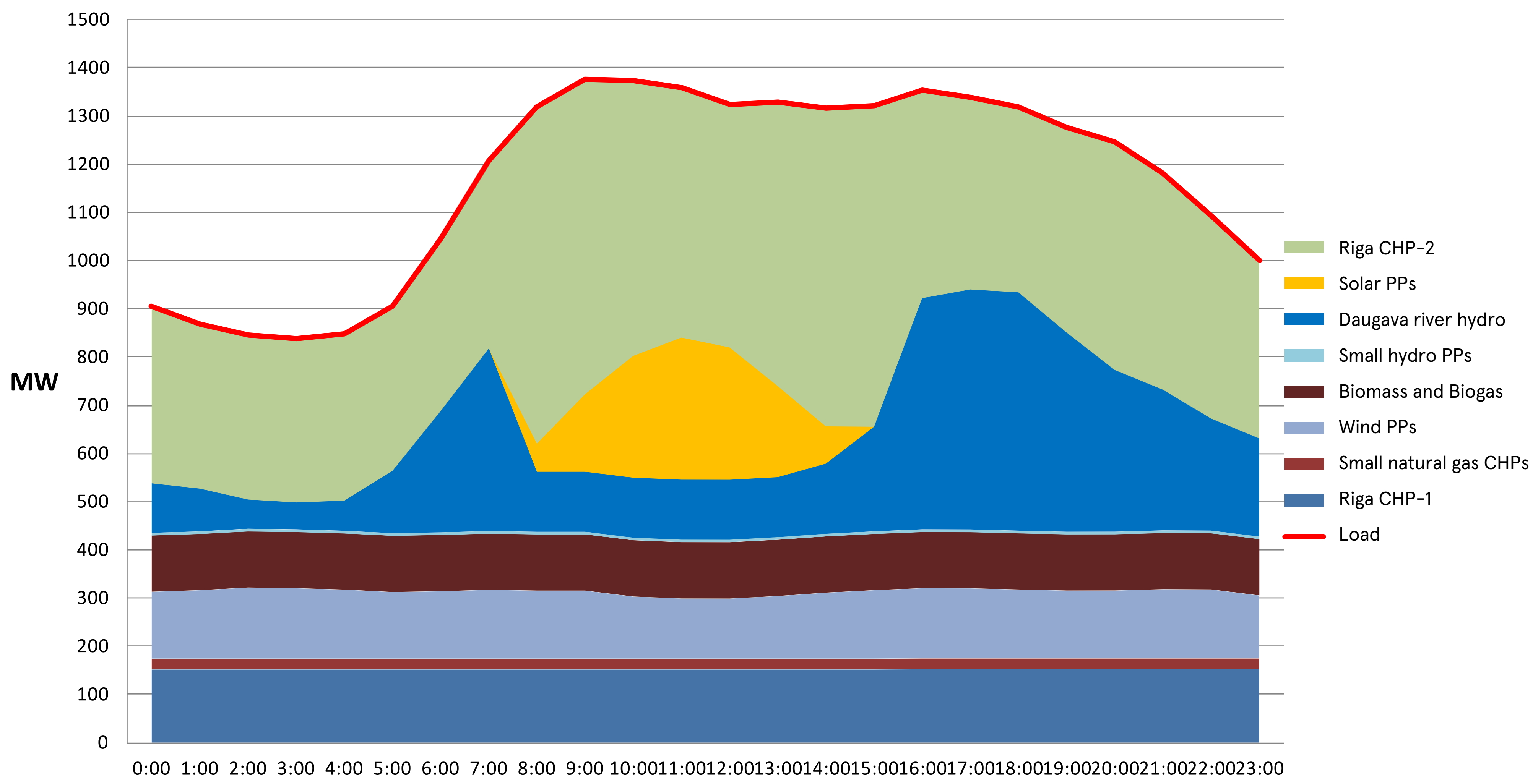


YEAR 2029. JANUARY
(working day, Wednesday of the third week, peak load)

15. tabula

Hour	Riga CHP-1	Riga CHP-2 [11]	Biomass and biogas	Gas fuelled co-generation	Small HPPs	Wind power	Solar power	Daugava HPPs [10]	Import	Load
01:00	153	368	117	22	6	138	0	103	0	903
02:00	153	340	117	22	6	141	0	89	0	860
03:00	153	340	117	22	6	147	0	61	0	865
04:00	153	340	117	22	6	145	0	56	0	856
05:00	153	346	117	22	6	142	0	63	0	892
06:00	153	340	117	22	6	137	0	130	0	970
07:00	153	357	117	22	6	139	0	252	0	1139
08:00	153	389	117	22	6	142	0	379	0	1264
09:00	153	699	117	22	6	140	59	125	0	1354
10:00	153	653	117	22	6	140	161	125	0	1386
11:00	153	570	117	22	6	128	253	125	0	1361
12:00	153	518	117	22	6	124	295	125	0	1321
13:00	153	503	117	22	6	124	275	125	0	1317
14:00	153	588	117	22	6	129	189	125	0	1287
15:00	153	660	117	22	6	136	78	146	0	1275
16:00	153	665	117	22	6	141	1	217	0	1309
17:00	153	430	117	22	6	145	0	481	0	1331
18:00	153	397	117	22	6	145	0	499	0	1317
19:00	153	384	117	22	6	142	0	495	0	1263
20:00	153	424	117	22	6	140	0	414	0	1215
21:00	153	472	117	22	6	140	0	336	0	1150
22:00	153	448	117	22	6	143	0	293	0	1096
23:00	153	420	117	22	6	142	0	233	0	1001
00:00	153	368	117	22	6	130	0	204	0	913
Produced amount of energy MWh	3664	11018	2799	535	137	3321	1311	5204	0	27990

YEAR 2029. JANUARY
(working day, Wednesday of the third week, peak load)

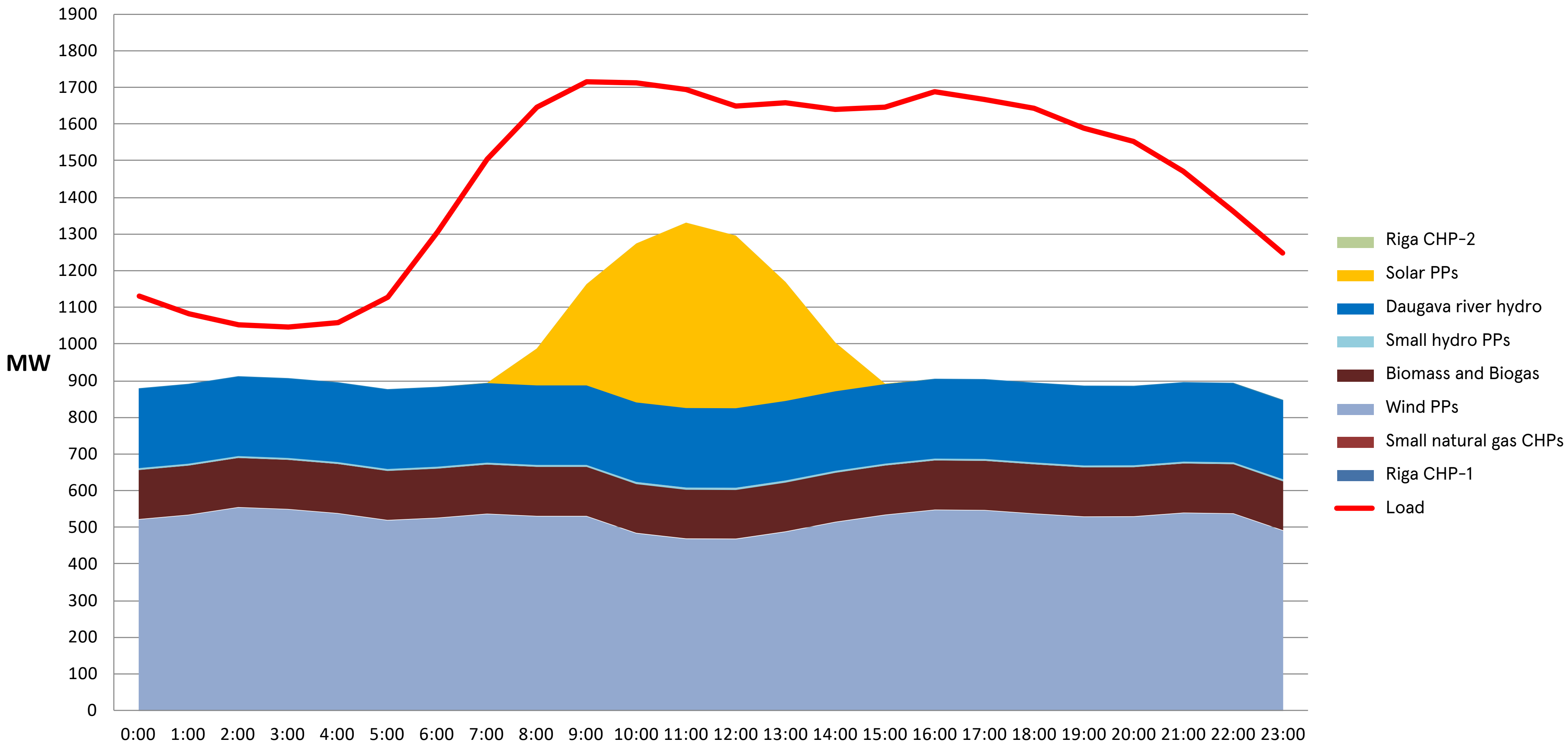


YEAR 2034. JANUARY
(working day, Wednesday of the third week, peak load)

Table 16

Hour	Riga CHP-1	Riga CHP-2 [11]	Biomass and biogas	Gas fuelled co-generation	Small HPPs	Wind power	Solar power	Daugava HPPs [10]	Import	Load
01:00	0	0	134	0	6	521	0	217	252	1130
02:00	0	0	134	0	6	533	0	217	191	1081
03:00	0	0	134	0	6	554	0	217	142	1053
04:00	0	0	134	0	6	549	0	217	140	1046
05:00	0	0	134	0	6	538	0	217	164	1058
06:00	0	0	134	0	6	519	0	217	252	1128
07:00	0	0	134	0	6	525	0	217	422	1304
08:00	0	0	134	0	6	536	1	217	612	1506
09:00	0	0	134	0	6	530	100	217	658	1645
10:00	0	0	134	0	6	530	275	217	553	1716
11:00	0	0	134	0	6	484	432	217	439	1712
12:00	0	0	134	0	6	468	504	217	365	1695
13:00	0	0	134	0	6	468	470	217	356	1650
14:00	0	0	134	0	6	488	323	217	489	1657
15:00	0	0	134	0	6	514	133	217	637	1641
16:00	0	0	134	0	6	533	1	217	755	1647
17:00	0	0	134	0	6	547	0	217	783	1687
18:00	0	0	134	0	6	546	0	217	765	1669
19:00	0	0	134	0	6	537	0	217	750	1644
20:00	0	0	134	0	6	528	0	217	705	1590
21:00	0	0	134	0	6	529	0	216	668	1553
22:00	0	0	134	0	6	539	0	216	578	1473
23:00	0	0	134	0	6	537	0	216	469	1362
00:00	0	0	134	0	6	491	0	216	400	1247
Produced amount of energy MWh	0	0	3223	0	137	12545	2240	5204	11544	34893

YEAR 2034. JANUARY
(working day, Wednesday of the third week, peak load)



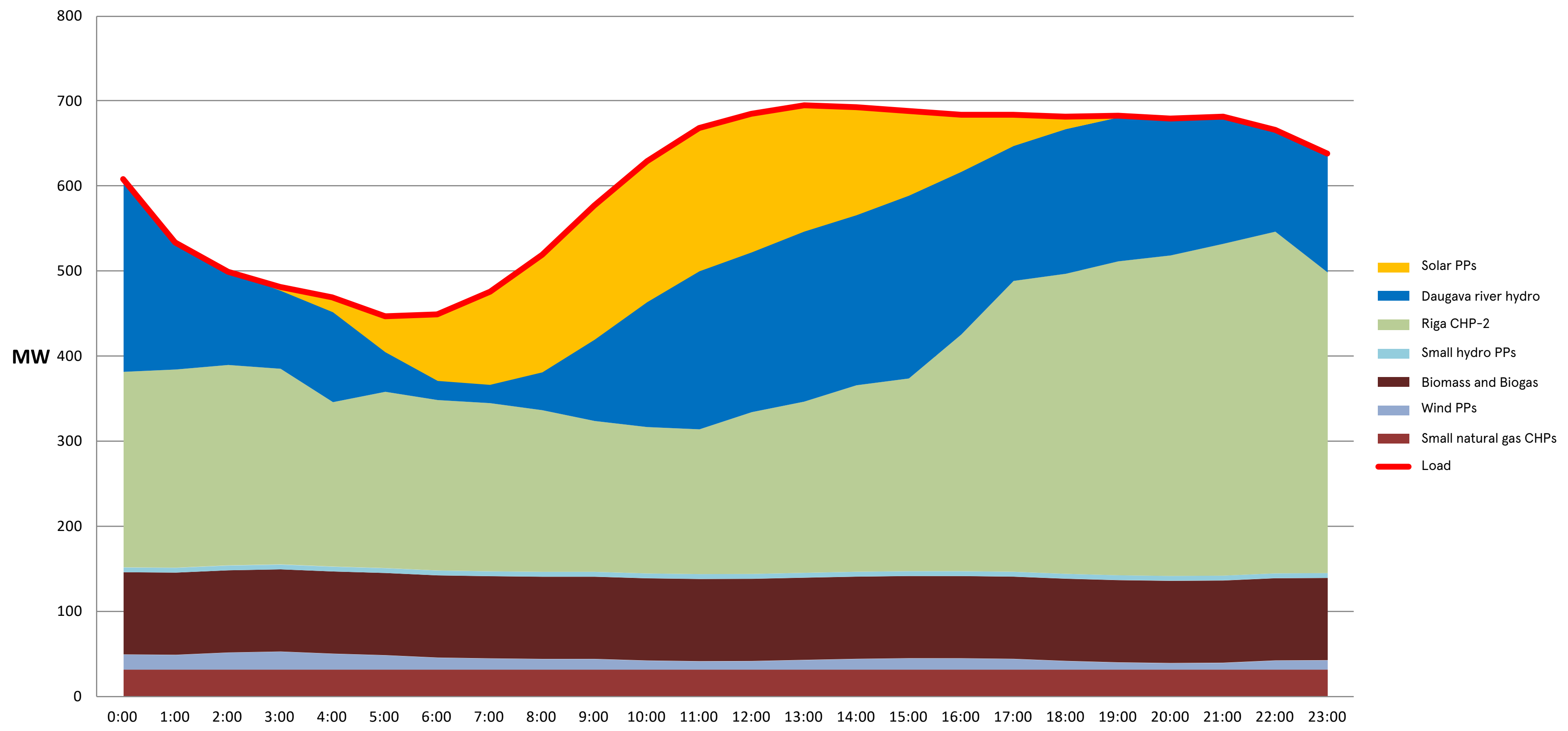
POWER DEMAND AND POSSIBLE SOURCES OF GUARANTEEING, HOURLY BALANCE FOR SCENARIO A (MINIMUM LOAD), MW
Year 2024 June – minimum monthly load

Table 17

Hour	Riga CHP-1	Biomass and biogas	Gas fuelled co-generation	Small HPPs	Wind power	Solar power	Riga CHP-2 [11]	Daugava HPPs [10]	Load	Export
00:00	0	97	32	6	18	0	230	227	608	0
01:00	0	97	32	6	17	0	233	150	534	0
02:00	0	97	32	6	20	0	235	110	499	0
03:00	0	97	32	6	21	4	230	92	481	0
04:00	0	97	32	6	19	17	193	106	469	0
05:00	0	97	32	6	17	42	207	47	447	0
06:00	0	97	32	6	14	79	200	23	450	0
07:00	0	97	32	6	13	110	197	22	476	0
08:00	0	97	32	6	12	138	190	45	519	0
09:00	0	97	32	6	12	157	177	96	576	0
10:00	0	97	32	6	10	166	172	147	629	0
11:00	0	97	32	6	10	169	170	186	668	0
12:00	0	97	32	6	10	163	190	188	685	0
13:00	0	97	32	6	11	149	201	200	695	0
14:00	0	97	32	6	12	127	219	200	692	0
15:00	0	97	32	6	13	100	226	215	688	0
16:00	0	97	32	6	13	68	278	191	684	0
17:00	0	97	32	6	12	37	342	159	684	0
18:00	0	97	32	6	10	15	352	170	681	0
19:00	0	97	32	6	8	3	369	169	683	0
20:00	0	97	32	6	7	0	376	161	679	0
21:00	0	97	32	6	8	0	390	150	681	0
22:00	0	97	32	6	11	0	401	120	666	0
23:00	0	97	32	6	11	0	353	140	638	0
Produced amount of energy MWh	**0**	**2325**	**757**	**134**	**309**	**1542**	**6131**	**3313**	**14513**	**0**

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

Year 2024 June – minimum monthly load

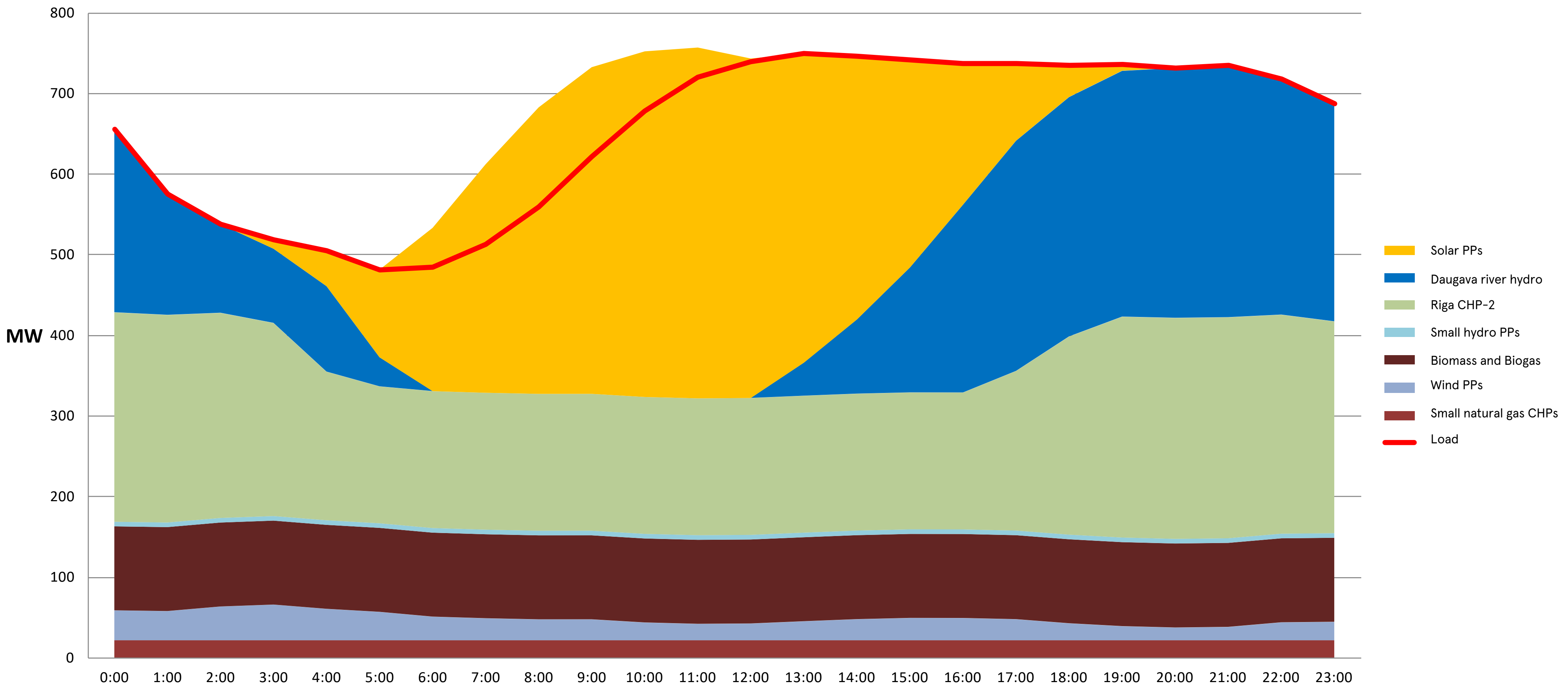


YEAR 2029 JUNE – MINIMUM MONTHLY LOAD

Table 18

Hour	Riga CHP-1	Biomass and biogas	Gas fuelled co-generation	Small HPPs	Wind power	Solar power	Riga CHP-2 [11]	Daugava HPPs [10]	Load	Export
00:00	0	104	22	6	37	0	260	227	656	0
01:00	0	104	22	6	36	0	258	150	576	0
02:00	0	104	22	6	42	0	255	110	538	0
03:00	0	104	22	6	44	11	240	92	519	0
04:00	0	104	22	6	39	44	185	106	505	0
05:00	0	104	22	6	35	109	170	36	482	0
06:00	0	104	22	6	29	203	170	0	485	49
07:00	0	104	22	6	27	283	170	0	513	99
08:00	0	104	22	6	26	355	170	0	559	124
09:00	0	104	22	6	26	405	170	0	621	111
10:00	0	104	22	6	22	429	170	0	679	74
11:00	0	104	22	6	20	435	170	0	720	37
12:00	0	104	22	6	21	421	170	0	739	5
13:00	0	104	22	6	23	384	170	41	750	0
14:00	0	104	22	6	26	327	170	92	746	0
15:00	0	104	22	6	27	257	170	155	742	0
16:00	0	104	22	6	27	175	170	233	737	0
17:00	0	104	22	6	26	95	198	286	737	0
18:00	0	104	22	6	21	39	246	297	735	0
19:00	0	104	22	6	17	8	274	305	736	0
20:00	0	104	22	6	16	0	274	310	732	0
21:00	0	104	22	6	16	0	274	312	735	0
22:00	0	104	22	6	22	0	272	292	718	0
23:00	0	104	22	6	23	0	263	270	688	0
Produced amount of energy MWh	**0**	**2494**	**535**	**137**	**647**	**3980**	**5040**	**3313**	**15646**	**498**

YEAR 2029 JUNE – MINIMUM MONTHLY LOAD

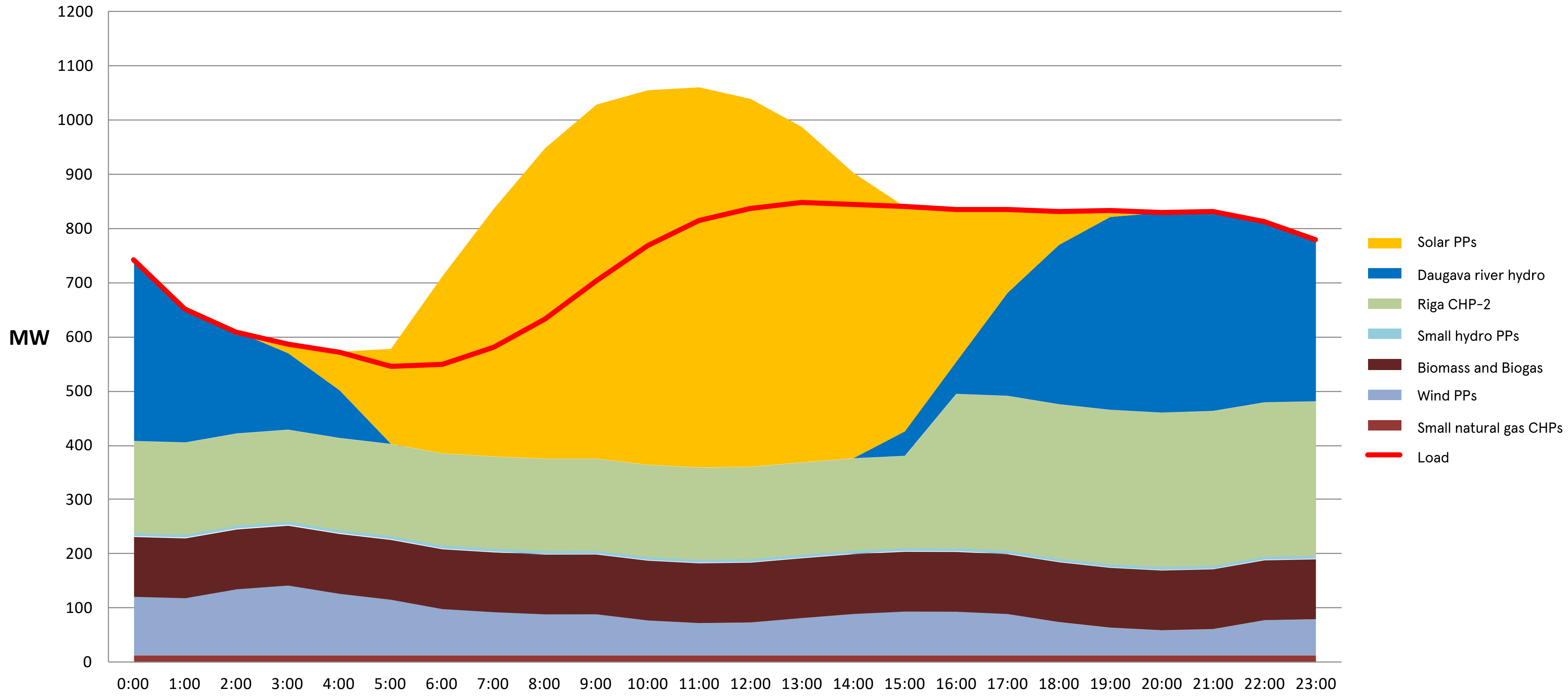


YEAR 2034 JUNE – MINIMUM MONTHLY LOAD

Table 19

Hour	Riga CHP-1	Biomass and biogas	Gas fuelled co-generation	Small HPPs	Wind power	Solar power	Riga CHP-2 [11]	Daugava HPPs [10]	Load	Export
00:00	0	111	13	6	108	0	170	335	743	0
01:00	0	111	13	6	105	0	170	247	652	0
02:00	0	111	13	6	122	0	170	188	609	0
03:00	0	111	13	6	129	18	170	141	587	0
04:00	0	111	13	6	113	71	170	88	572	0
05:00	0	111	13	6	102	175	170	0	545	32
06:00	0	111	13	6	85	327	170	0	549	162
07:00	0	111	13	6	79	457	170	0	581	254
08:00	0	111	13	6	75	573	170	0	633	314
09:00	0	111	13	6	75	653	170	0	704	325
10:00	0	111	13	6	64	691	170	0	768	286
11:00	0	111	13	6	59	702	170	0	815	245
12:00	0	111	13	6	60	679	170	0	837	202
13:00	0	111	13	6	68	619	170	0	849	138
14:00	0	111	13	6	76	527	170	0	845	57
15:00	0	111	13	6	80	415	170	45	840	0
16:00	0	111	13	6	80	281	285	59	835	0
17:00	0	111	13	6	76	154	285	190	834	0
18:00	0	111	13	6	61	63	285	294	832	0
19:00	0	111	13	6	51	13	285	356	834	0
20:00	0	111	13	6	46	0	285	369	829	0
21:00	0	111	13	6	48	0	285	369	832	0
22:00	0	111	13	6	64	0	285	334	813	0
23:00	0	111	13	6	66	0	285	298	779	0
Produced amount of energy MWh	0	2663	312	137	2473	6417	4999	3313	17718	2017

YEAR 2034 JUNE – MINIMUM MONTHLY LOAD



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

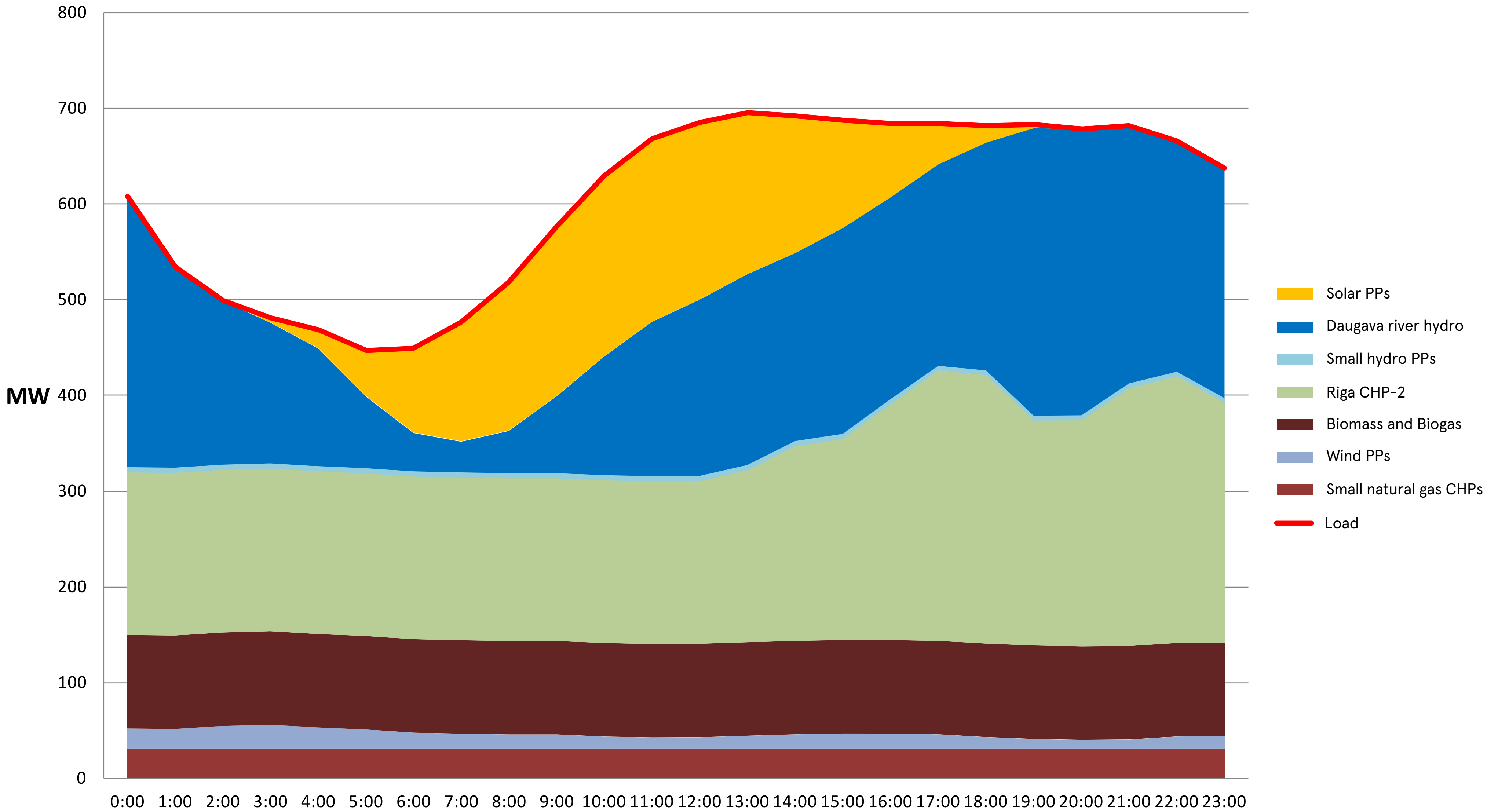
Year 2024 June – minimum monthly load

Table 20

Hour	Riga CHP-1	Biomass and biogas	Gas fuelled co-generation	Small HPPs	Wind power	Solar power	Riga CHP-2 [11]	Daugava HPPs [10]	Load	Export
00:00	0	98	32	6	20	0	170	283	608	0
01:00	0	98	32	6	20	0	170	209	534	0
02:00	0	98	32	6	23	0	170	171	499	0
03:00	0	98	32	6	24	5	170	147	481	0
04:00	0	98	32	6	22	19	170	123	469	0
05:00	0	98	32	6	19	48	170	75	447	0
06:00	0	98	32	6	16	89	170	40	450	0
07:00	0	98	32	6	15	124	170	32	476	0
08:00	0	98	32	6	14	156	170	44	519	0
09:00	0	98	32	6	14	178	170	80	576	0
10:00	0	98	32	6	12	188	170	124	629	0
11:00	0	98	32	6	11	191	170	161	668	0
12:00	0	98	32	6	11	185	170	184	685	0
13:00	0	98	32	6	13	168	180	199	695	0
14:00	0	98	32	6	14	143	203	196	692	0
15:00	0	98	32	6	15	113	210	215	688	0
16:00	0	98	32	6	15	77	246	211	684	0
17:00	0	98	32	6	14	42	282	211	684	0
18:00	0	98	32	6	12	17	280	238	681	0
19:00	0	98	32	6	10	4	235	300	683	0
20:00	0	98	32	6	9	0	236	299	679	0
21:00	0	98	32	6	9	0	269	269	681	0
22:00	0	98	32	6	12	0	278	241	666	0
23:00	0	98	32	6	13	0	250	240	638	0
Produced amount of energy MWh	0	2342	757	137	360	1746	4879	4292	14513	0

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

Year 2024 June – minimum monthly load



YEAR 2029 JUNE – MINIMUM MONTHLY LOAD

Table 21

Hour	Riga CHP-1	Biomass and biogas	Gas fuelled co-generation	Small HPPs	Wind power	Solar power	Riga CHP-2 [11]	Daugava HPPs [10]	Load	Export
00:00	0	108	22	6	54	0	170	344	656	49
01:00	0	108	22	6	53	0	170	266	576	49
02:00	0	108	22	6	61	0	170	220	538	49
03:00	0	108	22	6	65	14	170	134	519	0
04:00	0	108	22	6	57	58	170	85	505	0
05:00	0	108	22	6	51	142	170	0	482	18
06:00	0	108	22	6	43	265	170	0	485	129
07:00	0	108	22	6	40	370	170	0	513	203
08:00	0	108	22	6	38	464	170	0	559	249
09:00	0	108	22	6	38	529	170	0	621	252
10:00	0	108	22	6	32	560	170	0	679	220
11:00	0	108	22	6	30	569	170	0	720	184
12:00	0	108	22	6	30	550	170	0	739	148
13:00	0	108	22	6	34	502	170	0	750	92
14:00	0	108	22	6	38	427	170	0	746	25
15:00	0	108	22	6	40	336	170	59	742	0
16:00	0	108	22	6	40	228	170	163	737	0
17:00	0	108	22	6	38	125	170	268	737	0
18:00	0	108	22	6	31	51	170	347	735	0
19:00	0	108	22	6	25	10	170	394	736	0
20:00	0	108	22	6	23	0	170	521	732	118
21:00	0	108	22	6	24	0	170	523	735	118
22:00	0	108	22	6	32	0	170	497	718	118
23:00	0	108	22	6	33	0	170	471	688	123
Produced amount of energy MWh	**0**	**2596**	**535**	**137**	**950**	**5201**	**4080**	**4294**	**15646**	**2143**

YEAR 2029 JUNE – MINIMUM MONTHLY LOAD

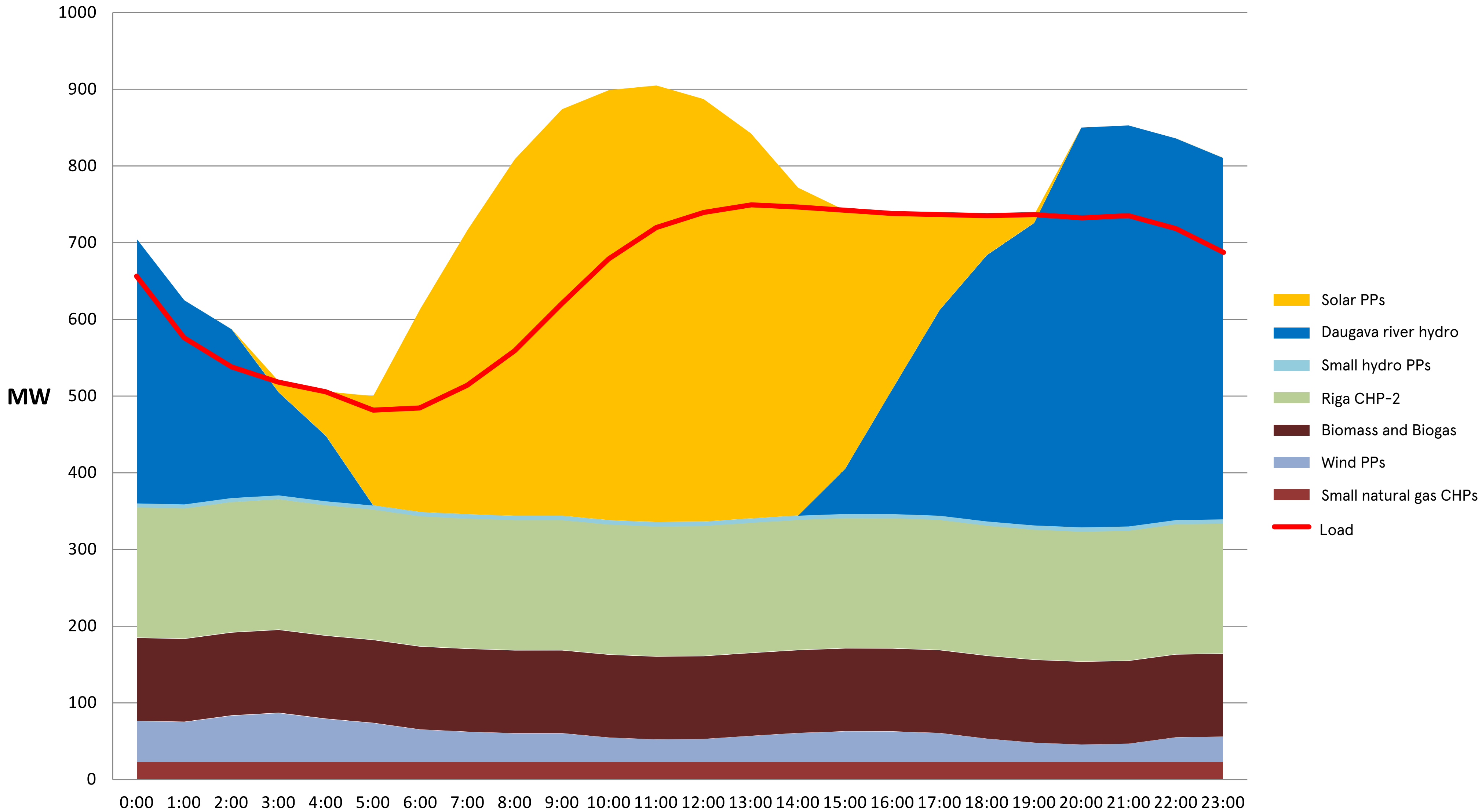
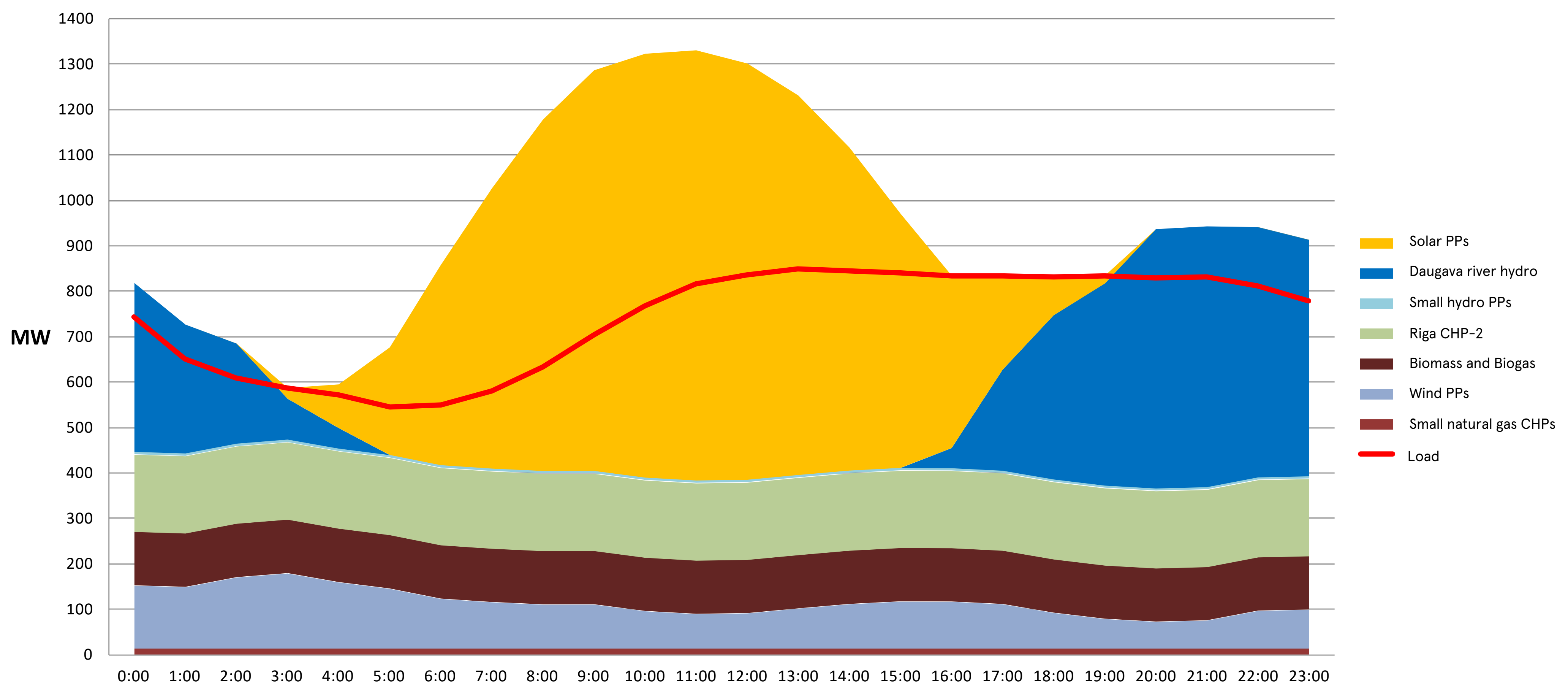


Table 22

Hour	Riga CHP-1	Biomass and biogas	Gas fuelled co-generation	Small HPPs	Wind power	Solar power	Riga CHP-2 [11)]	Daugava HPPs [10)]	Load	Export
00:00	0	119	13	6	139	0	170	371	743	45
01:00	0	119	13	6	136	0	170	283	652	45
02:00	0	119	13	6	158	0	170	220	609	45
03:00	0	119	13	6	166	24	170	90	587	45
04:00	0	119	13	6	147	96	170	45	572	45
05:00	0	119	13	6	132	237	170	0	545	45
06:00	0	119	13	6	110	441	170	0	549	45
07:00	0	119	13	6	102	616	170	0	581	45
08:00	0	119	13	6	97	773	170	0	633	621
09:00	0	119	13	6	97	881	170	0	704	551
10:00	0	119	13	6	83	932	170	0	768	486
11:00	0	119	13	6	76	946	170	0	815	439
12:00	0	119	13	6	78	916	170	0	837	418
13:00	0	119	13	6	88	835	170	0	849	406
14:00	0	119	13	6	98	711	170	0	845	410
15:00	0	119	13	6	104	559	170	0	840	415
16:00	0	119	13	6	104	380	170	44	835	420
17:00	0	119	13	6	98	207	170	222	834	420
18:00	0	119	13	6	79	84	170	361	832	423
19:00	0	119	13	6	65	17	170	444	834	81
20:00	0	119	13	6	59	0	170	570	829	45
21:00	0	119	13	6	62	0	170	573	832	45
22:00	0	119	13	6	83	0	170	550	813	45
23:00	0	119	13	6	86	0	170	520	779	45
Produced amount of energy MWh	0	2850	312	137	2449	8656	4080	4292	17718	5058

YEAR 2034 JUNE – MINIMUM MONTHLY LOAD

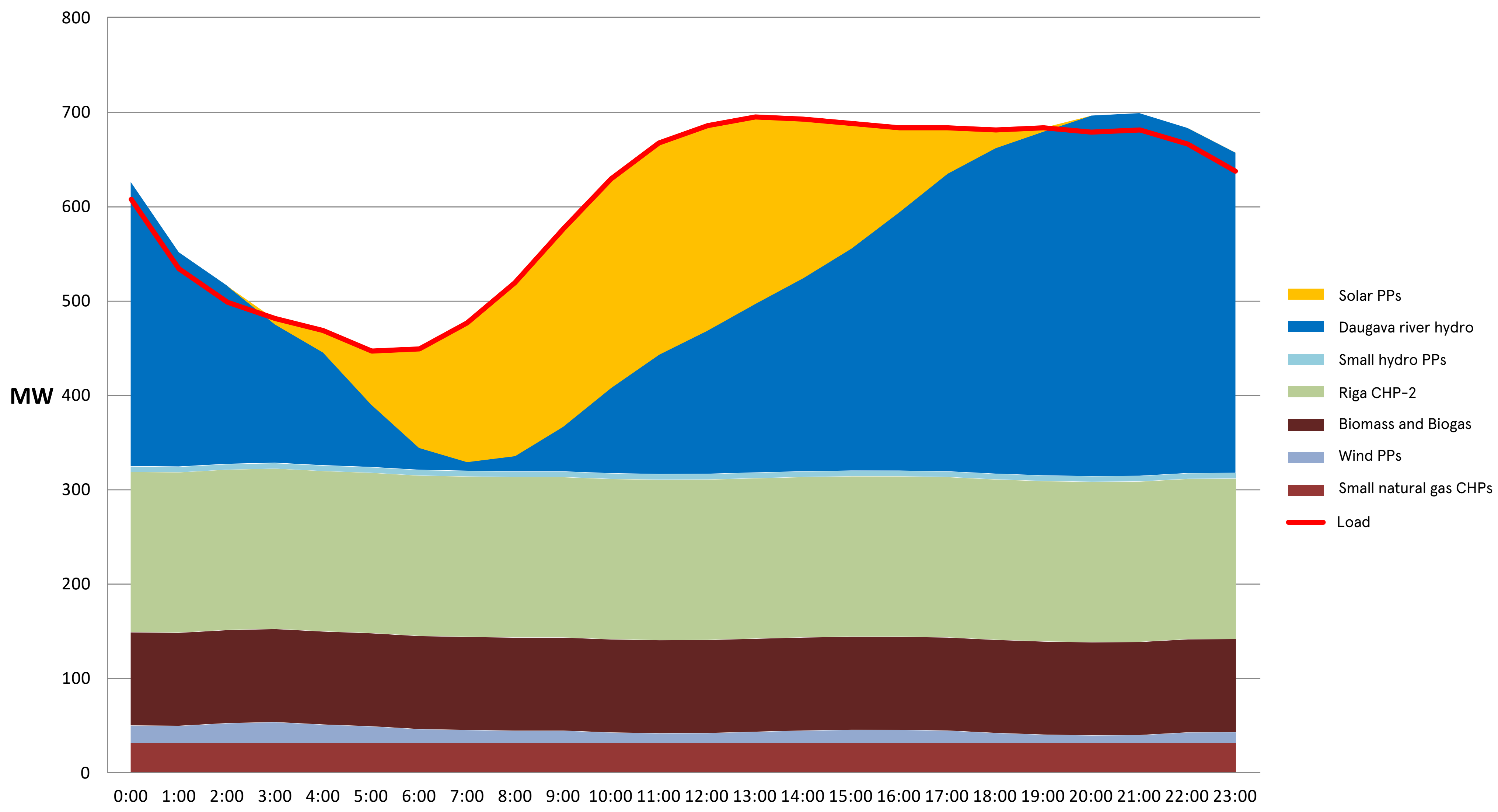


POWER DEMAND AND POSSIBLE SOURCES OF GUARANTEEING, HOURLY BALANCE FOR OPTIMISTIC SCENARIO EU2030 (MINIMUM LOAD), MW. Year 2024 June – minimum monthly load

Table 23

Hour	Riga CHP-1	Biomass and biogas	Gas fuelled co-generation	Small HPPs	Wind power	Solar power	Riga CHP-2 [11)]	Daugava HPPs [10)]	Load	Export
00:00	0	99	32	6	18	0	170	301	608	17
01:00	0	99	32	6	18	0	170	227	534	17
02:00	0	99	32	6	21	0	170	189	499	17
03:00	0	99	32	6	22	6	170	147	481	0
04:00	0	99	32	6	19	23	170	120	469	0
05:00	0	99	32	6	18	56	170	67	447	0
06:00	0	99	32	6	15	104	170	24	450	0
07:00	0	99	32	6	14	146	170	10	476	0
08:00	0	99	32	6	13	183	170	17	519	0
09:00	0	99	32	6	13	209	170	48	576	0
10:00	0	99	32	6	11	221	170	91	629	0
11:00	0	99	32	6	10	224	170	127	668	0
12:00	0	99	32	6	10	217	170	152	685	0
13:00	0	99	32	6	12	198	170	179	695	0
14:00	0	99	32	6	13	168	170	205	692	0
15:00	0	99	32	6	14	133	170	235	688	0
16:00	0	99	32	6	14	90	170	274	684	0
17:00	0	99	32	6	13	49	170	315	684	0
18:00	0	99	32	6	10	20	170	345	681	0
19:00	0	99	32	6	9	4	170	364	683	0
20:00	0	99	32	6	8	0	170	382	679	17
21:00	0	99	32	6	8	0	170	384	681	17
22:00	0	99	32	6	11	0	170	366	666	17
23:00	0	99	32	6	11	0	170	339	638	19
Produced amount of energy MWh	**0**	**2376**	**757**	**137**	**324**	**2051**	**4080**	**4908**	**14513**	**120**

POWER DEMAND AND POSSIBLE SOURCES OF GUARANTEEING, HOURLY BALANCE FOR OPTIMISTIC SCENARIO EU2030 (MINIMUM LOAD), MW. Year 2024 June – minimum monthly load

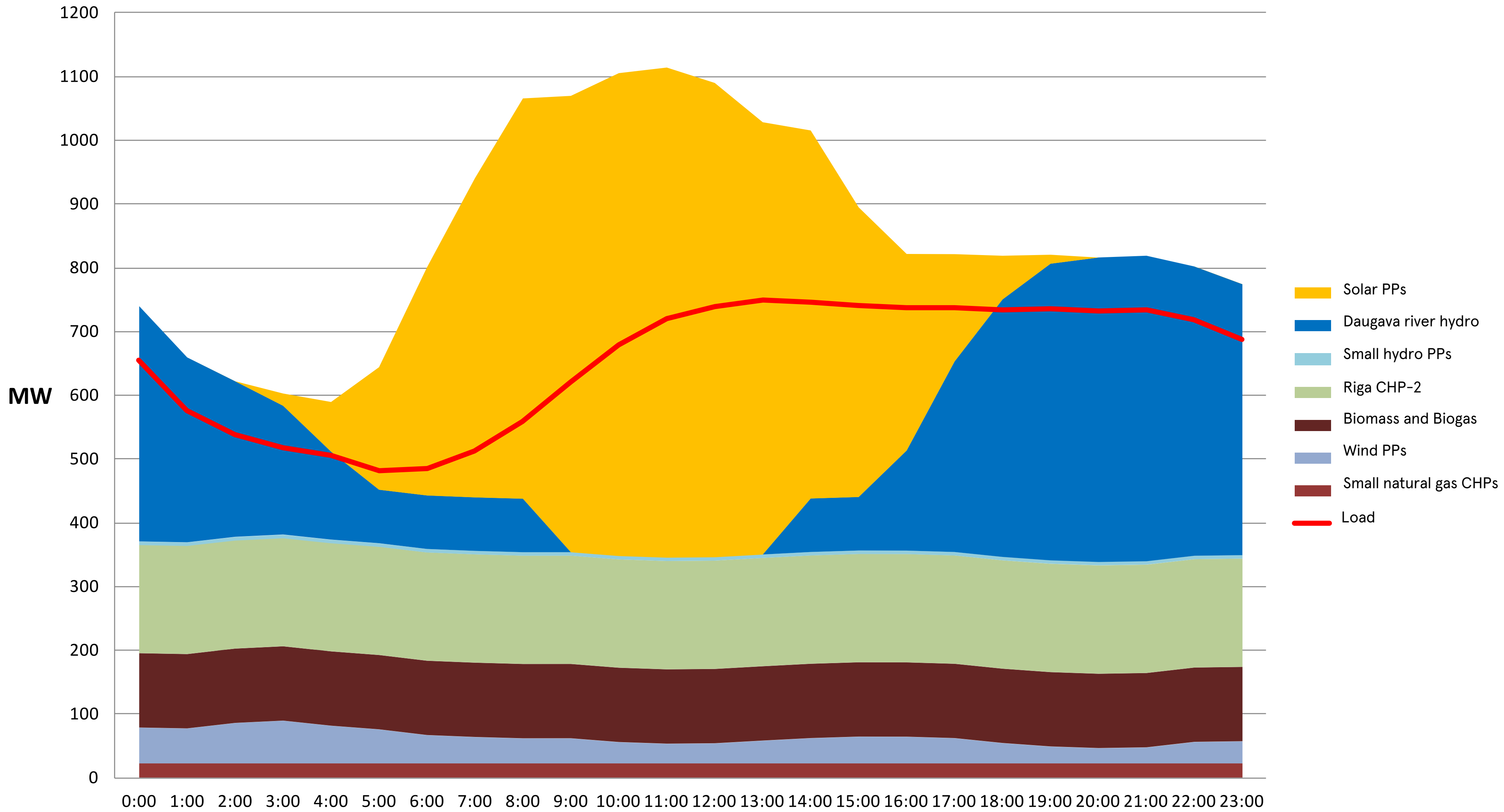


YEAR 2029 JUNE – MINIMUM MONTHLY LOAD

Table 24

Hour	Riga CHP-1	Biomass and biogas	Gas fuelled co-generation	Small HPPs	Wind power	Solar power	Riga CHP-2 [11)]	Daugava HPPs [10)]	Load	Export
00:00	Rīgas TEC1	117	22	6	56	0	170	369	656	84
01:00	0	117	22	6	55	0	170	290	576	84
02:00	0	117	22	6	63	0	170	244	538	84
03:00	0	117	22	6	67	19	170	202	519	84
04:00	0	117	22	6	59	78	170	138	505	84
05:00	0	117	22	6	53	192	170	84	482	162
06:00	0	117	22	6	44	358	170	84	485	316
07:00	0	117	22	6	41	501	170	84	513	427
08:00	0	117	22	6	39	628	170	84	559	506
09:00	0	117	22	6	39	716	170	0	621	448
10:00	0	117	22	6	33	758	170	0	679	427
11:00	0	117	22	6	31	769	170	0	720	394
12:00	0	117	22	6	31	744	170	0	739	351
13:00	0	117	22	6	35	678	170	0	750	279
14:00	0	117	22	6	39	577	170	84	746	269
15:00	0	117	22	6	42	454	170	84	742	153
16:00	0	117	22	6	42	308	170	157	737	84
17:00	0	117	22	6	39	168	170	299	737	84
18:00	0	117	22	6	32	69	170	404	735	84
19:00	0	117	22	6	26	14	170	465	736	84
20:00	0	117	22	6	24	0	170	478	732	84
21:00	0	117	22	6	25	0	170	479	735	84
22:00	0	117	22	6	33	0	170	454	718	84
23:00	0	117	22	6	34	0	170	425	688	86
Produced amount of energy MWh	0	2799	535	137	983	7032	4080	4908	15646	4828

YEAR 2029 JUNE – MINIMUM MONTHLY LOAD



YEAR 2034 JUNE – MINIMUM MONTHLY LOAD

Table 25

Hour	Riga CHP-1	Biomass and biogas	Gas fuelled co-generation	Small HPPs	Wind power	Solar power	Riga CHP-2 [11)	Daugava HPPs [10)	Load	Export
00:00	0	134	0	6	211	0	0	391	743	34
01:00	0	134	0	6	206	0	0	306	652	35
02:00	0	134	0	6	239	0	0	244	609	35
03:00	0	134	0	6	252	33	0	200	587	35
04:00	0	134	0	6	222	133	0	150	572	35
05:00	0	134	0	6	201	328	0	70	545	35
06:00	0	134	0	6	167	611	0	0	549	35
07:00	0	134	0	6	155	856	0	0	581	36
08:00	0	134	0	6	147	1073	0	0	633	889
09:00	0	134	0	6	148	1223	0	0	704	819
10:00	0	134	0	6	125	1294	0	0	768	754
11:00	0	134	0	6	116	1313	0	0	815	707
12:00	0	134	0	6	118	1271	0	0	837	686
13:00	0	134	0	6	134	1159	0	0	849	674
14:00	0	134	0	6	149	986	0	0	845	678
15:00	0	134	0	6	158	776	0	0	840	683
16:00	0	134	0	6	157	527	0	11	835	688
17:00	0	134	0	6	149	288	0	258	834	688
18:00	0	134	0	6	120	117	0	455	832	691
19:00	0	134	0	6	99	24	0	571	834	0
20:00	0	134	0	6	89	0	0	599	829	35
21:00	0	134	0	6	94	0	0	598	832	35
22:00	0	134	0	6	126	0	0	546	813	40
23:00	0	134	0	6	130	0	0	509	779	40
Produced amount of energy MWh	0	3223	0	137	3712	12014	0	4908	17718	8385

YEAR 2034 JUNE – MINIMUM MONTHLY LOAD