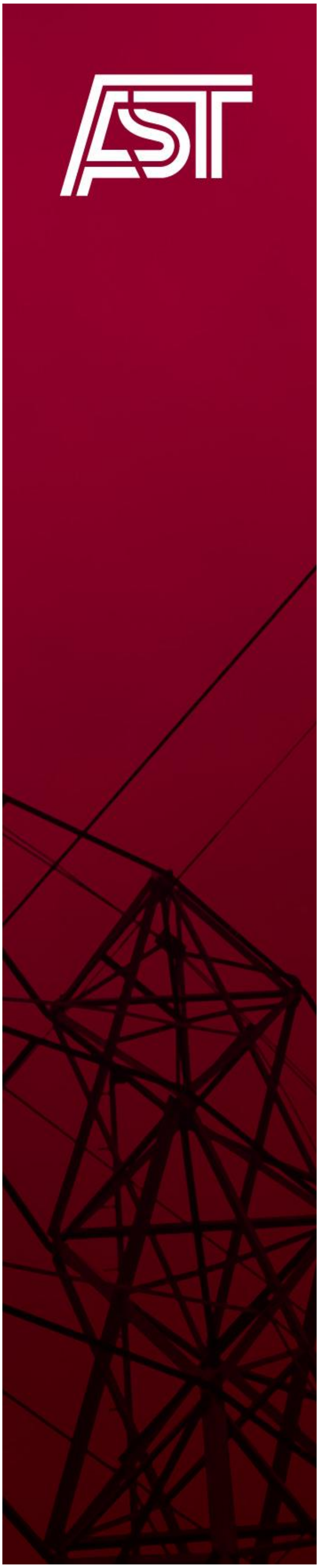

Annual statement of transmission system operator for the year 2015

Riga – 2016

Table of Contents

1. Electricity and power demand in the country last year ... 3
1.1. Electricity consumption (including losses) by week for year 2015. ... 3
1.2. Maximum winter peak load and minimum summer load (control-measurement data, MWh/h). ... 3
1.3. System load in control measurement days (24 hours). ... 3
2. Electricity and power demand in the coming years (minimum forecast period - 10 years), including the annual electricity consumption and peak loads by scenarios. ... 4
3. Supply and consumption compliance rating during the reporting period and forecast for the future years (minimum forecast period - 10 years) ... 5
3.1. Annual power consumption and possible sources of power supplies. ... 5
3.2. Information on energy cross-border trade amounts for 2015, comparison to 2014. ... 34
3.3. TSO evaluation for the time periods of insufficient power adequacy and suggestions for power supply guarantee in forthcoming years (i.e. generation development on certain locations, demand side management, new infrastructure creation). ... 34
3.4. Information on required and available emergency reserve capacities, replacement reserves (MW) and amount of reserve utilisation (MWh) in 2015. ... 38
3.5. TSO conclusions on generation capacity and power availability for the needs of power supply providing for Latvian consumers. ... 38
3.6. Conclusions of the TSO on the generation capacity adequacy and energy availability in the region of Baltic countries – Latvia, Lithuania and Estonia. ... 40
4. Transmission system adequacy for demand and maintenance quality ... 42
4.1. 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). ... 42
4.2. Information about the planned system interconnections and internal power system infrastructure projects of strategic importance (minimum forecast period - 10 years) ... 43
4.3. 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). ... 47
4.4. Existing generation capacities, greater than 1 MW. ... 47
4.5. Actions during maximum demand or supply deficit periods. ... 50

The Report is prepared in accordance with the Regulation No. 322 "Regulations on the TSO's annual statement" by Latvian Cabinet of Ministers from April 25, 2006, taking into account "Energy Development Guidelines for years 2007-2016 in Latvia" approved by the Latvian Cabinet of Ministers (Order No 571) on August 1, 2006, as well as taking into account "Energy Development Guidelines for years 2016-2020 in Latvia" approved by the Latvian Cabinet of Ministers (Order No. 129) on February 9, 2016.

1. Electricity and power demand in the country last year

1.1. Electricity consumption (including losses) by week for year 2015.

Total annual energy consumption including losses equals 7 207 586 MWh.

Table 1

Week	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Consumption, MWh	143467	161742	152082	157456	154652	154579	152770	151638
Week	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Consumption, MWh	147475	144477	140192	139975	140684	137725	132713	136412
Week	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**
Consumption, MWh	134133	126087	126586	130441	128232	123804	120810	120893
Week	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**
Consumption, MWh	122767	110909	121999	121093	119644	120409	120097	126067
Week	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
Consumption, MWh	127414	124764	126715	127055	127292	129992	128831	130123
Week	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**
Consumption, MWh	136171	140878	140728	141665	141819	140426	141808	152261
Week	**49**	**50**	**51**	**52**	**53**			
Consumption, MWh	149474	148824	149893	132828	146617			

1.2. Maximum winter peak load and minimum summer load (control-measurement data, MWh/h).

Minimum load:	453 MW	24.06.2015.g.	06.00
Maximum load:	1241 MW	08.01.2015.g.	17.00

1.3. System load in control measurement days (24 hours).

Table 2

2015	**June 24**	**January 31**
h	**MWh**	**MWh**
01:00	565	768
02:00	534	721
03:00	503	704
04:00	482	697
05:00	459	709
06:00	453	754
07:00	461	876
08:00	480	1036
09:00	521	1142

10:00	564	1179
11:00	591	1193
12:00	611	1174
13:00	616	1141
14:00	615	1168
15:00	621	1174
16:00	622	1177
17:00	629	1241
18:00	631	1204
19:00	634	1179
20:00	637	1131
21:00	648	1089
22:00	644	1028
23:00	626	939
00:00	601	835
Total	**13 748**	**24 259**

2. Electricity and power demand in the coming years (minimum forecast period - 10 years), including the annual electricity consumption and peak loads by scenarios.

Maximum power system load is calculated (normalized) based on GDP growth forecast submitted by the Latvian Ministry of Economics at the average regulated outdoor temperature during winter period (December-February) -3.5°C (Table 3). Changes in outdoor temperature also affect changes to the maximum load. Electricity consumption of the system is forecasted for three scenarios – conservative (A), base (B) and optimistic (EU)

Table 3

Year	Annual consumption for conservative scenario (A)	Annual consumption for base scenario (B)	Annual consumption for optimistic scenario (EU)	Peak load
	GWh	GWh	GWh	MW
2016	7185	7185	7332	1262
2017	7218	7248	7427	1285
2018	7247	7307	7520	1308
2019	7285	7378	7626	1333
2020	7327	7453	7737	1359
2021	7369	7530	7852	1387
2022	7409	7606	7968	1414
2023	7468	7703	8106	1446
2024	7506	7780	8225	1475
2025	7542	7857	8346	1505
2026	7588	7945	8480	1537

3. Supply and consumption compliance rating during the reporting period and forecast for the future years (minimum forecast period - 10 years)

3.1. Annual power consumption and possible sources of power supplies.

Electricity and electrical power balances as well as electricity consumption forecast is developed for three scenarios:

- **Scenario A "Conservative development".** Electricity system load forecast is based on the information on the load and electricity consumption forecast, supplied by distribution system operators. Forecast of the generation development is prepared, taking into account operation of the gas burning power stations in the energy market environment, operating mainly in co-generation mode during the winter periods. In conservative scenario development of wind power stations, bio-mass, bio-gas, small scale gas co-generation and solar generation stations is planned based on assumption, that development of each above mentioned generation type can be affected by possible changes in governmental support schemes.

- **Scenario B "Base scenario"** Electricity system load forecast is based on GDP growth forecast for Latvia, supplied by Ministry of Economy to the users involved in energy sector, as well as based on the information on the load and electricity consumption forecast, supplied by distribution system operators. Forecast of generation development takes into account power stations planned for commissioning or de-commissioning based on the information supplied by all power system users to the transmission system operator (TSO). In Base scenario (B) production of the Daugava HPP cascade and Riga CHP's is planned based on the annual average production. Development of the wind power stations, bio-mass and bio-gas stations, small gas co-generation stations and solar power stations is based on historical development tempo data for each type of generation in Latvia at moderate economy development tempo in the country.

- **Scenario EU "Optimistic development"** Generation development forecast and electricity system load increase are based on GDP increase forecast for Latvia, submitted by the Ministry of Economy, taking into account desired generation and load increase tempos necessary to achieve the development goals for 2020 and 2030 by EU, based on "Energy Development Guidelines for years 2016-2020 in Latvia" approved by the Latvian Cabinet of Ministers (Order No 129) on February 9, 2016. In this scenario, in addition to the development tempos from scenarios A and B, possible future power stations are taken into account, commissioning of which are deemed possible based on the information available at TSO. In this scenario forecasted development of wind, solar, bio-mass and bio-gas power stations is much faster, due to stronger governmental support and wider transmission system infrastructure development.

Note: *Power plant output is presented in net values and takes into account the power station planned annual maintenance schedules.*

Assumptions and explanations for the tables:

[1] Daugava cascade hydropower plants (hereinafter - the Daugava HPP) multi-annual average net output according to the statistical data are 2700 GWh per year.

[2] In 2010, a five-party agreement of BRELL ring concluded between the Estonian, Latvian, Lithuanian, Russian and Belarusian TSO provides for the mutual provision of emergency reserves from the beginning of the realization and up to 12 hours. Emergency reserve for Latvia provides BRELL five-party agreement on a common emergency reserve maintenance for each of the parties involved, maintaining 100 MW each, which consists of the sum of 500 MW. Taking into consideration the largest generating unit load in Latvia, Latvian power system needs of the emergency reserve is ensured according to the maximum generating units planned load, i.e. up to 442 MW (RigaCHP-2 largest unit). The available power reserves in Latvia is 100MW, and other missing power amount 342MW from neighbouring power systems can be received only 12 hours.

[3] Necessary emergency and replacement reserve for provision of Latvian power system operational security according to planned load and generation development scenarios.

[4] Power system regulation reserve assessed as 6% of the system peak load and 10% of the installed wind power station capacity for winter day peak load.

[5] For power balance monthly assessment it is necessary to account water inflow for Daugava HPPs in Daugava river. For “Conservative scenario” (A) January least average inflow since 2000 has been in 2003 (150 m3/s, which corresponds to 270 MW of power for covering peak demand). In “Base scenario” (B) inflow for Daugava HPPs is assumed 200 m3/s, which corresponds to 350 MW power equivalent. In “Optimistic scenario” (EU) inflow for Daugava HPPs is assumed 230 m3/s, which corresponds to 400 MW power equivalent. For coverage of minimum load during the June the same inflow values are assumed for each scenario respectively.

[6] Installed capacities of power stations in the tables are presented, including their own self-consumption (gross), but the rest of the tables are shown excluding self-consumption (net). Gross output is the total capacity of the power station developed by all main generator units and generators for self-consumption. Net power output is gross output minus the power of the self-consumption equipment required for feeding power and power losses in transformers.

[7] Wind power installed capacity and net capacity for Conservative scenario (A) and Base Scenario (B) assumed on the basis of the information report "Latvian Republic Action for renewable energy in the European Parliament and of the Council of 23 April 2009 Directive 2009/28/EC on the promotion of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC by 2020", in the Optimistic Scenario (EU) – based on technical requirements for producers issued by Latvians transmission system operator "Augstsprieguma tikls" AS and Latvian distribution system operator "Sadales tikls" AS.

[8] In the Conservative scenario (A) and in Base scenario (B), bio-mass and bio-gas power plant capacity assessed on the basis of the information presented in the report "Latvian Republic Action for renewable energy in the European Parliament and of the Council of 23 April 2009 Directive 2009/28/EC on the promotion of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC by 2020", but in the Optimistic scenario (EU) – based on technical requirements for producers issued by "Augstsprieguma tikls" AS and "Sadales tikls" AS.

[9] Starting from 2016 in electricity balance tables for Conservative scenario (A) RigaCHP-1, RigaCHP-2 and Imanta CHP power generation is assessed based on market situation in the market area of “Nord Pool”. In Base scenario (B) power generation in RigaCHP-1, RigaCHP-2 and Imanta CHP is assumed as long term annual average. In Optimistic scenario (EU) production of RigaCHP-1, RigaCHP-2 and Imanta CHP is assessed as maximum

possible, irrelevant to the “NordPool” market situation, developing the maximum possible amount of electricity in annual terms. For possibility of co-generation stations to receive compulsory payment for installed capacity according to Cabinet of Ministers Regulations No 221 "Regulations on electricity production and pricing with cogeneration stations" the utilization time of co-generation power stations or a separate equipment installed in them must be at least 1200 hours per year.

10) In the hourly load demand tables production in the power stations of Latvia is presented omitting possible emergency and replacement reserves (assumption 3). Emergency and replacement reserves for the needs of Latvian power system will be provided via market based reserve purchases from the users of Latvian or Baltic power systems

11) For conservative scenario (A) it is assumed that Riga CHP-2 can operate in co-generation mode only, when its output power reaches 803 MW nett. In Base scenario (B) and Optimistic scenario (EU) it is assumed that Riga CHP-2 maximum nett production can reach up to 850 MW with power plant operating in condensation mode.

12) Currently Baltic countries with the support from EU are investigating possible variants for synchronisation of the power systems of Baltic countries with power systems of continental Europe or Nordic countries and desynchronisation from the power system of Russia. Above mentioned operational changes can take place not sooner than 2025. Since currently the study is ongoing and authorised institutions have not yet decided on the possible synchronisation variants, Latvian transmission system operator in this annual report has not planned operational changes in the power system for the next 10 years.

Installed capacities (bruto) of power stations, MW

Table 4

Years		2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Power stations with installed capacity above 40 MW [6)]	**1**	**2631**	**2653**	**2661**	**2661**	**2661**	**2661**	**2661**	**2661**	**2661**	**2661**	**2661**
Including: Daugava HPPs	*1.1*	*1558*	*1580*	*1588*	*1588*	*1588*	*1588*	*1588*	*1588*	*1588*	*1588*	*1588*
Riga CHP1	*1.2*	*144*	*144*	*144*	*144*	*144*	*144*	*144*	*144*	*144*	*144*	*144*
Riga CHP2	*1.3*	*881*	*881*	*881*	*881*	*881*	*881*	*881*	*881*	*881*	*881*	*881*
Imanta CHP	*1.4*	*48*	*48*	*48*	*48*	*48*	*48*	*48*	*48*	*48*	*48*	*48*
Installed capacity of small power stations (conservative scenario A)	**2**	**377**	**393**	**408**	**424**	**439**	**455**	**471**	**506**	**534**	**561**	**588**
Including: Natural gas co-generation stations	*2.1*	*130*	*130*	*131*	*132*	*133*	*133*	*134*	*135*	*136*	*136*	*137*
Hydro power stations	*2.2*	*29*	*29*	*29*	*29*	*29*	*30*	*30*	*30*	*30*	*31*	*31*
Wind power stations [7)]	*2.3*	*72*	*81*	*90*	*99*	*109*	*118*	*127*	*156*	*177*	*197*	*218*
Onshore	*2.3.1.*	*72*	*81*	*90*	*99*	*109*	*118*	*127*	*136*	*145*	*154*	*163*
Offshore	*2.3.2.*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*20*	*31*	*43*	*54*
Biomass power stations [8)]	*2.4*	*72*	*74*	*76*	*78*	*80*	*82*	*84*	*86*	*88*	*90*	*92*
Biogas power stations [8)]	*2.5*	*73*	*77*	*80*	*83*	*87*	*90*	*93*	*97*	*100*	*103*	*107*
Solar power stations	*2.6*	*1.00*	*1.29*	*1.57*	*1.86*	*2.14*	*2.43*	*2.71*	*3.00*	*3.29*	*3.57*	*3.86*
Installed capacity of small power stations (base scenario B)	**3**	**382**	**403**	**424**	**445**	**466**	**487**	**508**	**554**	**591**	**628**	**665**
Including: Natural gas co-generation stations	*3.1*	*130*	*130*	*131*	*132*	*133*	*133*	*134*	*135*	*136*	*136*	*137*
Hydro power stations	*3.2*	*29*	*29*	*29*	*29*	*29*	*30*	*30*	*30*	*30*	*31*	*31*
Wind power stations [7)]	*3.3*	*72*	*81*	*90*	*99*	*109*	*118*	*127*	*161*	*186*	*211*	*235*
Onshore	*3.3.1.*	*72*	*81*	*90*	*99*	*109*	*118*	*127*	*136*	*145*	*154*	*163*
Offshore	*3.3.2.*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*25*	*41*	*56*	*72*
Biomass power stations [8)]	*3.4*	*75*	*80*	*85*	*90*	*95*	*100*	*105*	*110*	*115*	*120*	*125*
Biogas power stations [8)]	*3.5*	*75*	*81*	*86*	*91*	*97*	*102*	*107*	*113*	*118*	*123*	*129*
Solar power stations	*3.6*	*1.33*	*1.95*	*2.57*	*3.19*	*3.81*	*4.43*	*5.05*	*5.67*	*6.29*	*6.91*	*7.52*
Installed capacity of small power stations (optimistic scenario EU)	**4**	**412**	**454**	**496**	**538**	**580**	**647**	**707**	**766**	**825**	**884**	**944**
Including: Natural gas co-generation stations	*4.1*	*131*	*133*	*136*	*138*	*140*	*142*	*145*	*147*	*149*	*151*	*153*
Hydro power stations	*4.2*	*29*	*29*	*30*	*30*	*30*	*31*	*31*	*31*	*31*	*31*	*31*
Wind power stations [7)]	*4.3*	*93*	*115*	*137*	*159*	*181*	*228*	*267*	*306*	*346*	*385*	*425*
Onshore	*4.3.1.*	*93*	*115*	*137*	*159*	*181*	*203*	*225*	*246*	*268*	*290*	*312*

Offshore	*4.3.2.*	*0*	*0*	*0*	*0*	*0*	*25*	*43*	*60*	*78*	*95*	*113*
Biomass power stations [8)]	*4.4*	*78*	*86*	*94*	*102*	*110*	*118*	*126*	*134*	*142*	*150*	*158*
Biogas power stations [8)]	*4.5*	*79*	*87*	*96*	*105*	*113*	*122*	*131*	*139*	*148*	*157*	*165*
Solar power stations	*4.6*	*1.67*	*2.62*	*3.57*	*4.52*	*5.48*	*6.43*	*7.38*	*8.33*	*9.29*	*10.24*	*11.19*

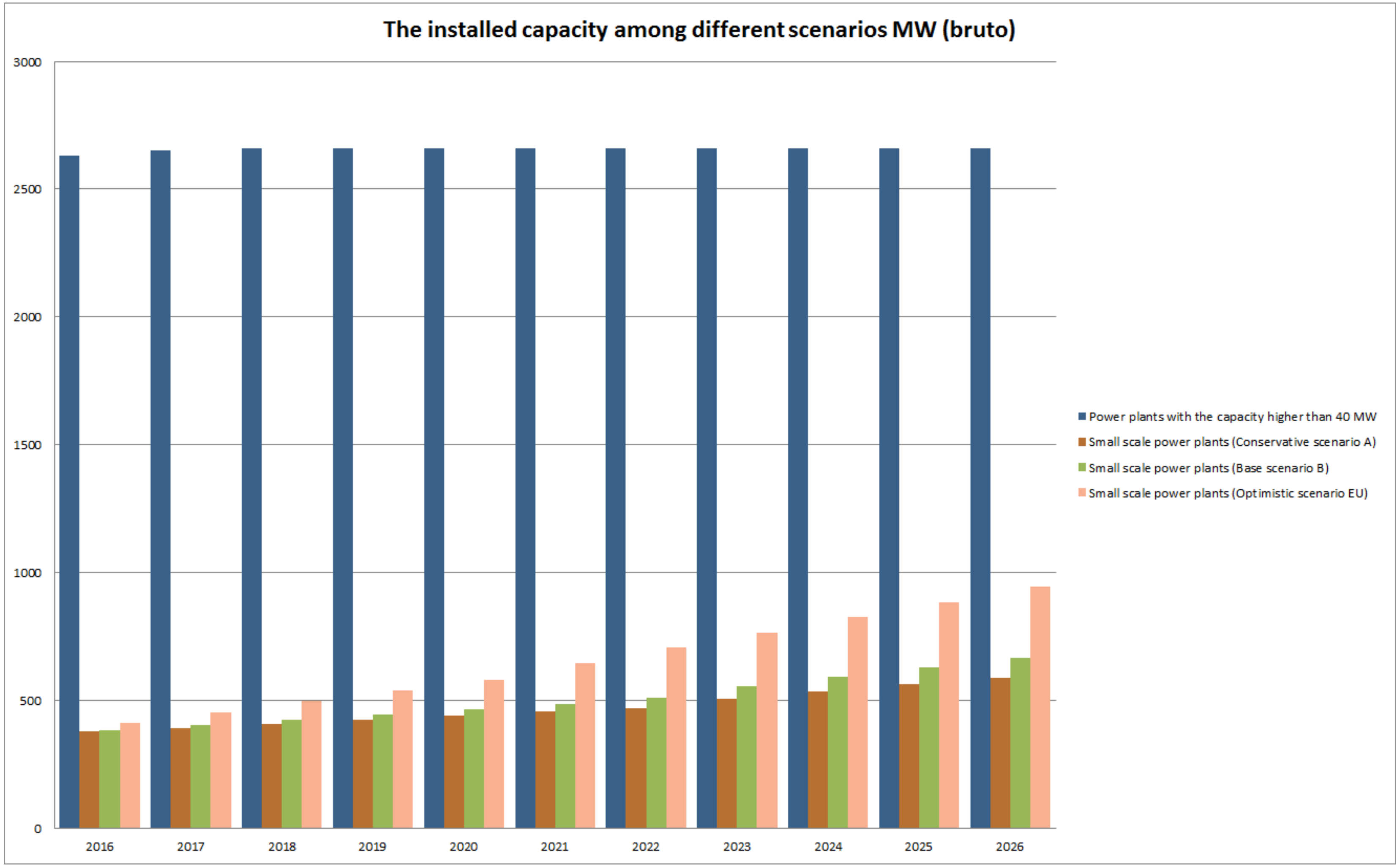

Fig. 1. Development of installed capacities in power stations (MW) in different scenarios

Latvian power system balance for Scenario A winter peak load hours, MW (neto)

Table 5

Years		2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Maximum load	**1**	**1262**	**1285**	**1308**	**1333**	**1359**	**1387**	**1414**	**1446**	**1475**	**1505**	**1537**
Power stations with installed capacity above 40 MW	**2**	**2535**	**2557**	**2564**	**2564**	**2564**	**2564**	**2564**	**2564**	**2564**	**2564**	**2564**
Including: Daugava HPPs	*2.1*	*1550*	*1572*	*1580*	*1580*	*1580*	*1580*	*1580*	*1580*	*1580*	*1580*	*1580*
Riga CHP-1	*2.2*	*139*	*139*	*139*	*139*	*139*	*139*	*139*	*139*	*139*	*139*	*139*
Riga CHP-2	*2.3*	*803*	*803*	*803*	*803*	*803*	*803*	*803*	*803*	*803*	*803*	*803*
Imanta CHP	*2.4*	*42*	*42*	*42*	*42*	*42*	*42*	*42*	*42*	*42*	*42*	*42*
Small power stations	**3**	**350**	**365**	**380**	**395**	**410**	**425**	**440**	**474**	**501**	**528**	**554**
Including: Natural gas co-generation power stations	*3.1*	*118*	*119*	*119*	*120*	*121*	*121*	*122*	*123*	*123*	*124*	*125*
Hydro power stations	*3.2*	*28*	*28*	*28*	*28*	*28*	*28*	*28*	*28*	*29*	*30*	*30*
Wind power stations	*3.3*	*71*	*80*	*89*	*98*	*107*	*117*	*126*	*154*	*175*	*195*	*216*
Onshore	*3.3.1.*	*71*	*80*	*89*	*98*	*107*	*117*	*126*	*135*	*144*	*153*	*162*
Offshore	*3.3.2.*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*20*	*31*	*42*	*54*
Biomass power stations	*3.4*	*65*	*67*	*69*	*71*	*73*	*75*	*76*	*78*	*80*	*82*	*84*
Biogas power stations	*3.5*	*67*	*70*	*73*	*76*	*79*	*82*	*85*	*88*	*91*	*94*	*97*
Solar power stations	*3.6*	*0.90*	*1.16*	*1.41*	*1.67*	*1.93*	*2.19*	*2.44*	*2.70*	*2.96*	*3.21*	*3.47*
Available capacities for peak load and reserve guaranteeing	**4**	**1442**	**1447**	**1452**	**1457**	**1462**	**1467**	**1472**	**1479**	**1485**	**1491**	**1497**
Including: Daugava HPPs [5)]	*4.01*	*270*	*270*	*270*	*270*	*270*	*270*	*270*	*270*	*270*	*270*	*270*
Riga CHP-1	*4.02*	*139*	*139*	*139*	*139*	*139*	*139*	*139*	*139*	*139*	*139*	*139*
Riga CHP-2	*4.03*	*803*	*803*	*803*	*803*	*803*	*803*	*803*	*803*	*803*	*803*	*803*
Imanta CHP	*4.04*	*42*	*42*	*42*	*42*	*42*	*42*	*42*	*42*	*42*	*42*	*42*
Natural gas co-generation power stations	*4.05*	*83*	*83*	*83*	*84*	*84*	*85*	*85*	*86*	*86*	*87*	*87*
Hydro power stations	*4.06*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*
Wind power stations	*4.07*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*15*	*17*	*20*	*22*
Biomass power stations	*4.08*	*46*	*47*	*48*	*50*	*51*	*52*	*53*	*55*	*56*	*57*	*59*
Biogas power stations	*4.09*	*47*	*49*	*51*	*53*	*55*	*57*	*59*	*62*	*64*	*66*	*68*
Solar power stations	*4.10*	*0.36*	*0.46*	*0.57*	*0.67*	*0.77*	*0.87*	*0.98*	*1.08*	*1.18*	*1.29*	*1.39*
Power system emergency reserve [2)]	**5**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**
Power system regulating reserve [4)]	**6**	**83**	**85**	**87**	**90**	**92**	**95**	**97**	**102**	**106**	**110**	**114**
Total reserve in Latvia[3)]	**7=5+6**	**183**	**185**	**187**	**190**	**192**	**195**	**197**	**202**	**206**	**210**	**214**
Power surplus (+), deficit (-)	**8=4-1-7**	**-3**	**-23**	**-43**	**-66**	**-90**	**-115**	**-140**	**-170**	**-196**	**-224**	**-254**
Power adequacy	**9=(4-7)/1**	**100%**	**98%**	**97%**	**95%**	**93%**	**92%**	**90%**	**88%**	**87%**	**85%**	**83%**

Latvian power system balance for Scenario B winter peak load hours, MW (neto)

Table 6

Years		2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Maximum load	**1**	**1262**	**1285**	**1308**	**1333**	**1359**	**1387**	**1414**	**1446**	**1475**	**1505**	**1537**
Power stations with installed capacity above 40 MW	**2**	**2535**	**2557**	**2564**	**2564**	**2564**	**2564**	**2564**	**2564**	**2564**	**2564**	**2564**
Including: Daugava HPPs	*2.1*	*1550*	*1572*	*1580*	*1580*	*1580*	*1580*	*1580*	*1580*	*1580*	*1580*	*1580*
Riga CHP-1	*2.2*	*139*	*139*	*139*	*139*	*139*	*139*	*139*	*139*	*139*	*139*	*139*
Riga CHP-2	*2.3*	*850*	*850*	*850*	*850*	*850*	*850*	*850*	*850*	*850*	*850*	*850*
Imanta CHP	*2.4*	*42*	*42*	*42*	*42*	*42*	*42*	*42*	*42*	*42*	*42*	*42*
Small power stations	**3**	**355**	**374**	**394**	**414**	**434**	**454**	**473**	**518**	**553**	**589**	**625**
Including: Natural gas co-generation power stations	*3.1*	*118*	*119*	*119*	*120*	*121*	*121*	*122*	*123*	*123*	*124*	*125*
Hydro power stations	*3.2*	*28*	*28*	*28*	*28*	*28*	*28*	*28*	*28*	*29*	*30*	*30*
Wind power stations	*3.3*	*71*	*80*	*89*	*98*	*107*	*117*	*126*	*159*	*184*	*208*	*233*
Onshore	*3.3.1.*	*71*	*80*	*89*	*98*	*107*	*117*	*126*	*135*	*144*	*153*	*162*
Offshore	*3.3.2.*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*25*	*40*	*56*	*71*
Biomass power stations	*3.4*	*68*	*73*	*77*	*82*	*86*	*91*	*95*	*100*	*105*	*109*	*114*
Biogas power stations	*3.5*	*68*	*73*	*78*	*83*	*88*	*93*	*98*	*102*	*107*	*112*	*117*
Solar power stations	*3.6*	*1.20*	*1.76*	*2.31*	*2.87*	*3.43*	*3.99*	*4.54*	*5.10*	*5.66*	*6.21*	*6.77*
Available capacities for peak load and reserve guaranteeing	**4**	**1526**	**1534**	**1542**	**1550**	**1558**	**1567**	**1575**	**1586**	**1595**	**1605**	**1615**
Including: Daugava HPPs [5)]	*4.01*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*
Riga CHP-1	*4.02*	*139*	*139*	*139*	*139*	*139*	*139*	*139*	*139*	*139*	*139*	*139*
Riga CHP-2	*4.03*	*803*	*803*	*803*	*803*	*803*	*803*	*803*	*803*	*803*	*803*	*803*
Imanta CHP	*4.04*	*42*	*42*	*42*	*42*	*42*	*42*	*42*	*42*	*42*	*42*	*42*
Natural gas co-generation power stations	*4.05*	*83*	*83*	*83*	*84*	*84*	*85*	*85*	*86*	*86*	*87*	*87*
Hydro power stations	*4.06*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*
Wind power stations	*4.07*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*16*	*18*	*21*	*23*
Biomass power stations	*4.08*	*48*	*51*	*54*	*57*	*60*	*64*	*67*	*70*	*73*	*76*	*80*
Biogas power stations	*4.09*	*48*	*51*	*55*	*58*	*62*	*65*	*68*	*72*	*75*	*78*	*82*
Solar power stations	*4.10*	*0.48*	*0.70*	*0.93*	*1.15*	*1.37*	*1.59*	*1.82*	*2.04*	*2.26*	*2.49*	*2.71*
Power system emergency reserve [2)]	**5**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**
Power system regulating reserve [4)]	**6**	**83**	**85**	**87**	**90**	**92**	**95**	**97**	**103**	**107**	**111**	**116**
Total reserve in Latvia[3)]	**7=5+6**	**183**	**185**	**187**	**190**	**192**	**195**	**197**	**203**	**207**	**211**	**216**
Power surplus (+), deficit (-)	**8=4-1-7**	**80**	**64**	**47**	**28**	**7**	**-15**	**-37**	**-63**	**-87**	**-111**	**-137**
Power adequacy	**9=(4-7)/1**	**106%**	**105%**	**104%**	**102%**	**101%**	**99%**	**97%**	**96%**	**94%**	**93%**	**91%**

Latvian power system balance for Scenario EU winter peak load hours, MW (neto)

Table 7

Years		2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Maximum load	**1**	**1262**	**1285**	**1308**	**1333**	**1359**	**1387**	**1414**	**1446**	**1475**	**1505**	**1537**
Power stations with installed capacity above 40 MW	**2**	**2535**	**2557**	**2564**	**2564**	**2564**	**2564**	**2564**	**2564**	**2564**	**2564**	**2564**
Including: Daugava HPPs	*2.1*	*1550*	*1572*	*1580*	*1580*	*1580*	*1580*	*1580*	*1580*	*1580*	*1580*	*1580*
Riga CHP-1	*2.2*	*139*	*139*	*139*	*139*	*139*	*139*	*139*	*139*	*139*	*139*	*139*
Riga CHP-2	*2.3*	*850*	*850*	*850*	*850*	*850*	*850*	*850*	*850*	*850*	*850*	*850*
Imanta CHP	*2.4*	*42*	*42*	*42*	*42*	*42*	*42*	*42*	*42*	*42*	*42*	*42*
Small power stations	**3**	**383**	**420**	**458**	**497**	**535**	**599**	**655**	**711**	**766**	**823**	**879**
Including: Natural gas co-generation power stations	*3.1*	*119*	*119*	*119*	*120*	*121*	*121*	*122*	*123*	*123*	*124*	*125*
Hydro power stations	*3.2*	*28*	*28*	*28*	*28*	*28*	*28*	*28*	*28*	*29*	*30*	*30*
Wind power stations	*3.3*	*92*	*114*	*135*	*157*	*179*	*225*	*264*	*303*	*342*	*382*	*421*
Onshore	*3.3.1.*	*92*	*114*	*135*	*157*	*179*	*201*	*222*	*244*	*266*	*287*	*309*
Offshore	*3.3.2.*	*0*	*0*	*0*	*0*	*0*	*25*	*42*	*59*	*77*	*94*	*111*
Biomass power stations	*3.4*	*71*	*78*	*85*	*93*	*100*	*107*	*115*	*122*	*129*	*136*	*144*
Biogas power stations	*3.5*	*72*	*79*	*87*	*95*	*103*	*111*	*119*	*127*	*135*	*142*	*150*
Solar power stations	*3.6*	*2*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*8*	*9*	*10*
Available capacities for peak load and reserve guaranteeing	**4**	**1582**	**1596**	**1609**	**1623**	**1636**	**1652**	**1668**	**1683**	**1699**	**1714**	**1729**
Including: Daugava HPPs [5)]	*4.01*	*400*	*400*	*400*	*400*	*400*	*400*	*400*	*400*	*400*	*400*	*400*
Riga CHP-1	*4.02*	*139*	*139*	*139*	*139*	*139*	*139*	*139*	*139*	*139*	*139*	*139*
Riga CHP-2	*4.03*	*803*	*803*	*803*	*803*	*803*	*803*	*803*	*803*	*803*	*803*	*803*
Imanta CHP	*4.04*	*42*	*42*	*42*	*42*	*42*	*42*	*42*	*42*	*42*	*42*	*42*
Natural gas co-generation power stations	*4.05*	*83*	*83*	*83*	*84*	*84*	*85*	*85*	*86*	*86*	*87*	*87*
Hydro power stations	*4.06*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*
Wind power stations	*4.07*	*9*	*11*	*14*	*16*	*18*	*23*	*26*	*30*	*34*	*38*	*42*
Biomass power stations	*4.08*	*50*	*55*	*60*	*65*	*70*	*75*	*80*	*85*	*90*	*95*	*101*
Biogas power stations	*4.09*	*50*	*56*	*61*	*67*	*72*	*78*	*83*	*89*	*94*	*100*	*105*
Solar power stations	*4.10*	*0.61*	*0.95*	*1.30*	*1.65*	*1.99*	*2.34*	*2.68*	*3.03*	*3.38*	*3.72*	*4.07*
Power system emergency reserve [2)]	**5**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**
Power system regulating reserve [4)]	**6**	**85**	**88**	**92**	**96**	**99**	**106**	**111**	**117**	**123**	**128**	**134**
Total reserve in Latvia[3)]	**7=5+6**	**185**	**188**	**192**	**196**	**199**	**206**	**211**	**217**	**223**	**228**	**234**
Power surplus (+), deficit (-)	**8=4-1-7**	**135**	**122**	**109**	**94**	**78**	**60**	**42**	**20**	**1**	**-19**	**-42**
Power adequacy	**9=(4-7)/1**	**111%**	**109%**	**108%**	**107%**	**106%**	**104%**	**103%**	**101%**	**100%**	**99%**	**97%**

Possible power balance for Scenario A (annual values), GWh

Table 8

Scenario A

Years		**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**
Energy demand	**1**	**7185**	**7218**	**7247**	**7285**	**7327**	**7369**	**7409**	**7468**	**7506**	**7542**	**7588**
Output in power stations with installed capacity above 40 MW	**2**	**3575**	**3728**	**3521**	**3524**	**3526**	**3528**	**3470**	**3470**	**3470**	**3470**	**3470**
Including: Daugava HPPs [1)]	*2.1*	*2116*	*2276*	*2284*	*2287*	*2289*	*2291*	*2293*	*2293*	*2293*	*2293*	*2293*
Riga CHP-1 [9)]	*2.2*	*513*	*493*	*451*	*451*	*451*	*451*	*451*	*451*	*451*	*451*	*451*
Riga CHP-2 [9)]	*2.3*	*887*	*899*	*726*	*726*	*726*	*726*	*726*	*726*	*726*	*726*	*726*
Imanta CHP	*2.4*	*60*	*60*	*60*	*60*	*60*	*60*	*0*	*0*	*0*	*0*	*0*
Small power stations	**3**	**1715**	**1766**	**1818**	**1869**	**1921**	**1973**	**2024**	**2126**	**2206**	**2288**	**2367**
Including: Natural gas co-generation power stations	*3.1*	*708*	*712*	*716*	*720*	*724*	*728*	*732*	*736*	*740*	*744*	*748*
Hydro power stations	*3.2*	*72*	*72*	*72*	*72*	*73*	*73*	*74*	*74*	*75*	*77*	*77*
Wind power stations	*3.3*	*143*	*161*	*179*	*197*	*215*	*233*	*251*	*319*	*365*	*412*	*458*
Onshore	*3.3.1.*	*143*	*161*	*179*	*197*	*215*	*233*	*251*	*269*	*287*	*306*	*324*
Offshore	*3.3.2.*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*50*	*78*	*106*	*134*
Biomass power stations	*3.4*	*393*	*404*	*415*	*425*	*436*	*447*	*458*	*469*	*480*	*491*	*502*
Biogas power stations	*3.5*	*400*	*418*	*436*	*455*	*473*	*491*	*509*	*527*	*545*	*564*	*582*
Solar power stations	*3.6*	*0.27*	*0.35*	*0.42*	*0.50*	*0.58*	*0.66*	*0.73*	*0.81*	*0.9*	*1.0*	*1.0*
Possible annual export/import	**4=(2+3)-1**	**-1895**	**-1723**	**-1908**	**-1891**	**-1880**	**-1868**	**-1915**	**-1872**	**-1830**	**-1784**	**-1750**
Possible spring flood period export	**5**	**500**	**500**	**500**	**500**	**500**	**500**	**500**	**500**	**500**	**500**	**500**
Annual adequacy	**6=(2+3-5)/1**	**67%**	**69%**	**67%**	**67%**	**68%**	**68%**	**67%**	**68%**	**69%**	**70%**	**70%**

Possible power balance for Scenario B (annual values), GWh

Scenario B *Table 9*

Years		**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**
Energy demand	**1**	**7185**	**7248**	**7307**	**7378**	**7453**	**7530**	**7606**	**7703**	**7780**	**7857**	**7945**
Output in power stations with installed capacity above 40 MW	**2**	**4176**	**4336**	**4344**	**4347**	**4349**	**4351**	**4253**	**4253**	**4253**	**4253**	**4253**
Including: Daugava HPPs [1)]	*2.1*	*2116*	*2276*	*2284*	*2287*	*2289*	*2291*	*2293*	*2293*	*2293*	*2293*	*2293*
Riga CHP1 [9)]	*2.2*	*460*	*460*	*460*	*460*	*460*	*460*	*460*	*460*	*460*	*460*	*460*
Riga CHP2 [9)]	*2.3*	*1500*	*1500*	*1500*	*1500*	*1500*	*1500*	*1500*	*1500*	*1500*	*1500*	*1500*
Imanta CHP	*2.4*	*100*	*100*	*100*	*100*	*100*	*100*	*0*	*0*	*0*	*0*	*0*
Small power stations	**3**	**1742**	**1821**	**1900**	**1979**	**2058**	**2137**	**2216**	**2357**	**2475**	**2594**	**2712**
Including: Natural gas co-generation power stations	*3.1*	*708*	*712*	*716*	*720*	*724*	*728*	*732*	*736*	*740*	*744*	*748*
Hydro power stations	*3.2*	*72*	*72*	*72*	*72*	*73*	*73*	*74*	*74*	*75*	*77*	*77*
Wind power stations	*3.3*	*143*	*161*	*179*	*197*	*215*	*233*	*251*	*331*	*388*	*445*	*502*
Onshore	*3.3.1.*	*143*	*161*	*179*	*197*	*215*	*233*	*251*	*269*	*287*	*306*	*324*
Offshore	*3.3.2.*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*62*	*101*	*139*	*178*
Biomass power stations	*3.4*	*409*	*436*	*464*	*491*	*518*	*545*	*573*	*600*	*627*	*655*	*682*
Biogas power stations	*3.5*	*411*	*440*	*469*	*498*	*527*	*556*	*585*	*615*	*644*	*673*	*702*
Solar power stations	*3.6*	*0.4*	*0.5*	*0.7*	*0.9*	*1.0*	*1.2*	*1.4*	*1.5*	*1.7*	*1.9*	*2.0*
Possible annual export/import	**4=(2+3)-1**	**-1267**	**-1091**	**-1064**	**-1052**	**-1046**	**-1042**	**-1137**	**-1093**	**-1052**	**-1009**	**-980**
Possible spring flood period export	**5**	**500**	**500**	**500**	**500**	**500**	**500**	**500**	**500**	**500**	**500**	**500**
Annual adequacy	**6=(2+3-5)/1**	**75%**	**78%**	**79%**	**79%**	**79%**	**80%**	**78%**	**79%**	**80%**	**81%**	**81%**

Possible power balance for Scenario EU (annual values), GWh

Scenario EU *Table 10*

Years		**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**
Energy demand	**1**	**7332**	**7427**	**7520**	**7626**	**7737**	**7852**	**7968**	**8106**	**8225**	**8346**	**8480**
Output in power stations with installed capacity above 40 MW	**2**	**8852**	**9012**	**9020**	**9023**	**9025**	**8837**	**8739**	**8739**	**8739**	**8739**	**8739**
Including: Daugava HPPs [1)]	*2.1*	*2116*	*2276*	*2284*	*2287*	*2289*	*2291*	*2293*	*2293*	*2293*	*2293*	*2293*
Riga CHP-1 [9)]	*2.2*	*494*	*494*	*494*	*494*	*494*	*494*	*494*	*494*	*494*	*494*	*494*
Riga CHP-2 [9)]	*2.3*	*5952*	*5952*	*5952*	*5952*	*5952*	*5952*	*5952*	*5952*	*5952*	*5952*	*5952*
Imanta CHP	*2.4*	*290*	*290*	*290*	*290*	*290*	*100*	*0*	*0*	*0*	*0*	*0*
Small power stations	**3**	**1845**	**1981**	**2117**	**2253**	**2426**	**2589**	**2751**	**2914**	**3076**	**3240**	**3402**
Including: Natural gas co-generation power stations	*3.1*	*708*	*712*	*716*	*720*	*724*	*728*	*732*	*736*	*740*	*744*	*748*
Hydro power stations	*3.2*	*72*	*72*	*72*	*72*	*73*	*73*	*74*	*74*	*75*	*77*	*77*
Wind power stations	*3.3*	*138*	*171*	*203*	*236*	*305*	*364*	*423*	*481*	*540*	*598*	*657*
Onshore	*3.3.1.*	*138*	*171*	*203*	*236*	*268*	*301*	*333*	*366*	*399*	*431*	*464*
Offshore	*3.3.2.*	*0*	*0*	*0*	*0*	*37*	*63*	*89*	*115*	*141*	*167*	*193*
Biomass power stations	*3.4*	*461*	*508*	*555*	*603*	*650*	*697*	*745*	*792*	*839*	*886*	*934*
Biogas power stations	*3.5*	*465*	*516*	*567*	*618*	*670*	*721*	*772*	*823*	*875*	*926*	*977*
Solar power stations	*3.6*	*1.5*	*2.4*	*3.2*	*4.1*	*5.0*	*5.8*	*6.7*	*7.6*	*8.4*	*9.3*	*10.2*
Possible annual export/import	**4=(2+3)-1**	**3365**	**3566**	**3616**	**3651**	**3714**	**3574**	**3523**	**3547**	**3590**	**3633**	**3661**
Possible spring flood period export	**5**	**500**	**500**	**500**	**500**	**500**	**500**	**500**	**500**	**500**	**500**	**500**
Annual adequacy	**6=(2+3-5)/1**	**139%**	**141%**	**141%**	**141%**	**142%**	**139%**	**138%**	**138%**	**138%**	**138%**	**137%**

Power demand and possible sources of guaranteeing, hourly balance for Scenario A (peak load), MW

Scenario A

Year 2017.January (working day, Wednesday of the third week, Peak load)

Table 11

Hour	Riga CHP-1	Riga CHP-2	Imanta CHP	Biomass	Biogas	Gas fuelled co-generation	Small HPP	Wind power	Solar power	Daugava HPPs 10)	Import	Load
01:00	139	411	42	46	47	83	6	7	0.00	16	0	795
02:00	139	363	42	46	47	83	6	7	0.00	15	0	747
03:00	139	346	42	46	47	83	6	7	0.00	15	0	729
04:00	139	328	42	46	47	83	6	7	0.00	25	0	722
05:00	139	325	42	46	47	83	6	7	0.00	41	0	734
06:00	139	303	42	46	47	83	6	7	0.00	109	0	781
07:00	139	352	42	46	47	83	6	7	0.00	186	0	907
08:00	139	448	42	46	47	83	6	7	0.00	256	0	1073
09:00	139	555	42	46	47	83	6	7	0.46	259	0	1183
10:00	139	644	42	46	47	83	6	7	0.46	208	0	1221
11:00	139	706	42	46	47	83	6	7	0.46	160	0	1235
12:00	139	703	42	46	47	83	6	7	0.46	144	0	1216
13:00	139	651	42	46	47	83	6	7	0.46	161	0	1182
14:00	139	647	42	46	47	83	6	7	0.46	194	0	1210
15:00	139	632	42	46	47	83	6	7	0.46	215	0	1216
16:00	139	606	42	46	47	83	6	7	0.46	244	0	1219
17:00	139	646	42	46	47	83	6	7	0.00	270	0	1285
18:00	139	608	42	46	47	83	6	7	0.00	270	0	1247
19:00	139	582	42	46	47	83	6	7	0.00	270	0	1221
20:00	139	602	42	46	47	83	6	7	0.00	201	0	1171
21:00	139	630	42	46	47	83	6	7	0.00	129	0	1128
22:00	139	588	42	46	47	83	6	7	0.00	108	0	1065
23:00	139	540	42	46	47	83	6	7	0.00	64	0	972
00:00	139	467	42	46	47	83	6	7	0.00	29	0	865

Scenario A

Year 2021. January (working day, Wednesday of the third week, Peak load)

Table 12

Hour	Riga CHP-1	Riga CHP-2	Imanta CHP	Biomass	Biogas	Gas fuelled co-generation	Small HPP	Wind power	Solar power	Daugava HPPs 10)	Import	Load
01:00	139	455	42	51	55	84	6	11	0.00	16	0	858
02:00	139	403	42	51	55	84	6	11	0.00	15	0	806
03:00	139	384	42	51	55	84	6	11	0.00	15	0	787
04:00	139	366	42	51	55	84	6	11	0.00	25	0	779
05:00	139	363	42	51	55	84	6	11	0.00	41	0	792
06:00	139	346	42	51	55	84	6	11	0.00	109	0	842
07:00	139	405	42	51	55	84	6	11	0.00	186	0	979
08:00	139	514	42	51	55	84	6	11	0.00	256	0	1158
09:00	139	629	42	51	55	84	6	11	0.87	259	0	1276
10:00	139	721	42	51	55	84	6	11	0.87	208	0	1317
11:00	139	784	42	51	55	84	6	11	0.87	160	0	1333
12:00	139	779	42	51	55	84	6	11	0.87	144	0	1312
13:00	139	725	42	51	55	84	6	11	0.87	161	0	1275
14:00	139	723	42	51	55	84	6	11	0.87	194	0	1305
15:00	139	708	42	51	55	84	6	11	0.87	215	0	1312
16:00	139	682	42	51	55	84	6	11	0.87	244	0	1315
17:00	139	729	42	51	55	84	6	11	0.00	270	0	1387
18:00	139	687	42	51	55	84	6	11	0.00	270	0	1345
19:00	139	660	42	51	55	84	6	11	0.00	270	0	1317
20:00	139	675	42	51	55	84	6	11	0.00	201	0	1264
21:00	139	700	42	51	55	84	6	11	0.00	129	0	1217
22:00	139	653	42	51	55	84	6	11	0.00	108	0	1149
23:00	139	598	42	51	55	84	6	11	0.00	64	0	1049
00:00	139	516	42	51	55	84	6	11	0.00	29	0	933

Scenario A

Year 2026. January (working day, Wednesday of the third week, Peak load) *Table 13*

Hour	Riga CHP-1	Riga CHP-2	Imanta CHP	Biomass	Biogas	Gas fuelled co-generation	Small HPP	Wind power	Solar power	Daugava HPPs [10)]	Import	Load
01:00	139	519	42	57	66	87	6	20	0.00	16	0	951
02:00	139	462	42	57	66	87	6	20	0.00	15	0	893
03:00	139	441	42	57	66	87	6	20	0.00	15	0	872
04:00	139	422	42	57	66	87	6	20	0.00	25	0	863
05:00	139	421	42	57	66	87	6	20	0.00	41	0	878
06:00	139	409	42	57	66	87	6	20	0.00	109	0	934
07:00	139	483	42	57	66	87	6	20	0.00	186	0	1085
08:00	139	611	42	57	66	87	6	20	0.00	256	0	1283
09:00	139	738	42	57	66	87	6	20	1.39	259	0	1414
10:00	139	803	42	57	66	87	6	20	1.39	208	32	1460
11:00	139	803	42	57	66	87	6	20	1.39	160	96	1477
12:00	139	803	42	57	66	87	6	20	1.39	144	90	1454
13:00	139	803	42	57	66	87	6	20	1.39	161	31	1413
14:00	139	803	42	57	66	87	6	20	1.39	194	32	1446
15:00	139	803	42	57	66	87	6	20	1.39	215	19	1454
16:00	139	796	42	57	66	87	6	20	1.39	244	0	1458
17:00	139	803	42	57	66	87	6	20	0.00	270	48	1537
18:00	139	803	42	57	66	87	6	20	0.00	270	2	1491
19:00	139	774	42	57	66	87	6	20	0.00	270	0	1460
20:00	139	784	42	57	66	87	6	20	0.00	201	0	1401
21:00	139	803	42	57	66	87	6	20	0.00	129	1	1349
22:00	139	749	42	57	66	87	6	20	0.00	108	0	1273
23:00	139	683	42	57	66	87	6	20	0.00	64	0	1163
00:00	139	588	42	57	66	87	6	20	0.00	29	0	1034

Power demand and possible sources of guaranteeing, hourly balance for Scenario B (peak load), MW

Scenario B

Year 2017. January (working day, Wednesday of the third week, Peak load)

Table 14

Hour	Riga CHP-1	Riga CHP-2	Imanta CHP	Biomass	Biogas	Gas fuelled co-generation	Small HPP	Wind power	Solar power	Daugava HPPs [10)]	Import	Load
01:00	139	381	42	51	51	83	6	8	0.00	34	0	795
02:00	139	347	42	51	51	83	6	8	0.00	20	0	747
03:00	139	330	42	51	51	83	6	8	0.00	19	0	729
04:00	139	323	42	51	51	83	6	8	0.00	19	0	722
05:00	139	322	42	51	51	83	6	8	0.00	33	0	734
06:00	139	348	42	51	51	83	6	8	0.00	53	0	781
07:00	139	386	42	51	51	83	6	8	0.00	141	0	907
08:00	139	452	42	51	51	83	6	8	0.00	241	0	1073
09:00	139	470	42	51	51	83	6	8	0.70	332	0	1183
10:00	139	505	42	51	51	83	6	8	0.70	335	0	1221
11:00	139	586	42	51	51	83	6	8	0.70	269	0	1235
12:00	139	627	42	51	51	83	6	8	0.70	208	0	1216
13:00	139	615	42	51	51	83	6	8	0.70	186	0	1182
14:00	139	620	42	51	51	83	6	8	0.70	209	0	1210
15:00	139	584	42	51	51	83	6	8	0.70	251	0	1216
16:00	139	560	42	51	51	83	6	8	0.70	278	0	1219
17:00	139	555	42	51	51	83	6	8	0.00	350	0	1285
18:00	139	517	42	51	51	83	6	8	0.00	350	0	1247
19:00	139	491	42	51	51	83	6	8	0.00	350	0	1221
20:00	139	531	42	51	51	83	6	8	0.00	260	0	1171
21:00	139	581	42	51	51	83	6	8	0.00	167	0	1128
22:00	139	545	42	51	51	83	6	8	0.00	140	0	1065
23:00	139	510	42	51	51	83	6	8	0.00	83	0	972
00:00	139	447	42	51	51	83	6	8	0.00	38	0	865

Scenario B

Year 2021. January (working day, Wednesday of the third week, Peak load)

Table 15

Hour	Riga CHP-1	Riga CHP-2	Imanta CHP	Biomass	Biogas	Gas fuelled co-generation	Small HPP	Wind power	Solar power	Daugava HPPs [10)]	Import	Load
01:00	139	412	42	64	65	85	6	12	0.00	34	0	858
02:00	139	374	42	64	65	85	6	12	0.00	20	0	806
03:00	139	356	42	64	65	85	6	12	0.00	19	0	787
04:00	139	348	42	64	65	85	6	12	0.00	19	0	779
05:00	139	348	42	64	65	85	6	12	0.00	33	0	792
06:00	139	378	42	64	65	85	6	12	0.00	53	0	842
07:00	139	426	42	64	65	85	6	12	0.00	141	0	979
08:00	139	505	42	64	65	85	6	12	0.00	241	0	1158
09:00	139	531	42	64	65	85	6	12	1.59	332	0	1276
10:00	139	569	42	64	65	85	6	12	1.59	335	0	1317
11:00	139	650	42	64	65	85	6	12	1.59	269	0	1333
12:00	139	690	42	64	65	85	6	12	1.59	208	0	1312
13:00	139	675	42	64	65	85	6	12	1.59	186	0	1275
14:00	139	683	42	64	65	85	6	12	1.59	209	0	1305
15:00	139	647	42	64	65	85	6	12	1.59	251	0	1312
16:00	139	624	42	64	65	85	6	12	1.59	278	0	1315
17:00	139	625	42	64	65	85	6	12	0.00	350	0	1387
18:00	139	584	42	64	65	85	6	12	0.00	350	0	1345
19:00	139	556	42	64	65	85	6	12	0.00	350	0	1317
20:00	139	592	42	64	65	85	6	12	0.00	260	0	1264
21:00	139	638	42	64	65	85	6	12	0.00	167	0	1217
22:00	139	597	42	64	65	85	6	12	0.00	140	0	1149
23:00	139	555	42	64	65	85	6	12	0.00	83	0	1049
00:00	139	483	42	64	65	85	6	12	0.00	38	0	933

Scenario B

Year 2026. January (working day, Wednesday of the third week, Peak load)

Table 16

Hour	Riga CHP-1	Riga CHP-2	Imanta CHP	Biomass	Biogas	Gas fuelled co-generation	Small HPP	Wind power	Solar power	Daugava HPPs 10)	Import	Load
01:00	139	458	42	80	82	87	6	23	0.00	34	0	951
02:00	139	414	42	80	82	87	6	23	0.00	20	0	893
03:00	139	394	42	80	82	87	6	23	0.00	19	0	872
04:00	139	385	42	80	82	87	6	23	0.00	19	0	863
05:00	139	386	42	80	82	87	6	23	0.00	33	0	878
06:00	139	422	42	80	82	87	6	23	0.00	53	0	934
07:00	139	485	42	80	82	87	6	23	0.00	141	0	1085
08:00	139	583	42	80	82	87	6	23	0.00	241	0	1283
09:00	139	621	42	80	82	87	6	23	2.71	332	0	1414
10:00	139	663	42	80	82	87	6	23	2.71	335	0	1460
11:00	139	747	42	80	82	87	6	23	2.71	269	0	1477
12:00	139	784	42	80	82	87	6	23	2.71	208	0	1454
13:00	139	765	42	80	82	87	6	23	2.71	186	0	1413
14:00	139	776	42	80	82	87	6	23	2.71	209	0	1446
15:00	139	741	42	80	82	87	6	23	2.71	251	0	1454
16:00	139	718	42	80	82	87	6	23	2.71	278	0	1458
17:00	139	728	42	80	82	87	6	23	0.00	350	0	1537
18:00	139	682	42	80	82	87	6	23	0.00	350	0	1491
19:00	139	651	42	80	82	87	6	23	0.00	350	0	1460
20:00	139	682	42	80	82	87	6	23	0.00	260	0	1401
21:00	139	723	42	80	82	87	6	23	0.00	167	0	1349
22:00	139	674	42	80	82	87	6	23	0.00	140	0	1273
23:00	139	621	42	80	82	87	6	23	0.00	83	0	1163
00:00	139	537	42	80	82	87	6	23	0.00	38	0	1034

Power demand and possible sources of guaranteeing, hourly balance for Scenario EU (peak load), MW

Scenario EU

Year 2017. January (working day, Wednesday of the third week, Peak load)

Table 17

Hour	Riga CHP-1	Riga CHP-2	Imanta CHP	Biomass	Biogas	Gas fuelled co-generation	Small HPP	Wind power	Solar power	Daugava HPPs [10)]	Import	Load
01:00	139	365	42	55	56	83	6	11	0.00	39	0	795
02:00	139	332	42	55	56	83	6	11	0.00	23	0	747
03:00	139	316	42	55	56	83	6	11	0.00	22	0	729
04:00	139	309	42	55	56	83	6	11	0.00	22	0	722
05:00	139	305	42	55	56	83	6	11	0.00	38	0	734
06:00	139	329	42	55	56	83	6	11	0.00	61	0	781
07:00	139	355	42	55	56	83	6	11	0.00	161	0	907
08:00	139	406	42	55	56	83	6	11	0.00	276	0	1073
09:00	139	411	42	55	56	83	6	11	0.95	379	0	1183
10:00	139	446	42	55	56	83	6	11	0.95	383	0	1221
11:00	139	535	42	55	56	83	6	11	0.95	308	0	1235
12:00	139	586	42	55	56	83	6	11	0.95	238	0	1216
13:00	139	576	42	55	56	83	6	11	0.95	213	0	1182
14:00	139	579	42	55	56	83	6	11	0.95	239	0	1210
15:00	139	537	42	55	56	83	6	11	0.95	287	0	1216
16:00	139	509	42	55	56	83	6	11	0.95	318	0	1219
17:00	139	494	42	55	56	83	6	11	0.00	400	0	1285
18:00	139	456	42	55	56	83	6	11	0.00	400	0	1247
19:00	139	430	42	55	56	83	6	11	0.00	400	0	1221
20:00	139	483	42	55	56	83	6	11	0.00	297	0	1171
21:00	139	546	42	55	56	83	6	11	0.00	191	0	1128
22:00	139	513	42	55	56	83	6	11	0.00	160	0	1065
23:00	139	487	42	55	56	83	6	11	0.00	94	0	972
00:00	139	430	42	55	56	83	6	11	0.00	44	0	865

Scenario EU

Year 2021. January (working day, Wednesday of the third week, Peak load)

Table 18

Hour	Riga CHP-1	Riga CHP-2	Imanta CHP	Biomass	Biogas	Gas fuelled co-generation	Small HPP	Wind power	Solar power	Daugava HPPs [10)]	Import	Load
01:00	139	373	42	75	78	85	6	23	0.00	39	0	858
02:00	139	336	42	75	78	85	6	23	0.00	23	0	806
03:00	139	318	42	75	78	85	6	23	0.00	22	0	787
04:00	139	310	42	75	78	85	6	23	0.00	22	0	779
05:00	139	308	42	75	78	85	6	23	0.00	38	0	792
06:00	139	335	42	75	78	85	6	23	0.00	61	0	842
07:00	139	371	42	75	78	85	6	23	0.00	161	0	979
08:00	139	435	42	75	78	85	6	23	0.00	276	0	1158
09:00	139	447	42	75	78	85	6	23	2.34	379	0	1276
10:00	139	485	42	75	78	85	6	23	2.34	383	0	1317
11:00	139	576	42	75	78	85	6	23	2.34	308	0	1333
12:00	139	625	42	75	78	85	6	23	2.34	238	0	1312
13:00	139	613	42	75	78	85	6	23	2.34	213	0	1275
14:00	139	617	42	75	78	85	6	23	2.34	239	0	1305
15:00	139	576	42	75	78	85	6	23	2.34	287	0	1312
16:00	139	548	42	75	78	85	6	23	2.34	318	0	1315
17:00	139	540	42	75	78	85	6	23	0.00	400	0	1387
18:00	139	498	42	75	78	85	6	23	0.00	400	0	1345
19:00	139	471	42	75	78	85	6	23	0.00	400	0	1317
20:00	139	520	42	75	78	85	6	23	0.00	297	0	1264
21:00	139	579	42	75	78	85	6	23	0.00	191	0	1217
22:00	139	542	42	75	78	85	6	23	0.00	160	0	1149
23:00	139	508	42	75	78	85	6	23	0.00	94	0	1049
00:00	139	443	42	75	78	85	6	23	0.00	44	0	933

Scenario EU

Year 2026. January (working day, Wednesday of the third week, Peak load)

Table 19

Hour	Riga CHP-1	Riga CHP-2	Imanta CHP	Biomass	Biogas	Gas fuelled co-generation	Small HPP	Wind power	Solar power	Daugava HPPs 10)	Import	Load
01:00	139	390	42	101	105	87	6	42	0.00	39	0	951
02:00	139	348	42	101	105	87	6	42	0.00	23	0	893
03:00	139	328	42	101	105	87	6	42	0.00	22	0	872
04:00	139	320	42	101	105	87	6	42	0.00	22	0	863
05:00	139	319	42	101	105	87	6	42	0.00	38	0	878
06:00	139	351	42	101	105	87	6	42	0.00	61	0	934
07:00	139	402	42	101	105	87	6	42	0.00	161	0	1085
08:00	139	485	42	101	105	87	6	42	0.00	276	0	1283
09:00	139	509	42	101	105	87	6	42	4.07	379	0	1414
10:00	139	551	42	101	105	87	6	42	4.07	383	0	1460
11:00	139	644	42	101	105	87	6	42	4.07	308	0	1477
12:00	139	690	42	101	105	87	6	42	4.07	238	0	1454
13:00	139	674	42	101	105	87	6	42	4.07	213	0	1413
14:00	139	682	42	101	105	87	6	42	4.07	239	0	1446
15:00	139	641	42	101	105	87	6	42	4.07	287	0	1454
16:00	139	614	42	101	105	87	6	42	4.07	318	0	1458
17:00	139	615	42	101	105	87	6	42	0.00	400	0	1537
18:00	139	569	42	101	105	87	6	42	0.00	400	0	1491
19:00	139	538	42	101	105	87	6	42	0.00	400	0	1460
20:00	139	582	42	101	105	87	6	42	0.00	297	0	1401
21:00	139	636	42	101	105	87	6	42	0.00	191	0	1349
22:00	139	591	42	101	105	87	6	42	0.00	160	0	1273
23:00	139	547	42	101	105	87	6	42	0.00	94	0	1163
00:00	139	468	42	101	105	87	6	42	0.00	44	0	1034

Power demand and possible sources of guaranteeing, hourly balance for Scenario A (minimum load), MW

Scenario A
Year 2017. June – minimum load

Table 20

Hour	Riga CHP-1	Riga CHP-2	Imanta CHP	Biomass	Biogas	Gas fuelled co-generation	Small HPP	Wind power	Solar power	Daugava HPPs [10)]	Import	Load
00:00	0	343	0	47	49	83	6	8	0.00	77	0	612
01:00	0	321	0	47	49	83	6	8	0.00	62	0	575
02:00	0	297	0	47	49	83	6	8	0.00	54	0	544
03:00	0	284	0	47	49	83	6	8	0.00	36	0	512
04:00	0	262	0	47	49	83	6	8	0.00	36	0	491
05:00	0	245	0	47	49	83	6	8	0.00	33	0	470
06:00	0	193	0	47	49	83	6	8	0.00	75	0	461
07:00	0	170	0	47	49	83	6	8	0.00	145	38	469
08:00	0	170	0	47	49	83	6	8	0.46	212	87	489
09:00	0	170	0	47	49	83	6	8	0.46	259	92	530
10:00	0	170	0	47	49	83	6	8	0.46	270	59	574
11:00	0	170	0	47	49	83	6	8	0.46	265	26	602
12:00	0	184	0	47	49	84	6	8	0.46	244	0	622
13:00	0	197	0	47	49	84	6	8	0.46	236	0	627
14:00	0	181	0	47	49	84	6	8	0.46	251	0	626
15:00	0	206	0	47	49	84	6	8	0.46	232	0	632
16:00	0	230	0	47	49	84	6	8	0.46	209	0	633
17:00	0	274	0	47	49	84	6	8	0.46	172	0	640
18:00	0	291	0	47	49	84	6	8	0.46	158	0	642
19:00	0	302	0	47	49	84	6	8	0.00	150	0	645
20:00	0	286	0	47	49	84	6	8	0.00	169	0	648
21:00	0	326	0	47	49	84	6	8	0.00	140	0	660
22:00	0	347	0	47	49	84	6	8	0.00	115	0	656
23:00	0	350	0	47	49	84	6	8	0.00	94	0	637

Scenario A
<u>Year 2021. June – minimum load</u>

Table 21

Hour	Riga CHP-1	Riga CHP-2	Imanta CHP	Biomass	Biogas	Gas fuelled co-generation	Small HPP	Wind power	Solar power	Daugava HPPs [10)]	Import	Load
00:00	0	372	0	52	57	85	6	12	0.00	77	0	660
01:00	0	348	0	52	57	84	6	12	0.00	62	0	621
02:00	0	321	0	52	57	84	6	12	0.00	54	0	587
03:00	0	305	0	52	57	84	6	12	0.00	36	0	553
04:00	0	282	0	52	57	84	6	12	0.00	36	0	529
05:00	0	263	0	52	57	84	6	12	0.00	33	0	507
06:00	0	211	0	52	57	84	6	12	0.00	75	0	498
07:00	0	170	0	52	57	84	6	12	0.00	145	20	506
08:00	0	170	0	52	57	84	6	12	0.87	212	67	527
09:00	0	170	0	52	57	84	6	12	0.87	259	69	572
10:00	0	170	0	52	57	84	6	12	0.87	270	33	620
11:00	0	172	0	52	57	84	6	12	0.87	265	0	649
12:00	0	215	0	52	57	84	6	12	0.87	244	0	671
13:00	0	228	0	52	57	84	6	12	0.87	236	0	677
14:00	0	213	0	52	57	84	6	12	0.87	251	0	676
15:00	0	238	0	52	57	84	6	12	0.87	232	0	682
16:00	0	262	0	52	57	84	6	12	0.87	209	0	683
17:00	0	306	0	52	57	84	6	12	0.87	172	0	691
18:00	0	323	0	52	57	84	6	12	0.87	158	0	693
19:00	0	335	0	52	57	84	6	12	0.00	150	0	696
20:00	0	320	0	52	57	84	6	12	0.00	169	0	700
21:00	0	361	0	52	57	84	6	12	0.00	140	0	712
22:00	0	381	0	52	57	84	6	12	0.00	115	0	707
23:00	0	382	0	52	57	84	6	12	0.00	94	0	688

Scenario A
Year 2026. June – minimum load

Table 22

Hour	Riga CHP-1	Riga CHP-2	Imanta CHP	Biomass	Biogas	Gas fuelled co-generation	Small HPP	Wind power	Solar power	Daugava HPPs [10)]	Import	Load
00:00	0	414	0	59	68	87	6	22	0.00	77	0	732
01:00	0	385	0	59	68	87	6	22	0.00	62	0	688
02:00	0	355	0	59	68	87	6	22	0.00	54	0	650
03:00	0	335	0	59	68	87	6	22	0.00	36	0	612
04:00	0	310	0	59	68	87	6	22	0.00	36	0	587
05:00	0	288	0	59	68	87	6	22	0.00	33	0	562
06:00	0	235	0	59	68	87	6	22	0.00	75	0	552
07:00	0	175	0	59	68	87	6	22	0.00	145	0	561
08:00	0	170	0	59	68	87	6	22	1.39	212	40	584
09:00	0	170	0	59	68	87	6	22	1.39	259	37	634
10:00	0	174	0	59	68	87	6	22	1.39	270	0	687
11:00	0	212	0	59	68	87	6	22	1.39	265	0	720
12:00	0	257	0	59	68	87	6	22	1.39	244	0	744
13:00	0	271	0	59	68	87	6	22	1.39	236	0	750
14:00	0	255	0	59	68	87	6	22	1.39	251	0	749
15:00	0	282	0	59	68	87	6	22	1.39	232	0	756
16:00	0	305	0	59	68	87	6	22	1.39	209	0	757
17:00	0	351	0	59	68	87	6	22	1.39	172	0	766
18:00	0	368	0	59	68	87	6	22	1.39	158	0	768
19:00	0	381	0	59	68	87	6	22	0.00	150	0	772
20:00	0	366	0	59	68	87	6	22	0.00	169	0	776
21:00	0	408	0	59	68	87	6	22	0.00	140	0	789
22:00	0	428	0	59	68	87	6	22	0.00	115	0	784
23:00	0	427	0	59	68	87	6	22	0.00	94	0	762

Power demand and possible sources of guaranteeing, hourly balance for Scenario B (minimum load), MW

Scenario B
Year 2017. June – minimum load

Table 23

Hour	Riga CHP-1	Riga CHP-2	Imanta CHP	Biomass	Biogas	Gas fuelled co-generation	Small HPP	Wind power	Solar power	Daugava HPPs 10)	Import	Load
00:00	0	313	0	51	51	83	6	8	0.00	100	0	612
01:00	0	296	0	51	51	83	6	8	0.00	80	0	575
02:00	0	274	0	51	51	83	6	8	0.00	71	0	544
03:00	0	267	0	51	51	83	6	8	0.00	47	0	512
04:00	0	245	0	51	51	83	6	8	0.00	47	0	491
05:00	0	229	0	51	51	83	6	8	0.00	43	0	470
06:00	0	170	0	51	51	83	6	8	0.00	98	5	461
07:00	0	170	0	51	51	83	6	8	0.00	188	87	469
08:00	0	170	0	51	51	83	6	8	0.70	275	156	489
09:00	0	170	0	51	51	83	6	8	0.70	336	175	530
10:00	0	170	0	51	51	83	6	8	0.70	350	145	574
11:00	0	170	0	51	51	83	6	8	0.70	343	111	602
12:00	0	170	0	51	51	83	6	8	0.70	317	64	622
13:00	0	170	0	51	51	83	6	8	0.70	306	48	627
14:00	0	170	0	51	51	83	6	8	0.70	325	68	626
15:00	0	170	0	51	51	83	6	8	0.70	300	37	632
16:00	0	170	0	51	51	83	6	8	0.70	272	8	633
17:00	0	218	0	51	51	83	6	8	0.70	224	0	640
18:00	0	239	0	51	51	83	6	8	0.70	205	0	642
19:00	0	253	0	51	51	83	6	8	0.00	194	0	645
20:00	0	232	0	51	51	83	6	8	0.00	218	0	648
21:00	0	280	0	51	51	83	6	8	0.00	181	0	660
22:00	0	308	0	51	51	83	6	8	0.00	149	0	656
23:00	0	317	0	51	51	83	6	8	0.00	122	0	637

Scenario B
Year 2021. June – minimum load

Table 24

Hour	Riga CHP-1	Riga CHP-2	Imanta CHP	Biomass	Biogas	Gas fuelled co-generation	Small HPP	Wind power	Solar power	Daugava HPPs [10)]	Import	Load
00:00	0	330	0	64	65	85	6	12	0.00	100	0	660
01:00	0	310	0	64	65	85	6	12	0.00	80	0	621
02:00	0	285	0	64	65	85	6	12	0.00	71	0	587
03:00	0	275	0	64	65	85	6	12	0.00	47	0	553
04:00	0	252	0	64	65	85	6	12	0.00	47	0	529
05:00	0	234	0	64	65	85	6	12	0.00	43	0	507
06:00	0	170	0	64	65	85	6	12	0.00	98	1	498
07:00	0	170	0	64	65	85	6	12	0.00	188	82	506
08:00	0	170	0	64	65	85	6	12	1.59	275	150	527
09:00	0	170	0	64	65	85	6	12	1.59	336	166	572
10:00	0	170	0	64	65	85	6	12	1.59	350	133	620
11:00	0	170	0	64	65	85	6	12	1.59	343	97	649
12:00	0	170	0	64	65	87	6	12	1.59	317	50	671
13:00	0	170	0	64	65	87	6	12	1.59	306	34	677
14:00	0	170	0	64	65	87	6	12	1.59	325	54	676
15:00	0	170	0	64	65	87	6	12	1.59	300	23	682
16:00	0	177	0	64	65	87	6	12	1.59	272	0	683
17:00	0	233	0	64	65	87	6	12	1.59	224	0	691
18:00	0	254	0	64	65	87	6	12	1.59	205	0	693
19:00	0	269	0	64	65	87	6	12	0.00	194	0	696
20:00	0	248	0	64	65	87	6	12	0.00	218	0	700
21:00	0	298	0	64	65	87	6	12	0.00	181	0	712
22:00	0	325	0	64	65	87	6	12	0.00	149	0	707
23:00	0	333	0	64	65	87	6	12	0.00	122	0	688

Scenario B

Year 2026. June – minimum load

Table 25

Hour	Riga CHP-1	Riga CHP-2	Imanta CHP	Biomass	Biogas	Gas fuelled co-generation	Small HPP	Wind power	Solar power	Daugava HPPs [10)]	Import	Load
00:00	0	354	0	80	82	87	6	23	0.00	100	0	732
01:00	0	330	0	80	82	87	6	23	0.00	80	0	688
02:00	0	302	0	80	82	87	6	23	0.00	71	0	650
03:00	0	288	0	80	82	87	6	23	0.00	47	0	612
04:00	0	262	0	80	82	87	6	23	0.00	47	0	587
05:00	0	242	0	80	82	87	6	23	0.00	43	0	562
06:00	0	176	0	80	82	87	6	23	0.00	98	0	552
07:00	0	170	0	80	82	87	6	23	0.00	188	74	561
08:00	0	170	0	80	82	87	6	23	2.71	275	141	584
09:00	0	170	0	80	82	87	6	23	2.71	336	152	634
10:00	0	170	0	80	82	87	6	23	2.71	350	114	687
11:00	0	170	0	80	82	87	6	23	2.71	343	75	720
12:00	0	170	0	80	82	87	6	23	2.71	317	23	744
13:00	0	170	0	80	82	87	6	23	2.71	306	7	750
14:00	0	170	0	80	82	87	6	23	2.71	325	27	749
15:00	0	175	0	80	82	87	6	23	2.71	300	0	756
16:00	0	205	0	80	82	87	6	23	2.71	272	0	757
17:00	0	262	0	80	82	87	6	23	2.71	224	0	766
18:00	0	283	0	80	82	87	6	23	2.71	205	0	768
19:00	0	300	0	80	82	87	6	23	0.00	194	0	772
20:00	0	279	0	80	82	87	6	23	0.00	218	0	776
21:00	0	330	0	80	82	87	6	23	0.00	181	0	789
22:00	0	357	0	80	82	87	6	23	0.00	149	0	784
23:00	0	362	0	80	82	87	6	23	0.00	122	0	762

Power demand and possible sources of guaranteeing, hourly balance for Scenario EU (minimum load), MW

Scenario EU
Year 2017. June – minimum load

Table 26

Hour	Riga CHP-1	Riga CHP-2	Imanta CHP	Biomass	Biogas	Gas fuelled co-generation	Small HPP	Wind power	Solar power	Daugava HPPs 10)	Import	Load
00:00	0	288	0	55	56	83	6	11	0.00	114	0	612
01:00	0	274	0	55	56	83	6	11	0.00	91	0	575
02:00	0	253	0	55	56	83	6	11	0.00	81	0	544
03:00	0	249	0	55	56	83	6	11	0.00	53	0	512
04:00	0	227	0	55	56	83	6	11	0.00	53	0	491
05:00	0	211	0	55	56	83	6	11	0.00	49	0	470
06:00	0	170	0	55	56	83	6	11	0.00	112	31	461
07:00	0	170	0	55	56	83	6	11	0.00	214	125	469
08:00	0	170	0	55	56	83	6	11	0.95	314	207	489
09:00	0	170	0	55	56	83	6	11	0.95	384	235	530
10:00	0	170	0	55	56	83	6	11	0.95	400	207	574
11:00	0	170	0	55	56	83	6	11	0.95	393	172	602
12:00	0	170	0	55	56	83	6	11	0.95	362	121	622
13:00	0	170	0	55	56	83	6	11	0.95	350	105	627
14:00	0	170	0	55	56	83	6	11	0.95	371	127	626
15:00	0	170	0	55	56	83	6	11	0.95	343	93	632
16:00	0	170	0	55	56	83	6	11	0.95	310	59	633
17:00	0	173	0	55	56	83	6	11	0.95	256	0	640
18:00	0	197	0	55	56	83	6	11	0.95	234	0	642
19:00	0	213	0	55	56	83	6	11	0.00	222	0	645
20:00	0	188	0	55	56	83	6	11	0.00	250	0	648
21:00	0	242	0	55	56	83	6	11	0.00	207	0	660
22:00	0	274	0	55	56	83	6	11	0.00	171	0	656
23:00	0	287	0	55	56	83	6	11	0.00	139	0	637

Scenario EU
<u>Year 2021. June – minimum load</u>

Table 27

Hour	Riga CHP-1	Riga CHP-2	Imanta CHP	Biomass	Biogas	Gas fuelled co-generation	Small HPP	Wind power	Solar power	Daugava HPPs 10)	Import	Load
00:00	0	281	0	75	78	85	6	23	0.00	114	0	660
01:00	0	264	0	75	78	85	6	23	0.00	91	0	621
02:00	0	240	0	75	78	85	6	23	0.00	81	0	587
03:00	0	234	0	75	78	85	6	23	0.00	53	0	553
04:00	0	210	0	75	78	85	6	23	0.00	53	0	529
05:00	0	193	0	75	78	85	6	23	0.00	49	0	507
06:00	0	170	0	75	78	85	6	23	0.00	112	50	498
07:00	0	170	0	75	78	85	6	23	0.00	214	144	506
08:00	0	170	0	75	78	85	6	23	2.34	314	225	527
09:00	0	170	0	75	78	85	6	23	2.34	384	250	572
10:00	0	170	0	75	78	85	6	23	2.34	400	219	620
11:00	0	170	0	75	78	85	6	23	2.34	393	182	649
12:00	0	170	0	75	78	85	6	23	2.34	362	129	671
13:00	0	170	0	75	78	85	6	23	2.34	350	112	677
14:00	0	170	0	75	78	85	6	23	2.34	371	134	676
15:00	0	170	0	75	78	85	6	23	2.34	343	100	682
16:00	0	170	0	75	78	85	6	23	2.34	310	66	683
17:00	0	170	0	75	78	85	6	23	2.34	256	3	691
18:00	0	191	0	75	78	85	6	23	2.34	234	0	693
19:00	0	208	0	75	78	85	6	23	0.00	222	0	696
20:00	0	184	0	75	78	85	6	23	0.00	250	0	700
21:00	0	238	0	75	78	85	6	23	0.00	207	0	712
22:00	0	271	0	75	78	85	6	23	0.00	171	0	707
23:00	0	282	0	75	78	85	6	23	0.00	139	0	688

Scenario EU

Year 2026. June – minimum load

Table 28

Hour	Riga CHP-1	Riga CHP-2	Imanta CHP	Biomass	Biogas	Gas fuelled co-generation	Small HPP	Wind power	Solar power	Daugava HPPs [10)]	Import	Load
00:00	0	277	0	101	105	87	6	42	0.00	114	0	732
01:00	0	256	0	101	105	87	6	42	0.00	91	0	688
02:00	0	228	0	101	105	87	6	42	0.00	81	0	650
03:00	0	218	0	101	105	87	6	42	0.00	53	0	612
04:00	0	193	0	101	105	87	6	42	0.00	53	0	587
05:00	0	173	0	101	105	87	6	42	0.00	49	0	562
06:00	0	170	0	101	105	87	6	42	0.00	112	71	552
07:00	0	170	0	101	105	87	6	42	0.00	214	164	561
08:00	0	170	0	101	105	87	6	42	4.07	314	245	584
09:00	0	170	0	101	105	87	6	42	4.07	384	265	634
10:00	0	170	0	101	105	87	6	42	4.07	400	228	687
11:00	0	170	0	101	105	87	6	42	4.07	393	188	720
12:00	0	170	0	101	105	87	6	42	4.07	362	133	744
13:00	0	170	0	101	105	87	6	42	4.07	350	115	750
14:00	0	170	0	101	105	87	6	42	4.07	371	138	749
15:00	0	170	0	101	105	87	6	42	4.07	343	102	756
16:00	0	170	0	101	105	87	6	42	4.07	310	68	757
17:00	0	170	0	101	105	87	6	42	4.07	256	5	766
18:00	0	189	0	101	105	87	6	42	4.07	234	0	768
19:00	0	209	0	101	105	87	6	42	0.00	222	0	772
20:00	0	185	0	101	105	87	6	42	0.00	250	0	776
21:00	0	241	0	101	105	87	6	42	0.00	207	0	789
22:00	0	273	0	101	105	87	6	42	0.00	171	0	784
23:00	0	282	0	101	105	87	6	42	0.00	139	0	762

3.2. Information on energy cross-border trade amounts for 2015, comparison to 2014.

Table 29

	Amounts of energy trade in 2014 (MWh)	Amounts of energy trade in 2015 (MWh)
Import	5 339 679	5 245 938
Export	3 023 388	3 424 478

Table 29 shows that in 2015 imports of electricity in comparison with 2014 has decreased by 1.8%, while the export from Latvian electricity system has increased by approximately 13% compared to the previous year. Such cross-border trading volumes indicate that in 2015 Latvian generation has exported larger volumes of electricity to neighbouring countries.

3.3. TSO evaluation for the time periods of insufficient power adequacy and suggestions for power supply guarantee in forthcoming years (i.e. generation development on certain locations, demand side management, new infrastructure creation).

Power system of Latvia is operating together with power systems of Estonia and Lithuania according to the principles of “Nord Pool” electricity market of Nordic countries, where balance of energy demand and supply is regulated under the electricity market conditions. Latvian TSO, as the institution responsible for the Latvian power system reliability, provides the market transactions within the Latvian bidding area, the continuous power balance between the Latvian consumption and generation, as well as control and publishes the available interconnection capacity for trade with the neighbouring power systems. Since the European Union's Energy Action Plan 2050 was adopted, which states that the generation development and national capacity adequacy should be focused on areas with renewable energy potential, to stimulate the reduction of CO2 emissions and greenhouse effect gas emission reduction, as well as contribute to a more efficient, competitive power generation development, the base capacity adequacy within the territory of one country is not necessarily an indication of adequacy of generating capacity, but it must be evaluated in complex with the available transmission capacities to/from the country or region (see paragraph 3.6.). In normal operation modes Latvian power system transfer capacities with neighbouring power systems are sufficient for provision of forecasted electricity imports/exports, with the exception of the Estonian-Latvian cross-border where capacity in some modes is insufficient, and the cross-border capacity during the whole year 2015 for 67% of the time was fully loaded, creating additional restrictions on the power system participants. Nevertheless, operating under above mentioned conditions during the previous years there have not been situations where a Latvian consumers or regions has had to be restricted due to insufficient generating capacity or insufficient capacity on interconnectors with Lithuania, Estonia and Russia. Until now, working synchronously with the Russian integrated power system / United power system (IPS/UPS) Latvian TSO in all operation modes has been able to provide the required power (consumption) within the Latvian electricity transmission system, regardless of the operational status of generating units within the territory of the Latvia. At the same time, analysing the adequacy of capacity on the national and regional level, the generating capacity of the Latvian power system is not sufficient to cover the Latvian power system peak load and ensure Latvian power system operation regardless of external conditions, especially in emergency situations caused by the cross-border transfer capacity reductions.

Analysing power supply adequacy for the forthcoming years in Conservative scenario (A) power demand (MW) table (table No 5) analysis shows that generation capacities are nearly sufficient only in 2016, for covering the peak demand of Latvian power system, to provide emergency and replacement reserves and fulfil the system regulation and security demands during the winter period.

In Conservative scenario (A) very slow progress is scheduled for Latvian electricity system since changes in state support mechanism for renewable energy producers are expected and operation of co-generation power plants, along with the natural gas power plants, including RigaCHP-1 and RigaCHP-2 in the free electricity market conditions will be ineffective. In Conservative scenario (A) tendencies in generation development will result in power deficit of 8% on 2021 and 17% on the year 2026. It is planned that in the year 2026 54 MW of total wind power capacity might be covered by off-shore wind parks, the pace of development for which is currently difficult to predict due to the national legislation uncertainty regarding support mechanisms for RES. Given the slow pace of wind power development, for conservative scenario (A), it is assumed that the off-shore wind farm development could begin not earlier than year 2023 (the minimum wind park construction period being approximately 5 years, research and building permit for the construction of off-shore wind farms taking c.a. 2 years). Throughout the period considered (2016-2026) generation capacity adequacy ranges from 83% to 100%, which points to the fact that generating capacity is insufficient to cover the consumption as well as to the fact that by 2026 capacity deficit will increase from 3 MW to 254 MW. Conservative scenario (A) clearly shows that it is very important not to lose / reduce the Latvian base power generation (Daugava cascade HPPs, RigaCHP-1 and RigaCHP-2). In Conservative scenario (A), the production of electricity is assessed if RigaCHP-1, RigaCHP-2 and Imanta CHP operates according to the elekctricity market conditions, when power plants are being inefficient and in the environment of competition are capable of producing only a fraction of the maximum possible power. The electricity balance table (Table 8) shows that the electricity deficit in the Latvian electricity system for Conservative scenario (A) ranges from 1,723 GWh to 1,915 GWh for the whole study period. Such power balance is assumed when during the high water inflow period on Daugava river (March, April, May) Daugava HPP’s are forced to export about 500 GWh of electricity to neighbouring systems.

In the Base scenario (B) analysis of the power demand (MW) power adequcy table (Table 6) shows that the Latvian electricity system is able to cover peak load from year 2016 to 2020 (106% to 101%), but from year 2021 to 2026 there is power deficit expected (1% to 9%). Base scenario (B) indicates that it is essential not to lose / reduce the existing Latvian base power generation (Daugava cascade HPPs, RigaCHP-1 and RigaCHP-2). For the Base scenario (B), it is assumed that the off-shore wind farm development might gradually take place from year 2023 onwards, after the commissioning of the Kurzeme Ring 3rd stage with implementation of first experimental wind turbines (25 MW) on the Baltic Sea shore, another assumption being that wind power development follows a slightly faster pace than planned in Conservative scenario (A). The electricity balance table (Table 9) shows that in the Base scenario (B) supply of electricity will not be sufficient for the whole development period (75-81%), which means that import of electricity from neighbouring power systems will be needed to ensure the electrical energy balance of Latvia. In the Base scenario (B) it is assumed that RigaCHP-1, RigaCHP-2 and ImantaCHP are operating according to the "Nord Pool" power exchange conditions and produces long-term average amount of electricity. For provision of Latvian power balance it is assumed that during the spring flood period (March-May), 500 GWh of electricity is exported to the neighbouring power systems since Latvian consumption during these months is insufficient to consume all of the electricity production in the Daugava HPP cascade. In the Base scenario (B) increased wind power share in the Latvian electricity system shall increase the need for regulatory reserves.

In the Optimistic scenario (EU) analysis of power (MW) adequcy table (Table 7) shows that the Latvian power system is able to cover the peak load from year 2016 to 2024 (101% to 111%), but from year 2025 to 2026 there is a power deficit (1% to 3%). This surplus generation capacity indicates that it is possible to export power to neighbouring power systems in order to help covering the peak loads of neighbouring power systems between years 2016 and 2024. In the Optimistic scenario (EU) it has been assumed that the off-shore wind farm development might gradually take place from year 2021 onwards. The electricity balance table (Table 10) shows that in the Optimistic scenario (EU) supply of electricity will be sufficient for the whole development period (137-142%), which means that for the provision of power balance Latvia will not need to import electricity from neighbouring power systems but Latvia will be able to export power to the neighbouring power systems. In the Optimistic scenario (EU) it has been assumed that RigaCHP-1, RigaCHP-2 and Imanta CHP will operate outside the electricity market conditions and outside of "Nord Pool" power exchange principles, and in order to ensure the security of Latvian electricity system these power stations are capable of producing the maximum possible amount of electricity, taking into account the annual repair schedules of these stations. In order to provide the power balance of Latvian power system it is assumed that during the spring flood (March- May), 500 GWh of electricity is exported to the neighbouring power systems, since Latvian consumption during these months is insufficient to consume all of the electricity production from the Daugava HPP cascade. In the Optimistic scenario (EU) even more rapid increase of the wind power share within the Latvian electricity system shall cause an increased need for regulatory reserves.

Analysing the winter peak load coverage period for the whole day for Conservative scenario (A), the conclusion is that in 2017 Latvian electricity system will be able to cover the daily load curve for the peak load day and there will be no need to import electricity from neighbouring power systems (Table 11). In Conservative scenario (A), in year 2021 Latvian power system will not require electricity imports from neighbouring power systems for peak load coverage (Table 12), but by the year 2026 in order to cover the peak load from 1 to 96 MW imports will be required, depending on the time of day (Table 13). In the Base scenario (B) Latvian TSO will be able to cover the day-time load for the full year of 2017 (Table 14), 2021 (Table 15) and year 2026 (Table 16). In the Base scenario (B), if necessary, it will be possible to export power to neighbouring power systems in order to help neighbouring countries to cover their peak loads in the winter months. In the Optimistic scenario (EU) as well as in the Base scenario (B) Latvian TSO will be able to cover the day-time load for the full year of 2017 (Table 17), 2021 (Table 18) and the year 2026 (Table 19).

For daily minimum load coverage in the Conservative scenario (A) by the year 2017 Riga CHP-1 and Imanta CHP are stopped (Table 20) of operation and power balance is provided mainly on renewable energy sources – biomass, biogas, wind power plants, the Daugava HPP’s, small hydroelectric power stations, solar power as well as small natural gas combined heat and power stations, and only RigaCHP-2 is regulated power station in the power system. Minimum production capacity of RigaCHP-2 is assumed as 170 MW. In such a scenario forced electricity exports to neighbouring power systems are ranging from 26 MW to 92 MW, depending on the time of day. In Conservative scenario (A) by the year 2021 biomass and biogas power plants, small hydroelectric power stations, wind and solar power plants, the Daugava cascade HPPs, small natural gas cogeneration plants are operating as the base power plants and RigaCHP-2 is being regulated (Table 21). Minimum output capacity for RigaCHP-2 in such case is assumed to be 170 MW. In such a scenario forced electricity exports to neighbouring power systems are ranging from 20 MW to 69 MW, depending on the time of day. By the year 2026 base power stations remain the same, while reduction of electricity exports to neighbouring power systems is caused by expected load growth, with such reduced exports being approximately 40 MW (Table 22).

For daily minimum load coverage in the Base scenario (B) by the 2017 RigaCHP-1 and ImantaCHP are stopped on operation (Table 23) and power balance is provided based on renewable energy sources – biomass, biogas, wind power plants, the Daugava cascade HPP’s, small hydroelectric power stations, solar power and small natural gas combined heat and power stations, and only RigaCHP-2 is being regulated. Minimum output capacity for this station is accepted as 170 MW. In such a scenario forced export of electricity to the neighbouring power systems is ranging from 5 to 175 MW, depending on the time of day. Total electricity exports amount is 905 MWh. In the Base scenario (B) by the year 2021 biomass, biogas power plants, small hydroelectric power stations, wind and solar power plants, the Daugava HPP’s and small natural gas cogeneration plants are operated as the base power plants, while RigaCHP-2 is being regulated (Table 24). The minimum capacity for RigaCHP-2 is assumed 170 MW. In such a scenario electricity export to the neighbouring power systems is in range from 1 to 166 MW, depending on the time of day. Total electricity exports are being 789 MWh, which is approx. 116 MWh less than in year 2017. By the year 2026 base power stations are the same, while reduced power exports within the range of 7-152 MW to neighbouring power systems are only caused by expected load growth (Table 25). For energy balance ensuring during the day and in order to provide power system security there is a need to export 613 MWh.

For daily minimum load coverage in the Optimistic scenario (EU), which is characterised by the fastest renewable energy source development by the year 2017 Riga CHP-1 and Imanta CHP are shut down (Table 26) and power balance is provided mainly on renewable energy sources – biomass and biogas, wind power plants, the Daugava HPP`s, small hydroelectric power stations, solar power stations, and small natural gas combined heat and power stations, and only RigaCHP-2 is regulated. Minimum output capacity for this station is assumed 170 MW. In such a scenario electricity exports to neighbouring power systems are ranging from 31 to 235 MW, depending on the time of day. Total electricity exports reach up to 1,482 MWh.

In the Optimistic scenario (EU) by the year 2021 biomass and biogas power stations, small hydroelectric power stations, wind and solar power stations, the Daugava HPP`s, small natural gas cogeneration stations are operated as the base power stations and RigaCHP-2 is regulated (Table 27). For this scenario RigaCHP-2 minimum capacity is assumed 170 MW. In such scenario electricity export to the neighbouring power systems is in the range from 3 to 250 MW, depending on the time of day.

Due to the rapid development of energy from renewable sources, power exports to neighbouring countries is increasing in order to maximize the use of renewable energy sources and to provide production coverage for the peak load hours of the day. Total electricity exports are reaching up to 1,613 MWh, an increase of 131 MWh more than in year 2017 in the such scenario. For the year 2026 base power stations remain the same, hourly exports to the neighbouring power systems increases only due to the growth of renewable energy development, ranging from 5 to 265 MW (Table 28). For providing of power system adequcy and power system security there is a need to export 1,722 MWh, an increase of 109 MWh more, compared to the same scenario in year 2021. Increasing the production of electricity from renewable energy sources, there is a problem with minimum load and peak load coverage. At minimum load it is necessary to keep quick-starting gas burning CHP stations (at minimal output capacity) operational, which then provides daily coverage of peak load. In such a way in order to ensure that the power system reliability at the minimum load it is required to export electricity produced from renewable energy sources, but at peak load it is required in addition to maintain an regulating gas station in operation, because renewable energy sources alone are unable to cover the daily peak load consumption. While developing renewable energy sources, a greater need for fast regulation emergency and replacement reserve capacity is faced, in order to ensure load-generation balance in the power system.

3.4. Information on required and available emergency reserve capacities, replacement reserves (MW) and amount of reserve utilisation (MWh) in 2015.

Table 30

Month	Max required	Available		Replacement reserve (replace BRELL emergency reserve after 12h)	Utilised emergency reserve
		In Latvia	BRELL agreement, till 12h		
	MW	MW	MW	MW	MWh
January	275	100	175	100	0
February	275	100	175	100	175.001
March	275	100	175	100	61.667
April	275	100	175	100	4965.997
May	275	100	175	100	1867.999
June	275	100	175	100	2776.167
July	275	100	175	100	255.831
August	275	100	175	100	3483.663
September	275	100	175	100	564.166
October	275	100	175	100	9919.8
November	275	100	175	100	248.333
December	275	100	175	100	0

3.5. TSO conclusions on generation capacity and power availability for the needs of power supply providing for Latvian consumers.

Energy Development Guidelines for time period 2016-2020 are outlining directions, taking into account objectives of climate and energy policies, which were established by the European Council in March 8-9, 2007 and which are to be achieved in EU by year 2020:

- to reduce GHG emissions by 20% compared to levels of 1990;
- increase the share of renewable energy in the total energy consumption up to 20%;
- increase energy efficiency by 20%.

When analyzing the power adequacy (Table 5) it is evident that in 2017 in Conservative scenario (A) Latvian power system self-sufficiency will be around 100% for the power adequacy and - 67% for the energy adequcy (Table 8). In the Base scenario (B) power adequcy coverage of over 100% is observed from year 2016 to 2020, but from year 2021 to 2026 there will be the power adequcy deficit from 1% to 9%. In Optimistic scenario (EU) electricity production for the time interval from year 2016 to 2026 will be from 137 to 141%, which points to the fact that the Latvian power system will be able to cover the consumption in the whole development period. Table of the power adequacy also shows that in the Optimistic scenario (EU) there is sufficient generation capacity from year 2017 to 2024, but from year 2025 to 2026 there is a small power deficit (up to 3%).

New big capacity power plant commissioning in Latvia and in Baltic States till 2025 is not expected, because according to the information provided by the Latvian Ministry of Economics, big capacity power stations projects in Latvia are not planned and "Energy Strategy 2030" provides only for the development of market conditions for those regional power industry projects that are economically viable and for power stations projects based on low-carbon technologies and in future to reduce direct State impact for new big capacity projects. Latvian participation (as the investor status) in the Visaginas NPP project is to be supported from the Latvian government only if the project will be technically and economically viable. The topic of the Visaginas NPP construction is very vague, and construction of the power plant is highly questionable, because:

1. During the 2013 referendum in Lithuania society majority opposed the construction of NPP in Lithuania;
2. Lithuania's neighbouring countries and the power generating companies (including Latvian ones) anymore are not considering the possibility of implementation Visaginas NPP as regional project;
3. Interconnections between Lithuania and Sweden and Lithuania and Poland commissioned at the end of 2015 has opened wide possibilities for electricity consumers in Baltic to buy cheaper electricity from the Nordic countries;
4. In addition to the direct investment in the nuclear power plant construction, there comparatively large investments are necessary for reservation arrangements to ensure NPP units operation in normal and emergency modes. This kind of investments are needed not only from Lithuanian TSO in which opetaional zone NPP will be constructed, but also from the other TSO's in Baltic countries, which is contrary to internal Latvian laws, since the Latvian TSO is not allowed to provide reserves for generating units in the licence area of other countries TSO.

According to information available at AS „Augstsprieguma tīkls" construction of new NPPs is going on in Belarus and the Kaliningrad region. Nuclear power plant in the Kaliningrad region is intended for electricity exports to the Baltic States and Central Europe, because at the moment, due to the commissioning of gas-burning thermal power plants Kaliningrad region power system is able to provide self-sufficient electricity supply in normal operation modes. The new NPP in Kaliningrad region is planned to develop with two generation units and total capacity up to 2400 MW. Currently power plant commissioning time is uncertain, and NPP construction is suspended due to necessity of serious internal Kaliningrad transmission network reinforcements and powerful interconnections to neighbouring power systems, necessary for the project implementation in any scenario, which are not currently being developed. Meanwhile the first unit of Belarus NPP, constructed for internal needs of Belarusian power system and electricity consumers, with installed capacity of 1200 MW, is expected to commisioning in 2018 and the second unit with similar installed capacity, intended energy export, is expected to commissioning in 2020. Implementation of Belarus NPP 2nd unit depends on the dialogue between Belarusian side and the neighbouring countries on questions of transmission network reinforcement and construction of new interconnections. Taking into account the tendencies of power systems development, it can be concluded that such a large number of nuclear power stations in the Baltic States and around the Baltic region is not necessary.

Potential future interest from renewable energy producers in Latvia could mainly be related to the potential of the Baltic Sea offshore wind and wind farm construction on the Kurzeme shore. Taking into account the experience of previous years, wind power station construction time, Kurzeme Ring project commissioning time, current situation with the technical rrequirements issued to electricity generators, as well as taking into account existing Latvian legislation on renewable energy, system operators have no reason to believe that the submitted applications for wind park construction will be implemented in full amount. In this context, TSO expect that the number of actually built wind power stations and installed generation capacity will be considerably less than indicated in the issued technical requirements, and more intensive power plant development is expected after 5-7 years at the earliest, but currently there is no available criteria by which to evaluate and monitor the planned wind park construction process in objective manner.

Information on the development plans received from Latvian power users (both large - connected to the transmission network and small - connected to the distribution network) show very conservative development in the next ten years.

3.6. Conclusions of the TSO on the generation capacity adequacy and energy availability in the region of Baltic countries – Latvia, Lithuania and Estonia.

In December 2015 the cooperation agreement has been concluded between the Baltic TSOs, regarding power system operational security assessments on the Baltic level. The power adequacy for the Baltic States, possible imports to the Baltic countries and the peak load of Baltic States have been evaluated and studied under such cooperation agreement. Regional capacity adequacy assessment was performed by TSOs for two cases: N-0 and N-2 scenarions. N-0 is a normal operation condition of Baltic power systems, for N-2 it is assumed that the two major power system elements are disconnected from transmission network. For the assessment of 2016, these two major power system components are NordBalt (700 MW) DC link between Lithuania and Sweden and the Estlink 2 (650 MW) DC link between Finland and Estonia. Power adequacy assessment is done for 15 years, taking into account two scenarios – with and without the Visaginas NPP. Due to the fact that big capacity Nuclear Power Plant construction in the Baltic countries is very questionable, as well as TSOs are not informed on any progress in relation to the Visaginas NPP project development (also described in point 3.5), in this chapter power adequacy on Baltic level ie prepared scenario without the Visaginas NPP .

Baltic generation adequacy during normal operation (N-0) for winter peak is given in Figure 2. From the graph it is evident that Baltic countries are able to cover the peak load till 2020, but after 2020, when production at the Estonian oil shale power stations is reduced due to sulphur emission limits, the Baltic power systems will have the power deficit. Due to the available transmission capacity of interconnections Baltic countries is possible to cover peak loads with the power imports from neighbouring countries.

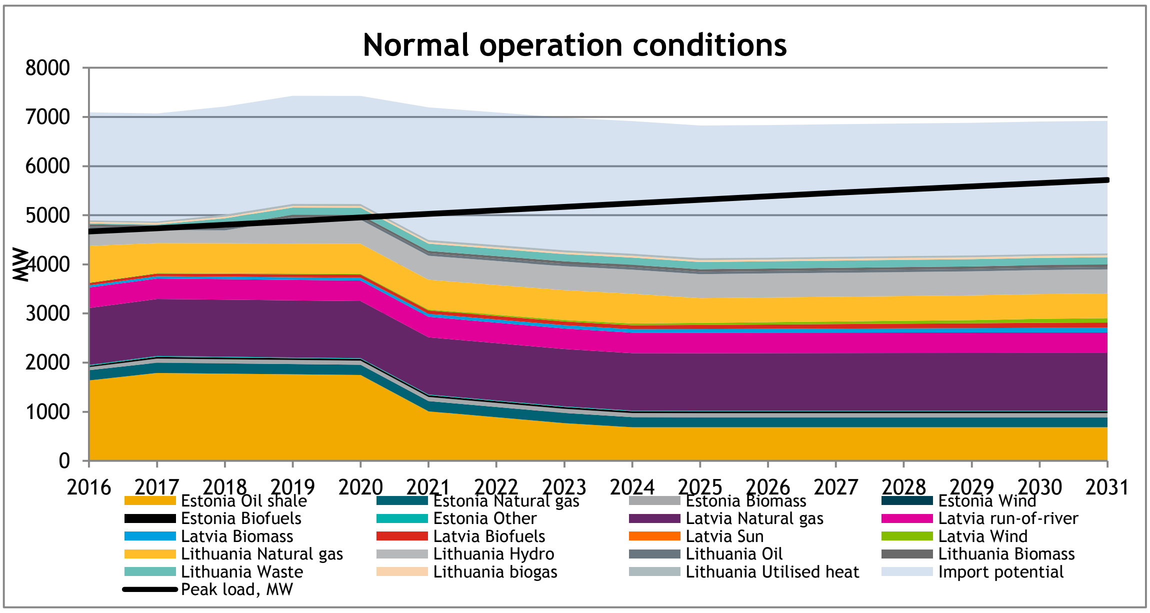

Fig. 2. Generation adequacy assessment for Baltic countries for winter peak load in normal operation conditions (N-0)

Power generation adequacy in Baltic countries in the situation when the two largest (N-2) Baltic power system elements (NordBalt and Estlink2) are switched off, is shown in Figure 3. The situation with the ower generation in the Baltic states till 2020 is unchanged, but in case of the outagesn of mentioned two major elements after 2028, the peak load coverage will not be possible via existing interconnections, as well as the available generation capacity in the Baltic countries is insufficient to provide the winter peak load. Such a scenario points that for covering of winter peak load in the Baltic power systems and secure power supply of Baltic consumers is necessary to develop power generation capacities in Baltic countries or construct new interconnectors with neighbouring countries.

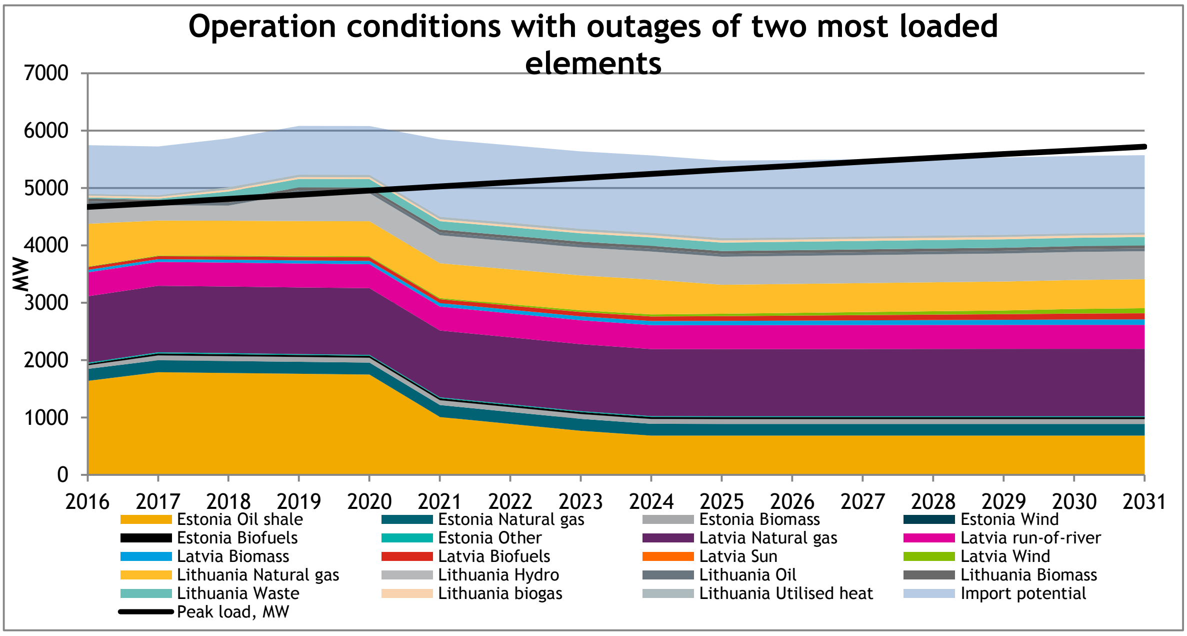

Fig. 3. Generation adequacy assessment for Baltic countries for winter peak load in operation conditions with outages of two major system components (N-2)

Figure 4 shows power adequacy for Baltic States in summer peak load period when water inflow in Dagava river is relatively low and part of big capacity power plants are out of operation due to planned maintenance and repairs.

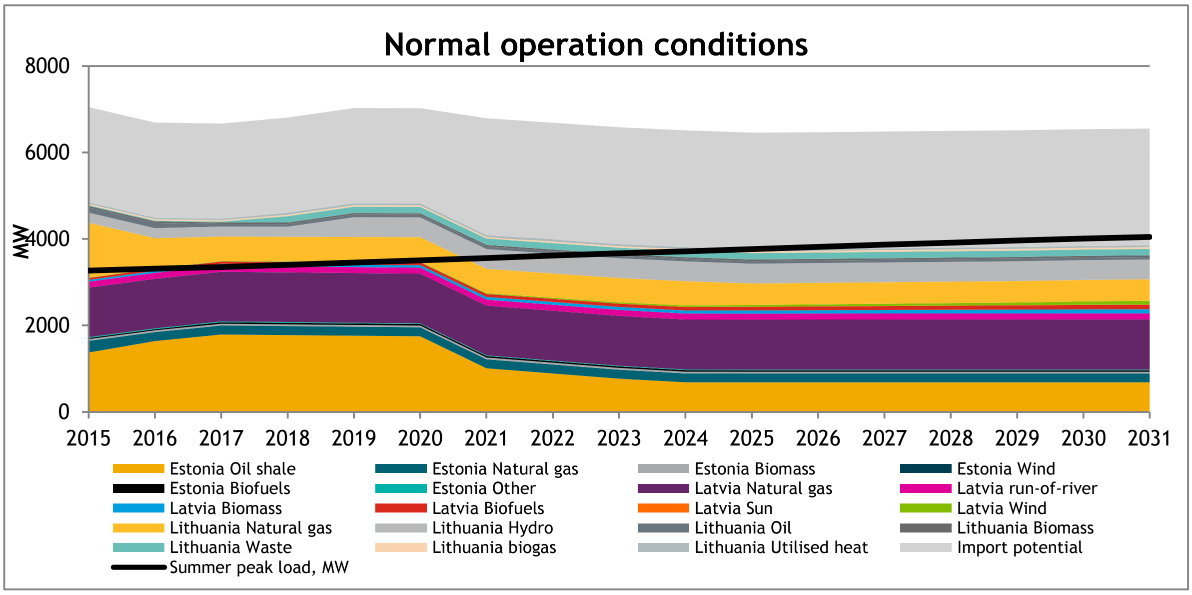

Fig. 4. Generation adequacy assessment for Baltic countries for summer peak load in normal operation conditions (N-0)

The graph show that Baltic power generation is sufficient till 2023, but from 2024 Baltic power system peak load during the summer months will be covered by electricity imports from neighbouring power systems. Interconnection transfer capacity with neighbouring countries is sufficient to cover peak loads for the whole period.

Power adequacy for Baltic countries during the summer peak load when two largest Baltic electricity system elements (NordBalt and Estlink2) are disconnected, is shown in Figure 5. Baltic generation is sufficient to cover summer peak loads by year 2023 and starting from 2024 the peak loads of Baltic electricity system will be covered by import from the neighbouring power systems, since interconnection capacity is sufficient to cover peak loads in summer.

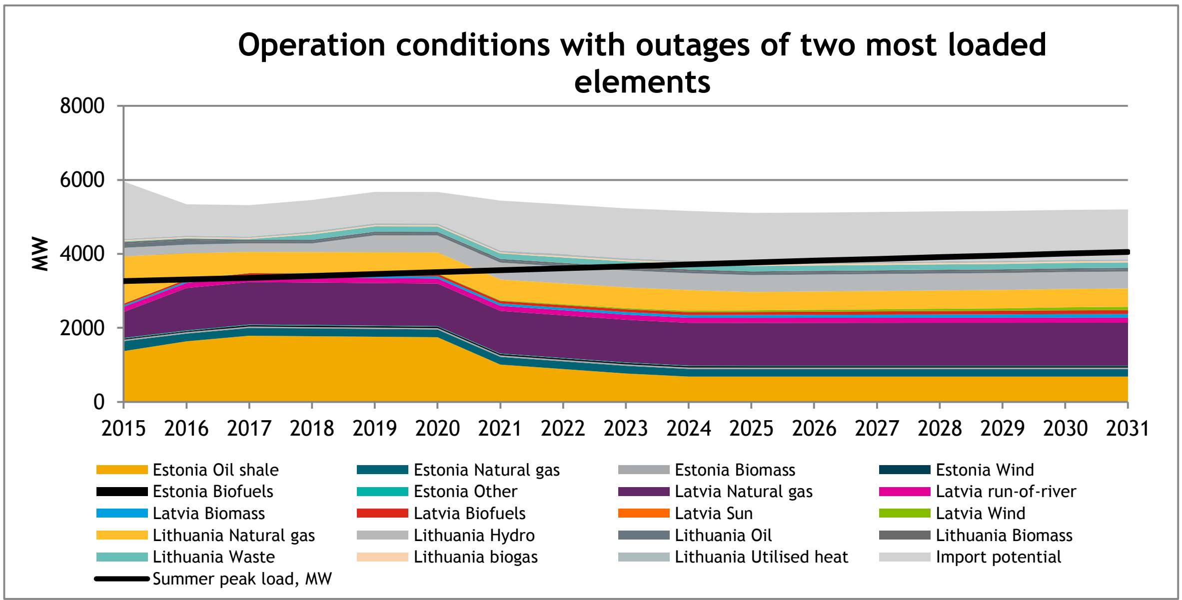

Fig. 5. Generation adequacy assessment for Baltic countries for summer peak load in operation conditions with outages of two major system components (N-2)

Baltic power systems regional adequacy analysis shown, that till year 2020 the generation capacity is sufficient to cover peak load in both summer and winter periods. Until 2023, the Baltic generation capacity is sufficient to cover peak loads in summer months, but during the winter months the Baltic power systems have to import electricity from neighbouring countries.

4. Transmission system adequacy for demand and maintenance quality

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

At present, various operation modes of Baltic power networks are characterised by reduced transmission capacities on the Latvian - Estonian cross-border due to the introduced restrictions by AS "Elering" (Estonian TSO) on cross-border and internal 330 kV transmission lines. The situation has been improved in 2013 with introduction of second generation unit in Riga CHP-2 with an installed capacity of 450 MW but this unit operates mostly in co-generation mode in winter (heating season) season when there is a heat load demand in the Riga city and in other periods mentioned power station is not competitive in the electricity market. The transmitted energy amount through Latvian transmission network increased in October 2013, when the Estonian-Finnish second DC interconnection Estlink2 has been commissioned and Latvian and Lithuanian (mostly) traders have increased the electricity trading amounts from the Nordic countries. Now, after the commissioning of Lithuanian-Swedish (NordBalt) interconnection the operational situation in the Estonian-Latvian cross-border in normal modes slightly improved, but in emergency mode it still remains critical and transmission capacity of Estonia-Latvia cross-section still is limited. In order to eliminate these disadvantages till 2020 is planned to implements Estonian-Latvian third connection, but after the mentioned project will be commissioned during the period up to year 2030 AS "Elering" plans to start the internal 330 kV transmission line reconstructions and elimination of the dimensioning problems. This means that the Latvian - Estonian cross-border capacity congestion will continue on. As the result of such cross-border capacity congestion, during the emergency or maintenance modes it is not possible to provide Latvian power system secure operation and Latvian and Lithuanian consumers possibility of import from the Nordic regions with cheapest electricity prices are limited.

The transmission capacity on Latvian-Lithuanian cross-section is sufficient and additional problems for electricity transportation in normal modes between Latvian and Lithuania are not expected, hence no additional measures are necessary to improve cross-border capacity between Latvia and Lithuania.

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

4.2.1. Kurzeme Ring 3rd stage “Ventspils-Tume-Imanta”

The Latvian electricity transmission network 330 kV project Kurzeme Ring 3rd stage "Ventspils-Tume-Imanta" implementation activities vae been continued in 2015. The expected date of project commissioning is the end of 2019. "Ventspils-Tume-Imanta" electricity transmission line project is included in following Latvian and European level development documents:

- Ten year network development plan of Latvian electricity transmission system,
- Ten year development plan of the transmission network of European Community,
- List of projects of common interest (hereinafter - PCI) with Nr.4.4.1, which is approved by the EU Regulation No. 2016/89 on November 18, 2015.

The project is co-financed from Connecting Europe Facility (CEF) funds, and co-finansion amount ir 45% of the total project costs. In May 2015 the Grant Agreement about project implementation conditions and co-financing rules has been signed between AS „Augstsprieguma tīkls” and the European Innovation and Network Executive Agency (INEA), delegated by the EC to manage the energy sector co-financing. In May 2015 AS „Augstsprieguma tīkls” announced a procurement procedure for "Ventspils-Tume-Imanta" 110 kV line reconstruction, reinforcing it with 330 kV line. Agreement for the design and construction works with the partnership of companies "LEC, RECK and Empower" has been signed on April 29, 2016.

On March 25, 2015 Latvian Cabinet of Ministers by the Cabinet Order No 140 has approved the results of environmental impact assessment (EIA) for Kurzeme Ring 3rd stage

"Ventspils-Tume-Imanta" and the status of National Interest Object for this project has been approved by Cabinet of Ministers order No 141.

After commissioning Kurzeme Ring project will provide the necessary infrastructure for wind farm development in Kurzeme region, will connect together two bigger Latvian production and consumption regions (Western and Central), as well as provide possibility for transit flow increase regarding operation of 700 MW DC connection between Sweden and Lithuania (NordBalt).

4.2.2. Third electricity interconnection between Latvia and Estonia

In cooperation with the Estonian transmission system operator and Latvian transmission system asset owner development of the third Estonian Latvian electrical interconnection between the 330 kV substations of Riga CHP-2 in Latvia and Killingi-Nomme in Estonia is going on. This interconnection will increase the available transmission capacity between the Latvian and Estonian electricity systems and will eliminate bottlenecks in the Estonian-Latvian cross-section, which currently restricts electricity trade between the Baltic and Nordic countries. Estonian-Latvian third interconnection project is considered one of the most important projects in the whole Baltic Sea region, since it is expected to provide increase of transmission capacity between Estonia and Latvia by 500/600 MW in normal mode and by 300/500 MW in isolated operation mode. Therefore Latvian-Estonian third interconnection, similar with Kurzeme Ring project is included in the Latvian, Estonian and European power transmission network development documents, such as:

- Ten year network development plan of Latvian electricity transmission system,
- Ten year network development plan of Estonian electricity transmission system,
- Ten year development plan of the European transmission network,
- PCI list with Nr.4.2.1, which is approved by the EU Regulation No. 2016/89 on November 18, 2015.

Taking into accounts the project importance for the whole Baltic Sea region, on November 21, 2014 European commission approved co-financing for "Estonia-Latvia third interconnection" project from CEF funds. Allocated amount of co-financing is 65% of the total project costs in the Latvian and Estonian territories.

In 2015 EIA and right-of-way studies for the third Estonian-Latvian interconnection have been continuing, as well as public consultations with local municipalieties and the land owners were carried out on the possible route variants in the Latvian territory, supported by European Commission co-financing from TEN-E funds. Due to the densely populated areas in Riga region and a sufficiently large opposition from the society and Latvian municipalities, at the end of 2014 the cooperation with the Latvian project promoters of European strategic railway project in Baltic countries "RailBaltica" has been started for a possibility to create a common route for rail and electricity transmission lines. Therefore, the EIA and line right of way approval process has been postponed for six months, and for some sections it was clarified and aligned with the overall "RailBaltic" project route options. EIA report for the Latvian-Estonian third interconnection project was completed in February 2016 and on February 16 the final EIA report has been submitted to the Environment State Bureau (ESB). On June 10, 2016 ESB has published the Conclusion No7 on the environmental impact assessment report for Estonian-Latvian third interconnection, where announce that acceptable transmission line route from environmental and society point of view is option on existing 110 kV electricity transmission line and in the stage from Saulkrasti to Riga CHP-2 substations - via common route with "RailBaltica" project.

On August 24, 2016 the Cabinet of Ministers has approved the EIA results and route variants for Latvian-Estonian third interconnection in the Latvian territory, and allocated the national interest object status for mentioned project. The procurement procedure for the design and construction works in Latvian territory is planned to announce in Q4 of 2016. Route variant in Estonian territory has also been approved by the relevant national authorities and procurement process for the project construction works in the Estonian territory is being prepared. Due to the fact that the project is a common one for two European Union member countries, the Latvian TSO „Augstsprieguma tīkls” and the Estonian TSO "Elering" closely cooperate with each other during the project implementation process.

Commissioning date of Latvian-Estonian third interconnection project is expected until the end of 2020.

4.2.3. Internal electricity transmission network connection “Riga CHP-2 – Riga HPP”

In 2015 the internal Latvian transmission network reinforcement project Riga CHP-2 - Riga HPP implementation activities have beem continued. Riga CHP-2 - Riga HPP project is Latvian electricity transmission network reinforcement for Riga region that will provide full functionality for the Estonian - Latvian third interconnection during repairs and outages modes in transmission grid of Riga region, as well as improve the power output possibilities from the reconstructed Riga CHP-2. In addition, this project, which is a direct connection between Riga CHP-2 and Riga HPP will provide the Riga CHP-2 with emergency start-up possibility from Riga HPP. At the regional level, this network reinforcement will play an essential role in the transmission capacity increase through the Baltic region in North - South direction, because after Baltic States connection with Nordic and Polish electricity systems the need for an internal Baltic electricity transmission network reinforcement has appeared on in order to ensure power flows in North - South direction. The project is to be commissioned by the end of 2020, before the implementation of the Estonian-Latvian third interconnection.

Similarly with other projects described in this chapter, the Riga CHP-2 - Riga HPP is candidate project for European co-funding from the Connecting Europe Facility funds, because it is also included in the Latvian and European development documents:

- Ten year network development plan of Latvian electricity transmission system,
- Ten year development plan of the European transmission network,
- PCI list with Nr.4.2.3, which is approved by the EU Regulation No. 2016/89 on November 18, 2015.

4.2.4. Reconstruction of existing 330 kV interconnections between Latvia and Estonia.

10-year development plan of Latvian electricity transmission system also includes plans for 330 kV transmission line Valmiera (Latvia) - Tartu (Estonia) and Valmiera (Latvia) - Tsirguliina (Estonia) reconstruction – in order to increase the capacity of cross-border between Latvia and Estonia. These transmission lines have been built in the 60-ties and 70-ies of the last century (Soviet Union period), and the construction standards used during the construction no longer meets current operational requirements, such as capacity differences between winter and summer seasons, is obstacle for optimal and efficient electricity market fukctioning. These lines have to be replace with news one, with higher transmission capacity, to increase total transmission capacity through Baltic power system in the North - South direction. Both lines are planned to reinforced immediately after the Estonian - Latvian third 330kV interconnection commissioning and the expected commissioning of the two projects is year 2024.

Both of these projects are included in the Latvian and European 10-year Development Plans, as well as being included in the PCI list with No. 4.8.1. and No. 4.8.3, and are candidates for EU co-financing.

4.2.5. Baltic networks synchronisation with Europe transmission networks and de-synchronisation from Russian power system.

Complying with the requirements of the joint communique of Baltic Prime Ministers from June 11, 2007 and based on the results of synchronization research projects on the Baltic power system synchronisation into the European Union internal electricity market, completed on October 2013, in year 2015 work of the Baltic synchronization project with continental Europe or Nordic countries and desynchronization from the Russian Integrated Power system/United power system (IPS/UPS) system has been continued. On January 14, 2015, during a meeting on Baltic ministers in Riga - Latvian Minister of Economy Dana Reizniece - Ozola, the Estonian Minister of Economy and Infrastructure Urve Palo and Lithuanian Energy Minister Rokas Masiulis, politically agreed on the Baltic synchronization project with the Continental Europe and on the it future development directions by signing of the Declaration on the energy security of supply in Baltics, where one of the topics is intended to support the Baltic synchronization with the European power system and desynchronization from the Russian IPS/UPS system. In February 2015, the Baltic TSO`s approved the "Synchronisation" roadmap, where agreed on the development scenarios via Lithuania and Poland with two AC interconnections LitPol Link1 and LitPol link 2. In 2015 Baltic TSO`s met big opposition from Polish side with research and implementation process of the second Lithuanian and Polish interconnection LitPol link 2 and Latvian and Estonian TSO`s offered the possibility of the Baltic power system synchronization with the Nordic electricity systems. At the end of 2015 the European Commission established the "Synchronisation" Working Group under the Baltic Electricity Market Interconnection Plan (BEMIP) electricity corridor for the representatives from Baltic Sea region TSO`s and responsible ministries. Currently, three possible variants of the Baltic States interconnection is studuing taking into account economic and technical advantages. The evaluated scenarios ar following:

- Baltic electricity system interconnection with continental European networks;
- Baltic electricity system interconnection with the Nordic electricity systems;
- Isolated operation of Baltic electricity system.

Study results are expected by the end of year 2016 and on the basis of these results is expected to select "Synchronisation" scenario option.

Complying with the "Synchronisation roadmap" prepared by the Baltic TSO`s and responsible ministries of Baltic countries and it approval at the beginning of 2016, the Baltic TSO`s have started activities for “Isolated operation test” preparation, to check the Baltic power systems possibility to work in isolated operation mode. The European co-financing from CEF funds by 50% has been received for such study preparing.

The Lithuanian-Swedish (NordBalt) DC interconnection with the transmission capacity of 700 MW and the Lithuanian-Polish DC interconnection (LitPol Link1) with transmission capacity 500 MW have been commissioned at the end of 2015. Mentioned interconnections and Estlink2 DC interconnector between Estonia and Finland with 650 MW transmission capacity, commissioned in 2013, provided deeper Baltic transmission networks integration to the Nordic electricity transmission networks and Baltic electricity market integration into the Nordic market. By the end of 2020 the Lithuanian and Polish TSO`s are planning to implement a second stage of DC interconnection LitPol Link 1 with transmission capacity 1,000 MW. Consequently, the implementation of these interconnections will provide the Baltic countries with more opportunities to buy or sell electricity from/to neighboring countries, but in different operational modes will provide realiable corridor for power flows from the Nordic countries to the continental Europe, thereby increasing the loading and the transit volumes through the Latvian electricity transmission networks.

4.3. 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 paragraph 4.2. will provide secure and reliable operation of transmission network, the power consumption and generation adequacy, stable operation of power stations and electricity transit through Latvia and the Baltic countries, as well as eliminate Baltic countries' energy island operation and connecting it to the power transmission networks of Europe. Despite the fact that after the implementation of regional direct current interconnections with Finland, Sweden and Poland, the Baltic States interconnection transmission capacity has increased, as well as electricity transit through the Latvian electricity transmission networks has decreased insignificantly, the long term, one of the possible solutions is to encourage all Latvian and Lithuanian power plants to participate in the "Nord Pool" electricity market and promote the electricity market liquidity. Increased competition and the development of new capacity will reduce the price of electricity in the Baltic region, as well as reduce the impact on the import of electricity from Russia and third countries.

330 kV and 110 kV transmission network is planned to be reconstructed, modernized and developed, according to the electricity transmission system development plan, elaborated by "Augstsprieguma tikls" AS and approved by the Public Utilities Commission (PUC). Mentioned plan is published in the AST and PUC websites. In parallel with the development of 330 kV transmission network, the 110 kV transmission network has also to be developed, especially in places where the requirements of reliability n-1 criterion are not realised. In 110 kV network planned 110 kV substation reconstructions are proposed, as well as the planned replacement of aged transformers. In addition to the completed 330 kV loop network around Riga, in Riga region it is necessary to reconstruct the 110 kV substations and improve the 110 kV network in order to increase security of energy supply.

4.4. Existing generation capacities, greater than 1 MW.

Latvian power system power stations with installed capacity above 1 MW are presented in the Table 31:

Table 31

No	**Station name**	**Installed capacity (MW)**
	Natural gas co-generation stations	
1	B-Energo SIA	1.998
2	Biosil SIA	1.998
3	BK Enerģija	3.9
4	Daugavpils siltumtīkli PAS	5.955
5	Dienvidlatgales īpašumi SIA	1.998
6	DLRR Enerģija SIA	1.698
7	Energy & Communication, AS	3.9
8	LATNEFTEGAZ SIA	3.986
9	RB Vidzeme SIA	1.998

10	Rēzeknes siltumtīkli SIA	5.572
11	Dobeles enerģija SIA	1.5
12	Fortum Latvia, SIA	3.996
13	Līvbērzes enerģija, SIA	1.644
14	WINDAU, SIA	3.8
15	Elektro bizness SIA	3.6
17	Mārupes siltumnīcas SIA	1.99
18	Olainfarm enerģija AS	2
19	Olenergo AS	3.12
20	Residence Energy, AS	1.24
21	SABIEDRĪBA MĀRUPE, SIA	2
22	Sal-Energo, SIA	3.99
23	VANGAŽU SILDSPĒKS, SIA	2.746
24	Zaļā dārzniecība SIA	1.999
25	Biznesa centrs Tomo SIA	1
26	Rīgas siltums AS	2.4
27	RTU Enerģija SIA	1.56
28	Uni-enerkom, SIA	2.997
29	LIEPĀJAS ENERĢIJA, SIA	4
30	SALDUS SILTUMS, SIA	1.3
31	VALMIERAS ENERĢIJA, AS	4
32	Juglas jauda, SIA	14,9
Biomass and biogas power stations		
1	AD Biogāzes stacija, SIA	1.96
2	Agro Iecava, SIA	1.95
3	Conatus BIOenergy, SIA	1.96
4	Bioenerģija-08, SIA	1.98
5	Biodegviela, SIA	2
6	BIO ZIEDI, SIA	1.998
7	DAILE AGRO, SIA	1
8	Getliņi EKO, BO SIA	5.24
9	Grow Energy, SIA	1.996
10	KŅAVAS GRANULAS, SIA	1
11	LIEPĀJAS RAS, SIA	1
12	RIGENS, SIA	2.096
13	Zaļā Mārupe, SIA	1
14	GRAANUL INVEST, SIA	6.492
15	Krāslavas nami, SIA	1
16	Liepājas Enerģija, SIA	2.5
17	GAS STREAM	1
18	BIO FUTURE, SIA	1
19	Pampāļi, SIA	1
20	EcoZeta, SIA	1.4
21	Saldus enerģija,SIA	1.862
22	BIOEninvest, SIA	1
23	Priekules Bioenerģija, SIA	2.4
24	Piejūras energy, SIA	1.6
25	Agro Lestene, SIA	1.5

26	OŠUKALNS, SIA	1.4
27	EGG Energy SIA	1.996
28	Fortum Jelgava SIA	23,82
29	RĪGAS SILTUMS AS	4
30	Agrofirma Tērvete AS	1.5
31	Zaļās zemes enerģija SIA	1
32	International Investments SIA	1
33	SM Energo SIA	1.1
34	Enefit power un Heat Valka SIA	2.4
35	TURBO ENERĢIJA SIA	1.95
36	Betula Premium SIA	1.9
37	Incukalns Energy SIA	3.999
38	Graanul Pellets Energy SIA	3.99
39	PREIĻU ENERĢĒTIKA SIA (Seces koks SIA)	1.15
40	JE Enerģija SIA	1
41	ATMOSCLEAR CHP RSEZ SIA	3.98
42	TUKUMS DH SIA	1.25
Wind power stations		
1	Baltnorvent, SIA, Alsungas VES	2
2	BK Enerģija, SIA	1.95
3	Enercom Plus, SIA	2.75
4	Impakt, SIA Užavas VES	1
5	Lenkas energo, SIA Lenkas VES- 1	2.745
6	VĒJA PARKS 10, SIA	1.8
7	VĒJA PARKS 11, SIA	1.8
8	VĒJA PARKS 12, SIA	1.8
9	VĒJA PARKS 13, SIA	1.8
10	VĒJA PARKS 14, SIA	1.8
11	VĒJA PARKS 15, SIA	1.8
12	VĒJA PARKS 16, SIA	1.8
13	VĒJA PARKS 17, SIA	1.8
14	VĒJA PARKS 18, SIA	1.8
15	VĒJA PARKS 19, SIA	1.8
16	VĒJA PARKS 20, SIA	1.8
17	WINERGY, SIA	20.7
18	Silfs V SIA	1
19	Latvenergo AS	1.2
Hydro power stations		
1	Spridzēnu HES, SIA	1.2
2	Aiviekstes HES, Latvenergo AS	1.32
Latvenergo power stations		
1	Ķeguma HES	240.1
2	Rīgas HES	402
3	Pļaviņu HES	894
4	Rīgas TEC-1	144
5	Rīgas TEC-2	881

4.5. Actions during maximum demand or supply deficit periods.

In the event of the deficit of power and energy in Latvian territory and in the neighbouring countries to cover the consumption of the Latvian power system, the TSO will be forced to limited or disable from the network a certain number of consumers in order to balance the power consumption and the generation in Latvian power system. In this case, the TSO will act according to Latvian legislation and will inform the Ministry of Economy of the problem of ensuring the balance of power.

On behalf of „Augstsprieguma tīkls" AS

Chairman of the Board V. Boks