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Cross-border energy infrastructure in the Baltic Sea Region

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[1] Political State of the Region Report does not classify Norway as a BSR state and therefore does not include Norway in the report. As this report is based on that document, this report does not include Norway.

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Tables and maps

[3] BPS2 does not go through Belarus.

1. Introduction to consumption of energy in the Baltic Sea Region (BSR)

According to the Political State of the Region Report[4], the Baltic Sea Region consists of nine countries which are located around the Baltic Sea. Those countries are Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, Russia and Sweden, together creating an energy network, which is of a strategic importance in matter of energy reliability, security of energy supplies, and effective use of resources for the region. The table below consists of primary energy consumption[5] of each Baltic Sea Region country, in order to outline their energy needs based on various energy resources. Norway and Iceland are commonly considered as members of the Baltic Sea Region due to their longstanding Nordic cooperation and cultural similarity[6]. However, they are not included in this report due to the Political State of the Region Report's classification.

Table 1. Primary energy consumption in the Baltic Sea Region in 2011

	Oil	Natural gas	Solid fossil fuels	Nuclear energy	Hydro-electricity	Renewables	Total (mtoe*)	Total (TWh)
Denmark	44 %	20 %	17 %	0 %	<0,3 %	18 %	18,7	217
Estonia**	13 %	9 %	69 %	0 %	7 %***		5,4	66
Finland	38 %	12 %	12 %	19 %	10 %	9,%	27,7	322
Germany	36 %	21 %	25 %	8 %	1 %	8 %	306,4	3563
Latvia**	31 %	31 %	2 %	0 %	25 %***		4,8	56
Lithuania	42 %	48 %	3 %	0 %	3 %	2 %	6,4	74
Poland	26 %	13 %	58 %	0 %	1 %	2 %	102,8	1196
Russia	20 %	56 %	13 %	6 %	5 %	0,02 %	685,6	7974
Sweden	29 %	2 %	4 %	27 %	30 %	8 %	50,5	587
EU 27	38 %	24 %	17 %	12 %	4 %	5 %	1690,7	19663

*Mtoe equals to million tonnes of oil equivalent
**Data for Estonia and Latvia from 2010
***All renewables, including hydroelectricity
Sources: Author's calculations based on: ESR 2011, BP 2012.

[4] Published by Baltic Development Forum in 2011.
[5] The country's Primary Energy Consumption (PEC) illustrates the total gross energy supply, defined as domestic production plus net imports, before any conversion of the primary energy into final energy forms has taken place. Net energy losses in the production of electricity and synthetic gas, refinery use and other energy sector uses and losses are included as well. Primary Energy Consumption definition from: ESR, 2011.
[6] PSRR, 2011.

Most of the countries within the Baltic Sea Region are strongly dependent on fossil fuels. Only Sweden's consumption mainly relies on hydroelectricity, renewables and nuclear power. The rest of the countries are heavily dependent on fossil fuels, such as natural gas in case of Russia, coal in Poland, oil in Finland and Denmark, oil shale in Estonia, or a mix of them in Germany, Latvia and Lithuania. However, an increase in use of renewable resources is visible in Nordic countries and in Latvia, as well as current plans to fully replace the use of fossil fuels in Germany in 40 years, which is highly possible to happen due to prosperous German economy and the country's advanced technology. Meanwhile in Lithuania, Poland and Russia, renewable sources of energy are barely used, which is about to be changed in the future due to the national energy strategies.

Taking into consideration last year's accident at nuclear power plant in Fukushima, Japan which has recently influenced the global discussion on the future of nuclear power, some countries like Germany decided to abandon nuclear power, while in others, nuclear power is widely used, for example in Sweden and Finland. Some other countries consider cross-border cooperation in order to increase their energy supply security and prepare a legal framework for implementation of a new rule of law to determine conditions for nuclear energy use. A public opinion poll in December 2006 in Poland showed that 60% of Poles supported construction of nuclear power plant in order to reduce the country's dependence on natural gas and to diminish CO_2 emissions. Moreover, 48% claimed that they would allow such a plant being built in their neighbourhood due to its immediate local benefits including lower power cost[7].

As most of the countries in the Baltic Sea Region are not abounding in highly valued natural resources, they are strongly influenced by imports, mainly from Russia where there are large deposits of natural gas and crude oil. In order to increase energy security, the BSR countries need to improve international cooperation and build new energy networks.

The main focus of this report is to present the newest ventures and initiatives in the Baltic Sea Region as well as the on-going projects and cooperation among BSR's countries. The aim of this report is to introduce each Baltic Sea Region country's energy profile and cross-border relations among the Baltic Sea countries, and to analyse the existing energy infrastructure in the Baltic Sea Region by taking into account future projects as well.

As there was lack of a comprehensive report on energy infrastructure in the BSR, this report gathers information on existing, under construction or planned electricity interconnections between countries, liquefied natural gas terminals and gas pipelines and oil terminals and pipelines within the Baltic Sea Region. Of a high importance is the energy infrastructure potential in each particular country and relations among them presented in the report.

[7] NPP, 2012.

2. Energy profiles of the BSR countries

Denmark

Denmark generates nearly half of its electricity from coal, with a substantial amount produced by wind as well. Around 10% of domestic consumption comes from nuclear power. In 1985, the Danish parliament passed a resolution that nuclear power plants would not be built in the country, which has not changed at present. In 2010, the country generated 38,6 TWh of electricity gross, of which 44% from coal, 20% from gas and 20% from wind. Around 11,7 TWh was exported and 10,6 TWh imported. Energinet.dk owns and operates the main electrical infrastructure in the country[8].

Norwegian hydro turbines system is strongly connected with Danish wind turbines system. The electricity imported from Sweden consists of nearly half of nuclear and half of hydro, whereas the electricity imported from Germany is mostly produced by brown coal and nuclear power. Norwegian electricity is almost all hydro. Thus, nuclear power provides a crucial part of Danish electricity supply. West Denmark has the most intense network of wind turbines in the world. The wind turbines strongly depend on 29 GWe of Norwegian hydro capacity, of which over 1 GWe can be dispatched immediately while the wind power is unavailable in Denmark[9]. Therefore, a natural and relevant interdependence exists between those two systems. While winds are good, power can be delivered back to Norway to conserve hydro potential. Although about 20% of electricity comes from wind, the country consumes only around half of it. Wind energy is effectively exported due to the spot price and also lower fossil generation in the country. However, while Norway and Sweden have to import more electricity than usually, Denmark increases its thermal generation. Furthermore, the Danish Government aims to supply 30% of energy consumption from renewables by 2020[10].

The Danish gas transmission system consists of upstream pipelines in the Danish part of the North Sea and onshore transmission pipelines. The pipelines go north-south from Aalborg to Ellund, and west-east from Nybro to Dragor. Distribution pipelines are made of a pipeline system network to the consumers with a gas treatment plant at Nybro, and two underground gas storage facilities at Stenlille and Lille Torup. Danish gas system is linked to the German grid at Ellund on the Danish-German border, and to the Swedish gas network at Dragor. The entire gas supply of Sweden comes from Denmark and its gas system[11], and from Norway with imports of liquefied natural gas (LNG).

In Denmark, there is one crude oil pipeline connecting some of the offshore production with the refinery and export terminal situated at Fredericia. The 330 km long pipeline is owned and operated by DONG Oil Pipe A/S, and has a capacity of 360 thousand barrels a day. A product pipeline system, Northern European Pipeline System (NEPS), spreads from Heide in Germany to North Jutland. The owner and operator of NEPS is the Danish military forces. Furthermore, the Danish stockholding agency owns and operates a number of product pipelines in Jutland and Zealand, including one from Kalundborg refinery to the Hedehusene terminal, supplying the Copenhagen area. Additionally to the ports at the refineries, the main terminals for loading and off-loading oil products on tankers are the ports of Aabenraa, Aalborg, Copenhagen and

[8] NED, 2012.
[9] NED, 2012.
[10] NED, 2012.
[11] Denmark, 2011.

Stigsnaes. Many other ports are used only to import oil products. The total storage capacity in Denmark equals to over 7,8 million cubic meters[12].

There is also an on-going discussion on the introduction of a long-term target to become fully independent from fossil fuels by 2025, which is highly possible to happen due to the country's engagement in the use of renewable resources. Total oil demand equals to almost 170 thousand barrels a day and is not expected to change drastically soon, with growing demand for diesel being offset due to decrease in demand for other fuels. Demand for natural gas, which was under 5 bcm in 2010, is going to drop largely due to new trends for renewable energy use in the power sector. The country is a net exporter of oil and natural gas and expects to remain so at least until the end of 2018 and 2020, respectively. It is also a net importer of middle distillates. In 2010, the country's net-exports of oil reached 82 barrels a day. Domestic gas production totalled 8,2 bcm in the same year, of which around 3,5 bcm was exported to Sweden, Germany, and the Netherlands[13].

Estonia

Estonia is a rather unique country as there are no high valued energy sources like gas, oil or coal but the country has a high potential of oil shale, at the same time having one of the best know-how in the oil shale industry. In 2010, over 78% of total energy production came from oil shale and almost 20% from wood fuel, making the production one-sided and dependent on non-renewable resources. Moreover, oil shale is not able to satisfy all energy demands, as liquid fuels constitute almost one third of total consumption, followed by 25% of heat, 21% of electricity, 17% of solid fuels and 5% of gas in total energy consumption[14]. Almost all of the domestic production is composed of solid fuels primarily to generate electricity and heat, thus the imports are necessary.

Most of Estonian exports consist of shale oil. Electricity equalled to 39% of total exports in 2010. Regarding oil shale, Estonia exports only processed products of it. Energy imports consist primarily of liquid fuels (69%) and natural gas (24%), which both are mainly imported from Russia[15].

Estonia sees nuclear energy as one of the most economically efficient future energy sources. After the Fukushima accident, Estonia did not abandon plans to build a nuclear plant. According to the Energy Sector Development Plan 2020, the country is working on its legal framework to constitute the conditions and processes of creating a nuclear plant by 2012[16], which would be built by 2023[17].

The environmental issues concerning nuclear energy are widely discussed in the society, as well as the overall necessity of nuclear energy in the country. However, the government is still planning to implement a new rule of law to allow the use of nuclear energy in the country[18]. The most probable location according to the Estonian media is Pakri Island, but the decision is still to be made while taking into consideration many factors[19], especially when laying legal foundations, training nuclear scientists or

[12] Denmark, 2011.
[13] Denmark, 2011.
[14] KAS, 2011.
[15] KAS, 2011.
[16] KAS, 2011.
[17] TBC, 2009.
[18] KAS, 2011.
[19] TBC, 2011.

drawing up a project take years. Estonian companies are also interested in taking part in nuclear power plant projects in neighbouring countries[20], such as cooperation with Latvia and Lithuania regarding Visaginas NPP project, which is presented under Lithuania's energy profile. Currently the largest renewable energy sources in use are wood fuels and turf, which require long restoration time. Hydro energy is quite likely not going to expand because of insufficient water resources[21].

Finland

Finland is a very high import dependent country when it comes to energy. In order to balance the lack of imports diversity, Finland gathers the country's supply from many different sources. Finnish biomass resources strongly enhance the country's supply security. The biomass resources are typically used in efficient, combined heat and power stations. The country is also abounding in peat, but there is an impact on moving away from carbon-intensive fuels by following the rules of a good energy policy such as energy security, environmental sustainability and economic efficiency. The electricity market is well integrated with the competitive Nordic market, Nord Pool. However, the gas market is physically linked only with Russia, which is the source of all Finnish gas. Finland generally lacks domestic energy resources. There is no coal production, no exploration or production of crude oil, and no domestic resources of natural gas in the country. All fossil fuels are imported and the net imports of electricity vary from 15 to 20% of total consumption, depending on rainfall in the Nordic countries. Coal is imported from Russia and Poland. All of Finnish gas supply is imported from Russia. Furthermore, nearly all of the Finnish oil imports and approximately 10% of the country's electricity come from Russia as well. The rest of oil imports come from Denmark, the UK, Kazakhstan, and Norway. Some of Finnish-processed gasoline and gasoil are exported to the USA, Sweden, Denmark, Canada, and Germany[22].

The primary domestic Finnish energy resources are hydro power, wood, wood waste and peat. The country's fossil fuels and hydropower covered around 72% of the primary energy consumption in 2011, which amounted to 228 TWh. According to the Energy Strategy of 2008, the aim is to increase the share of renewable energy to 38% by 2020 by intensifying the use of wood-based energy, waste fuels, heat pumps, biogas and wind energy, which is not very realistic. The construction of new power plants will require reduction or no emission of greenhouse gases, as it is visible in combined power and heat plants, using renewable fuels or hydro, wind and nuclear power plants. The Finnish power system is a part of the interconnected Nordic power system, formed of Norwegian, Swedish, Danish and Finnish power systems. Moreover, Finland has a direct current connection from Russia which enables power trading across the border. Electricity is also imported from Estonia. The power produced in Finland mainly comes from thermal, nuclear and hydropower plants. In 2010, they amounted to 55%, 28% and 17% of domestic electricity production, respectively. So far the use of wind power in electricity production is of a small volume but has increased gradually[23].

According to Statistics Finland's preliminary data, total energy consumption in 2011 decreased over 5% from the previous year. Consumption of electricity went down by 3,8% from 2010 but the net imports of electricity increased by nearly 32%. Carbon dioxide emissions from the production and use of energy declined by over 11% due to

[20] EE, 2012.
[21] KAS, 2011.
[22] Finland, 2007.
[23] IAEA, 2012.

11% reduction in use of fossil fuels and 8% in use of peat. The consumption of coal dropped by 21% and oil by over 5%. The consumption of nuclear energy grew by 2%. Production of wind power increased by 64%, the share of which in total energy consumption amounted to 0,1%. Wood fuels covered over one-fifth of total energy consumption. Electricity produced with hydropower dropped by 3%. In 2011, imports of energy products increased by 37%, while the exports grew by 29%[24].

In Finland there are four nuclear reactors, which provide almost 30% of the country's electricity. The fifth reactor named Olkiluoto 3 is currently under construction and two more are planned. The existing reactors in Finland are Olkiluoto 1 & 2 with the capacity of 860 MW[25] net each, and Loviisa 1 & 2 of 488 MW each. Olkiluoto 3 is estimated to start its commercial operation in August 2014. Olkiluoto 4 and Hanhikivi 1 are scheduled to be operational by 2020. There are no uranium mines in the country, so the fuel has to be imported. It is bought in Canada, Australia and Africa, converted in Canada and France and enriched in Russia. Fuel fabrication has been in Germany, Sweden and Spain[26].

Germany

In Germany, more than 90% of the primary energy consumption is based on crude oil, natural gas, coal, and uranium. There is also a large potential of geothermal energy, but it is not widely used so far. Majority of the fuels consumed in Germany are currently imported as follows: 98% of the crude oil, 87% of natural gas, and around 77% of coal come from abroad[27]. Some 40% of gas consumed in Germany is imported from Russia, approximately one third from Norway, and 24% from the Netherlands[28]. Russia also delivers over 1/3 of oil consumed in Germany. The country has changed its energy policy by reducing its dependence on fossil fuels and nuclear power, and by relying more on renewable energy sources. Those actions, though, require an enormous investment and a huge growth in energy efficiency. The use of fossil fuels has been reduced and exploration started on new economically feasible reserves such as the exploitation of shale gas. Germany relies on secure supplies of inexpensive energy. Over the last ten years, primary energy consumption has dropped by around 2,5% overall, of which nuclear fuels decreased by over 17%, coal by 16%, petroleum by over 14%, and lignite by nearly 2%. Only natural gas has noted a rise in consumption of 3%. If the non-conventional gas deposits produce significant quantities of natural gas, they may compensate lowering production of the conventional gas fields or cause natural gas imports cuts. Imports of hard coal will rise due to the termination of subsidies for domestic hard coal production in 2018. Lignite is the only fuel in the country able to satisfy its all demands from domestic production[29].

Germany has a huge impact on European energy policy due to its large size and strategic position within the continent. It is also the largest consumer of energy among European countries. The country has a relatively high share of oil in its primary energy consumption, and it relies on a diverse set of fuels to satisfy its supply. However, the reliance on oil is falling and an important share of supply comes from coal, natural gas and nuclear, also the share of renewables has been growing fast recently, forming around 9% of the country's total primary energy consumption in 2011. As the country

[24] SF, 2012.
[25] Megawatts.
[26] NPF, 2012.
[27] BGR, 2012.
[28] Liuhto, 2012.
[29] RAER, 2011.

provides less than one-fifth of its natural gas needs domestically, the rest has to be imported, mainly from the Netherlands and roughly 40% from Russia, which increase German reliance on Russian gas, especially after the Nord Stream operation began[30]. According to the Federal Ministry of Economics and Technology, in 2011, the share of renewables in gross electricity production in Germany amounted to 20%, of which 8% came from the wind, 5% from biomass, 3% from both water and photovoltaic, and 1% from biogenic household waste[31].

Germany's new energy policy consists of not only phasing out nuclear power by 2022, but also of the expansion of renewables; especially wind and solar power, which are supposed to reach 50% of the energy mix by 2030 and then 80% by 2050. There is also the reduction of greenhouse gases included in the German government policy, reaching 80% by 2050[32]. In September 2010, the Federal Government set ambitious targets for energy and climate policy, such as reducing energy consumption and increasing energy efficiency. Beside the gradual withdrawal from nuclear power by 2022, the expansion of electricity grids and further development of renewable energy are included. It will be a long transition process as 80% of the country's electricity currently comes from fossil fuels and nuclear energy, which are to be replaced by renewable sources in 40 years, which is possible to happen due to the country's prosperous economy and advanced technology. In addition to the creation of more offshore wind farms, there are needs for new electricity grids and smart load management, as well as new high-efficiency fossil power stations and innovative energy technology, more efficient building and production processes, and profounder foreign exchange[33]. Especially from France, Poland, and Russia (Kaliningrad), which are expected to export more electricity to Germany, mainly from nuclear sources and Russian gas. A public opinion poll in mid 2008 showed that 46% of Germans want the country to continue using nuclear energy, while another 46% supported the nuclear phase out policy[34].

Latvia

Latvia is one of the EU's most import dependent countries regarding energy issues. There are no significant domestic energy resources in the country, except for peat, timber and hydro. Peat land areas cover 10% of the territory, and the timber wastes alone are estimated at 700 thousand tonnes annually. The main resource for heat production is biomass. However, more than half of wood resources produced in Latvia, are exported to other European countries[35]. Latvia and other BSR countries are net oil importers, dependent on Russian supplies. There is no oil production in the country, and therefore all the oil supply has to be imported, as well as natural gas. Underground storage facility at Incukalns is estimated to have a potential active capacity of around 2,3 bcm[36], allowing to keep deficit-free supply. Coal and coke are imported from Poland and countries close by. The country does not have nuclear power plants[37]; although together with Lithuania and Estonia considers participating in the Visaginas NPP project, which is described under Lithuania's energy profile.

[30] Germany, 2007.
[31] FMET, 2012.
[32] GNEP, 2012.
[33] FMET, 2012.
[34] NPG, 2012.
[35] EPL, 2010.
[36] LatG, 2012.
[37] AEA, 2011.

Latvia is one of the countries where the trend of electricity demand is growing faster than the total demand for energy. Electricity is generated by the country's hydroelectric power plants, combined heat and power plants, and biogas and wind power plants. The rest of electricity needed is imported. For the heat generation various fuels are used such as natural gas and residual fuel oil, which are imported, and domestically produced fuel wood. In 2011, energy resource generation and recycled products amounted to 24 TWh, while almost twice as much of energy resources had to be imported, of which 36% was natural gas. Fuel wood was the most widely used local energy resource in the total consumption of primary energy resources, which together with hydro and wind power, used tyres, municipal waste for heating, charcoal, straw, and other solid biomass, biogas, bioethanol and biodiesel constituted nearly 33% of total consumption of primary energy resources in the country, which is still to grow in the future, according to the Latvian energy policy. Electricity produced domestically in hydropower and wind stations equalled to 70% of the consumption of electricity in 2011[38]. Biomass and biogas are also used to produce electricity in Latvia. The volume of electricity produced domestically depends on the flow rate in the Daugava River, where the hydropower plants are built. 17% of total electricity consumed in the country was imported. After the shutting down of the Ignalina NPP in 2009, Latvia stopped being the only one country in the region with insufficient amount of electricity produced in its power plants. Lithuania also needs to import electricity. Thus, mostly suppliers from Estonia and Russia compete for supplying Latvian electricity market. Natural gas was the main source for producing heat energy and electricity in 2011. The share of heat energy generated by natural gas amounted to 80%[39].

According to Latvia's energy policy, savings are to be achieved mainly in the household sector (78%), services sector (12%), 6% in the transport sector, and 5% in industry, making end-use energy savings of 6,1 TWh until 2020[40]. Regarding electricity market, Latvia is still not linked to the European grid, but to the Russian/CIS electricity system. The country's natural gas market is purely monopolistic so far, with only one entity licensed to transport, distribute, store and supply natural gas – AS Latvijas Gaze with 47% of shares owned by E.ON Ruhrgas International AG, 34% by Russian Gazprom, and 16% owned by SIA Itera-Latvija[41]. The Latvian transportation system is linked to Lithuanian, Estonian and Russian natural gas transportation systems[42].

Lithuania

In Lithuania, there are a few energy resources such as oil reserves estimated at 87 Mt, peat, wood and hydroelectric potential of about 960[43] MW[44]. The oil is refined at the Mažeikiai refinery. All natural gas is imported. The gas network Minsk-Vilnius has a capacity of 8 bcm yearly and a connection with Latvia. It also supplies the region of Kaliningrad. 40% of the households and half of the urban heating plants are directly supplied by the gas grid. Before the closure of Ignalina NPP, gas covered 25-30% of the country's energy needs, which is about to increase drastically. Very little amounts of coal are also imported and mainly consumed by the residential and service sector. Domestically extracted peat is used generally in the heat sector. Regarding renewable

[38] Author's calculation based on: MERL, 2010.
[39] MERL, 2010.
[40] LEER, 2012.
[41] ITERA International Group of companies is one of the largest independent producers and traders of natural gas operating in the CIS and the Baltic States.
[42] RDLEM, 2011.
[43] LitES, 2012.
[44] Megawatt.

resources, hydropower is a principal renewable energy source for electricity production. Therefore, the country's main heat production from renewable resources are biomass, (particularly wood, chips, wood waste, straw) and biogas, as there is a noticeable potential of wood and agricultural waste in the country[45]. In 2011, the total installed renewable capacity was 393 MW, which increased by nearly 33% from the previous year. This constitutes almost 8% of the total installed energy capacity in the country, of which 2-3% was represented by hydroelectricity[46].

Lithuania's primary energy supply is so far influenced by imports of crude oil, natural gas and nuclear fuel from Russia. The country's nuclear power plant, Ignalina was generating 70% of the country's electricity, which was mostly exported. Currently, over 60% of electricity has to be imported. The Baltic States are willing to increase their energy independence from Russia, which satisfies 80% of Lithuania's energy imports at present. Thus, integration into the EU energy market is of a strategic importance for the Baltic States[47].

The highest concern regarding electricity sector is the dependence on the electric power network. Therefore, a new energy policy, introduced in the National Energy strategy until 2025, contains many objectives to achieve. The strategy focuses on construction of electricity network connections with Scandinavia and Poland, rebuilding the power grid within the country, a new regional nuclear power plant, and an increase of the share of renewable energy sources in energy production to 23% by 2020. Thus, the main goal is to achieve energy independence before 2020 by diversifying energy supplies[48].

After the shutting down of Ignalina nuclear plant, Lithuania is planning to build a new one, named Visaginas, replacing the previous one. The project is supposed to engage the Baltic States, and the Japanese corporation Hitachi as a strategic investor. One of the Poland's largest power producers and suppliers PGE Polska Grupa Energetyczna S.A. was also interested in participating in the project but in December last year the company suspended its activity[49]. Projected capacity of Visaginas could reach 1350 MW, of which Latvia requires no more than 275 MW or 20% of shares, and Estonia 300 MW. Lithuania is bound by law to own 34% of shares, which is equal to around 460 MW. This means that if Poland joins the project, it will receive more than 300 MW of electrical energy. Due to the small size of the Baltic States economies, Poland's participation would be significant[50].

According to the draft of a license agreement, Lithuania will receive 38% of shares, Estonia 22%, Latvia 20% and Hitachi 20%. In case Poland re-joins the project, it would be possible to build two nuclear reactors instead of one. However, this option is still to be discussed. Polish authorities have a very positive opinion about the project but also stress that the decision depends on the economic factors, companies and experts involved[51]. The project is estimated to cost € 4,6 - 5,2 billion and the plant should be ready for commercial operation in 2020-2022[52].

[45] LSES, 2012.
[46] LREP, 2012.
[47] NPL, 2012.
[48] EPLit, 2010.
[49] WNP, 2012a.
[50] LT, 2012.
[51] While working on the report, the decision still was not made.
[52] WNP, 2012a.

It is a unique project due to the cooperation between many countries and its importance to the national security of participants and a foreign policy, which would reinforce the independence of not only Baltic States energy systems but also the Baltic Sea Region in general. However, the October 2012 referendum has introduced some uncertainty to Visaginas project. 63% of voters in Lithuania said that they would not allow building new nuclear power capacity in the country. The Social Democrats had forced the referendum to make Visaginas project an election issue. It seems that the former Homeland Union-Christian Democrat Party will be replaced, since Labour and Social Democratic parties did better electorally and may form a coalition with another small party. The matter will be decided by the incoming government. In case of rejecting the project, Baltic States will remain largely dependent on Russia for electricity[53].

Poland

97% of Polish energy produced domestically comes from thermal power stations[54], of which 62% is based on hard coal and 32% on lignite[55]. Recently, there have been also new geological researches started for a low-emission shale gas in Poland.

At present, oil constitutes the second largest energy source in Poland, with 26% share of the country's total primary energy consumption, connected to the gradual decrease of coal's shares over ten years, which now comprises 58%. The share of natural gas in the total primary energy consumption equalled to 13% in 2011[56]. As there are no significant proven reserves of crude oil in the country and the domestic crude oil production is minimal, oil has to be imported, mainly from Russia. In 2010, the country's import dependency equalled to 96,4%. Russia provides nearly all of the country's crude oil imports through the Druzhba pipeline. There are six refineries with a total primary distillation capacity of approximately 28 million tonnes annually, with the biggest one in Płock, and three oil port terminals in the country, of which two are small oil terminals for imports of oil products. Total storage capacity as of June 2010 was 72,7 million barrels, of which 60% was used for crude oil[57].

Poland produced around 6 bcm of natural gas in 2010, which satisfied 35% of the country's natural gas demand. Another 11 bcm had to be imported in order to meet the country's need. Russia has been the primary source of natural gas imports, providing approximately 80% of natural gas supplies. However, there is a possibility of unconventional gas resources in Poland, which if confirmed, could change the energy landscape in the country. The country's gas system is linked with the European gas network mainly along the east-west direction of the Yamal pipeline. There are eight operational underground gas storage facilities, owned by the Polish Oil and Gas Company (PGNiG), which is the leading producer of gas and crude oil in Poland[58].

After series of investigations in certain regions of Poland the Polish Geological Institute (PGI) estimated the amount of shale gas resources at 346-768 bln cubic meters. The report of PGI points out at the same time that the maximum could reach up to 1920 bcm[59]. There are also researches conducted on the environmental influences of shale

[53] NPL, 2012.
[54] BEWP, 2012.
[55] Enerad, 2012.
[56] BP, 2012.
[57] Poland, 2011.
[58] Poland, 2011.
[59] DGP, 2012a.

gas, but the extraction should not cause any risks for the environment if done in accordance with the legal regulation in force (e.g. geological analysis is properly executed, and the equipment is constantly controlled)[60]. In USA, where the shale gas extraction is the most advanced, there are 5000 boreholes drilled each year, compared to which Poland has only around 22 boreholes so far with the plans to create 127 by 2017. It means that there is still huge need for capital investment[61].

In Poland, there are the largest reserves of coal in the EU, estimated at around 14 billion tonnes. Coal is the primary source of fuel for electricity production, forming around 88% of the total, while natural gas share is around 3% and biofuels 4%. At present, as domestic demand for electricity constantly grows, Poland is likely to lose its current status as a net electricity exporter, unless capacity supplements are made. As the EU's strict climate policy targets require energy sources diversification away from coal, the Polish Government decided to introduce nuclear power in the country. By 2030, nuclear energy is estimated to provide 15% of electricity. The government's plan from 2009 includes legislation for a regulatory framework, which has already been passed in May 2011. Poland's state-owned, largest power group by generating capacity, Polska Grupa Energetyczna SA (PGE) announced its interest in building the first nuclear power plants in Poland[62]. The current Polish government's energy strategy until 2030 aims at commercial operation of the first nuclear power plant by 2020 and at reaching a capacity of 6000 MW by 2030. By the end of 2013, PGE should select an appropriate location and in 2016 start building the plant[63].

Russia

Russia is the country holding the largest natural gas resources in the world, at the same time being the world's second-largest producer of natural gas and second-largest holder of coal reserves. It has also the eighth largest crude oil reserves in the world, helping it become the largest worldwide producer of crude oil in 2009. Russia is a dominant exporter of oil and natural gas and satisfies half of its domestic energy needs with natural gas. There are 40 refineries in the country, with a total crude oil processing capacity of 5,4 million barrels a day. There is also a widespread domestic distribution and export pipeline network. Russia exports its crude oil mainly to European countries. The top importers of Russian oil are, in the order of supplies amount, Germany, the Netherlands[64], Poland, China, France, Italy, the United States, Finland, Lithuania, Spain, Sweden, Ukraine, Kazakhstan, Slovakia, Japan, Turkey, and Czech Republic. Crude oil and petroleum products delivered by rail (5% of Russian oil exports) are exported through Estonia and Latvia[65].

The most important Russian state-controlled business – Transneft – having a monopoly over the country's pipeline network, controls almost 50000 km of pipelines with the capacity to transport around 93% of the Russian oil[66]. The state-run Gazprom commands the country's natural gas upstream, with 90% of its total output produced by the company. It is also in charge of most of the Russian gas reserves directly or in joint ventures, as well as through Russian natural gas pipeline system. Gazprom's position is confirmed by its legal monopoly over the country's gas exports. The main importers

[60] DGP, 2012b.
[61] DGP, 2012a.
[62] NPP, 2012.
[63] EJ, 2012.
[64] Huge amount of Russian oil sold to the Netherlands is sold further.
[65] EIA, 2010.
[66] TCP, 2012.

of Russian gas are the CIS and EU countries. Moreover, Russia is one of the most important global electric power producers and consumers, having installations with a capacity of over 220 thousand MW on its area. Thermal power generated by oil, natural gas and coal-fired, stands for nearly 68% of electricity generation in the country, with the 16% share of hydropower and nuclear each[67].

However, the country also has a strong development potential for all renewable resources of energy. As 9% of global water resources are accumulated in the country, Russia could make a regional use of hydroelectric power, where favourable conditions are available. A new national energy strategy until 2030, accepted by the government in 2009, includes an increase of use of renewables, based mainly on hydropower plants and decrease of fossil fuels' dependence. Russia also has an extensive technical potential for geothermal power, 96626 TWh[68].

The Russian Government's Energy strategy 2030 aims to expand nuclear energy, planning to increase its output by nearly 50% by 2020. The country's objective is to export nuclear goods and services[69]. Russia plays a dominant role in global fast neutron reactor technology, having only one utility operating nuclear power plant – Rosenergoatom – with its ten branches and 33 operating reactors. In 2007, Russian electricity production reached 1015 TWh, of which 16% (160 TWh) came from nuclear power, 48% from gas, 17% from coal and 18% from hydro. In 2010, nuclear production amounted to 170,0 TWh, which was 16,1% of Russia's total electricity production, caused by better performance of the nuclear plants. Rosenenergoatom points towards 90% capacity factor by 2015, and the 2016 nuclear production is projected to reach 239 TWh – close to 19% of total electricity. The capacity of hydro-electricity is increasing as well, with the plans to grow by 60% until 2020 and double its output by 2030. The plan is to produce up to half of the country's electricity by nuclear and hydro energy by 2030[70].

Russian reactors are mainly licensed for 30 years but the extension period could last 15-25 years, based on the reactor type, with the necessary modernization investments included. After the Fukushima disaster, nuclear power plants in Russia have been checked and safety upgrade programs completed, aiming to achieve additional power and water supply back-up[71].

The recent Federal Target Program consists of a 25-30% share of nuclear power in electricity output by 2030, 45-50% by 2050 and 70-80% by the end of the century by building new nuclear capacity, which is not very realistic due to the country's heavy dependence on fossil fuels. The nuclear power plants in Russia are listed in table 2[72].

[67] EIA, 2010.
[68] RER, 2011.
[69] NPR, 2012.
[70] NPR, 2012.
[71] NPR, 2012.
[72] NPR, 2012.

Table 2. Nuclear power plants in Russia

Existing	Under construction (commercial operation)	Planned (commercial operation)	Proposition (commercial operation)
Rosenergoatom (its 10 branches)	Vilyuchinsk FNPP (2014)	Leningrad II-3, 2012 (2017)	Smolensk II-1, 2024
Balakovo 1-2, 3-4	Beloyarsk 4 (2014)	Leningrad II-4, 2014 (2019)	Smolensk II-2, 2025
Beloyarsk 3	Novovoronezh II-1 (2014)	Nizhny Novgrod 1, 2014 (2019)	Zheleznogorsk MCC (2015)
Bilibino 1-4	Leningrad II-1 (10/2013)	Nizhny Novgrod 1, 2015 (2022)	Zheleznogorsk MCC (2016)
Kalinin 1-2, 3, 4	Novovoronezh II-2 (2016)	Baltic 2 (Kaliningrad), 2014 (2018)	Kursk II-3
Kola 1, 2, 3-4	Rostov 3 (2014)	Tver 1, 2012 (2017)	Kursk II-4
Kursk 1-2, 3, 4	Leningrad II-2 (2016)	Tver 2, 2013 (2017)	Smolensk II-3 (2026)
Leningrad 1, 2, 3, 4	Rostov 4 (6/2017)	Tsentral 1, 2013 (2018)	Smolensk II-4 (2027)
Novovoronezh 3-4, 5	Baltic 1 (Kaliningrad) (2017, Oct 2016 start)	Tsentral 2, 2014 (2019)	South Urals 1 (2021)
Smolensk 1-3		Seversk 1, 2013 (2020)	Novovoronezh II-3 (2017)
Rostov 1, 2		Seversk 2, 2014 (2025)	South Urals 2 (2025)
		Kursk II-1, 2015 (2020)	Novovoronezh II-4 (2019)
		Kursk II-2 (2023)	Tver 3 (2019)
		Kola II-1, 2015 (2020)	South Urals 3 (2030)
		Kola II-2 (2021)	Primorsk 1 (2019)
		Beloyarsk 5, 2015-16 (2020)	Nizhny Novgorod 3 (2019)
		Dimitrovgrad, 2014 (2017)	Nizhny Novgorod 4 (2020)
			Tsentral 3 (2019)
			Tsentral 4 (2020)
			South Ural 4 (2020)
			Tver 4 (2020)
			Primorsk 2 (2020)
			Pevek (2020)
			Beloyarsk 6 (approved, 2024)
			Balakova 5 & 6
			Sakha

Source: WNA 2012.

As an example of a Russian nuclear power plant located in the Baltic Sea Region, the Baltic/Baltiskaya nuclear power plant to be situated in Kaliningrad was proposed to generate electricity for exports, with up to 49% of European ownership. It will be the main competitor for the future Visaginas Lithuanian plant, aiming at integration with the European energy network. Main importers would be Germany, Poland, Latvia, Lithuania, and Estonia. Electricity transmission would be established through Poland or an undersea cable. A significant transmission capacity to east via Lithuania already exists to the St. Petersburg region and, in case Lithuania rejects the Visaginas project, it could be used to create a grid between Baltic States, Poland and Russia[73]. However, Poland and Lithuania have already refused to import energy from Kaliningrad due to the plans of building their own nuclear power plants[74].

Sweden

In Sweden, the proportion of renewable energy use is significantly higher than in many other countries basically because Sweden holds major renewable energy resources, such as hydro power and biomass. In 2010, total energy use in Sweden equalled to 616 TWh, of which 30,3% was supplied by crude oil and oil products, 27% came from nuclear power, 23% from biofuel, peat and waste, 11% from hydro power, 4% from coal and coke, and 3% from natural gas[75]. Swedish electricity is mainly generated by hydropower and nuclear power. In 2010, hydropower equalled to 46%, nuclear power 38%, and wind power 2,4% of total electricity production. The remaining proportion came from fossil fuels and biomass. In turn, the net imports of electricity equalled to 2 TWh, mostly from Finland. Exchange of electricity between the countries depends on price variation among different price areas, which are affected by inflow of water into reservoirs and their storage level[76].

Sweden uses relatively small amount of gas, which is imported from Denmark through a pipeline connection and from Norway as LNG. Currently, the natural gas network runs from Trelleborg to Gothenburg with some branches along the route. Gas is mostly used in combined heat and power plants, and in industry. The Swedish natural gas market is at present a competitive market. Biogas is upgraded in over 30 plants in the country, and then it is sold as pure biogas or as a mix with natural gas. There is an existing natural gas network in the southern part of the country, providing an opportunity to purchase pure biogas. Nevertheless, there are huge differences in the development of gas infrastructure within the country. Most of the gas filling stations are placed in southern Sweden or in major urban areas[77].

The use of oil has halved since 1970. Currently, Sweden is an exporter of refined oil products and the refining capacity has considerably increased. In 2010, Sweden imported over 19 million tonnes of crude oil and exported 5,1 million net tonnes of refinery products. Around half of the country's imports of crude oil come from the North Sea, mainly from Norway and Denmark. Imports of crude oil from Russia amounted to 44% of total in 2010. Since 1970s, Sweden has successfully conducted its phase-out of oil, essentially due to decreasing use of residential heating oil[78]. Coal in Sweden is primarily used in industrial processes. In 2010, the country has used 1,8 million tonnes of coking coal and 0.8 million tonnes of energy coal. The use of district heating sector

[73] NPR, 2012.
[74] Forbes, 2012.
[75] Author's calculations based on: EiS, 2011.
[76] EiS, 2011.
[77] EiS, 2011.
[78] GPST, 2011.

for electricity production and district heating itself amounted to 3,3 TWh of energy coal and 2,0 TWh of coke oven and blast furnace gas in 2010. Sweden also uses biofuels, waste and peat, mostly in the forest industry, for heat and electricity generation and for heating residential buildings as well. In 2010, the use of biofuels, waste and peat in energy supply amounted to 23% of total. The magnitude of those is produced domestically, with considerable imports of ethanol, wood pellets and peat. There are waste, demolition wood and similar fuels imported as well. In 2010, biofuels, waste, peat, and waste heat amounted to 73% of energy provided to generate district heating, which is widely used heating method for multi-dwelling buildings and non-residential premises[79].

Energy policy involves efficient and sustainable energy use and a cost-effective energy supply, and facilitating the transition to an ecologically sustainable society. In order to promote it, the government invests vastly in providing information and recommendations for households on energy savings[80].

In Sweden, there are ten operating nuclear reactors which generate around 40% of the country's total electricity production, which is 9400 MW. The country also has a tax that discourages the use of nuclear power, which is now approximately 0,67 Euro/kWh. The tax forms around one-third of the operating cost of nuclear power. The present government's climate program determines that further constructions will be conducted only at existing sites and to replace current ten units. It also imposes that renewable sources should provide half of energy production by 2020, that the Swedish car fleet should not use fossil fuels any more in ten years and that the country will become carbon-neutral[81] by 2050[82].

Nuclear power plants

The table below presents all existing, under construction or planned nuclear power plants placed within the Baltic Sea Region. Currently, there are no nuclear power plants in Denmark, Estonia, Latvia, Lithuania and Poland. There are plans to introduce nuclear energy in Poland, Latvia and Estonia, while Germany resigns from this source of energy. On the contrary, Finland and Russia are expanding their nuclear capacity.

[79] EiS, 2011.
[80] GPST, 2011.
[81] Carbon-neutral – having a net zero carbon footprint.
[82] NPS, 2012.

Table 3. Nuclear power plants in the Baltic Sea Region

Nuclear Power Plants	Existing (expected shutdown)	Under construction (commercial operation)	Planned (commercial operation)
Denmark	-	-	-
Estonia	-	-	by 2023
Finland	Loviisa 1 (2027)	Olkiluoto 3 (Aug 2014)	Olkiluoto 4 (2020)
	Loviisa 2 (2030)		Hanhikivi 1 (2020)
	Olkiluoto 1 (2039)		
	Olkiluoto 2 (2042)		
Germany	Greifswald 1-4, 5 (shutdown)		
	Brunsbuttel (shutdown)		
	Kruemmel (shutdown)		
	Stade (shutdown)		
	Brokdorf (2021)		
Latvia	-	-	-
Lithuania	Ignalina (closed)	-	Visaginas (2021)
Poland	-	-	by 2030
Russia	Kola 1, 2, 3-4	Leningrad II-1 (2013)	
	Leningrad 1, 2, 3, 4	Leningrad II-2 (2016)	
		Baltic 1/Kaliningrad (2016)	
Sweden	Oskarshamn 1, 2, 3		
	Ringhals 1, 2, 3, 4		
	Forsmark 1, 2, 3		

Source: NORDREGIO 2011, World Nuclear Association 2012.

3. Electricity networks

3.1 Existing electric cable networks

There are several electric cable connections between the BSR countries such as: Konti-Skan, Baltic Cable, Kontek, EstLink, Fenno-Skan, SwePol Link, and a direct current connection from Russia to Finland.

Konti-Skan is the first interconnection between Sweden and the western grid in Denmark. The converter stations were firstly situated in Stenkullen and Vester Hassing. The second Konti-Skan cable with a capacity of 300 MW connects Lindome and Vester Hassing since 1988[83]. Baltic Cable links the Swedish and German power systems since 1994. The capacity of this submarine cable is 600 MW[84]. Kontek is an interconnection between Denmark and Germany with the capacity of 600 MW. It has been operational since 1995, providing higher security of operation, and better opportunities of power exchange and trading[85]. There are also four 400 kV cross-border Russian-Finnish connections from substation in Vyborg to Finnish substations in Yllikkälä/Kymi with a capacity of 350 MW each and the maximum transmission capacity in normal mode of operation equal to 1400 MW. It is designed for the transfer of electricity from Russia to Finland with the possibility to expand the bidirectional electricity transmission in the future[86].

Apart from wood fuels and turf used to produce electric energy, recent Estonian developments concerning renewable resources have been focusing principally on generating electric energy from windmills. Since 2008, Estonian electricity produced by renewable sources of energy has grown five times and reached 11% in 2010. As energy diversity is needed in energy sector development, there was an electric cable between Estonia and Finland, called EstLink I opened in 2007 in order to secure energy supplies and develop a common market with Nordic countries. Since then, electricity exports from Estonia to Finland equal to approximately 1,5 TWh yearly. Estonia exports the same amount to Latvia as well. In 2010, the exports of electricity from Estonia to Lithuania amounted to over 1 TWh[87]. EstLink I has a capacity of 350 MW and is owned by Estonian, Latvian, Lithuanian and Finnish enterprises. According to the estimates, this connection would be able to provide around 2 TWh of electric energy to the Nordic market per year. The total Finnish power consumption totals 85 TWh approximately, while Baltic States together use 21 TWh yearly. Energy deliveries through the cable can be supplied by Estonian oil shale fired production and Latvian hydropower surplus due to the flood season. If necessary, EstLink would allow energy to be imported from the Nordic countries in a long term as well[88].

Another high-voltage direct current (HVDC) transmission, Fenno-Skan 1 connects Rauma in Finland with Dannebo in Sweden. It started its commercial operation in 1989. The 200 km long connection with the capacity of 500 MW is designed for further extension with a second cable and pole, so that it will become a bipolar link[89]. Fenno-Skan 2 became fully operational in December 2011 with its transmission capacity of 800 MW, connecting Finnböle in Sweden with Rauma in Finland. It allows increasing

[83] ABB, 2012a.
[84] ABB, 2012c.
[85] ABB, 2012d.
[86] IARF, 2012.
[87] KAS, 2011.
[88] TDW, 2007.
[89] ABB, 2008.

the transfer of electricity between those countries by 40% and creates opportunities for trade on the Nordic market, making the integration within it even deeper[90]. In February 2012, following the accident with the German ship, the cable has been damaged and now has to be reconstructed with the cost of higher electricity prices[91]. Once fixed, it will enable the exports of electricity from the new Finnish Olkiluoto reactor to the Swedish market[92].

In order to establish power system security within the countries participating in the Baltic Ring and connect the grid of Continental Europe with Nordic electric network, the HVDC transmission mono-polar link between Sweden and Poland has started its operation in 2000. The 600 MW transmission capacity link eases connection of different power systems with different demands. Due to the rainy summers in Sweden, the country can sell its energy surplus, and vice versa, during low energy demand periods any extra energy excess can be sold back to Scandinavia. The cable develops general security of participants' energy operations and provides ecological energy from Sweden, reducing a negative impact on the environment in Poland[93].

3.2 Construction or planned electric cable networks

To assure even more powerful energy transmission between Baltic States and Nordic countries, the building of EstLink II is in progress, after the preliminary planning for the construction and a conditional capital investment decision have been made. This second high-voltage direct current interconnection is approximately 170 km long, starting in Anttila in Finland, having around 145 km submarine cable laid on the bottom of the Gulf of Finland, ending in Pussi, Estonia (Map 1). It has a capacity of 650 MW, increasing the total transmission capacity to 1000 MW. In summer 2012, the cable was laid at the bottom of the sea. Thus, the connection is supposed to be ready by the beginning of 2014. The project has also received financial support from the European Union worth of € 100 million as an investment subsidy[94].

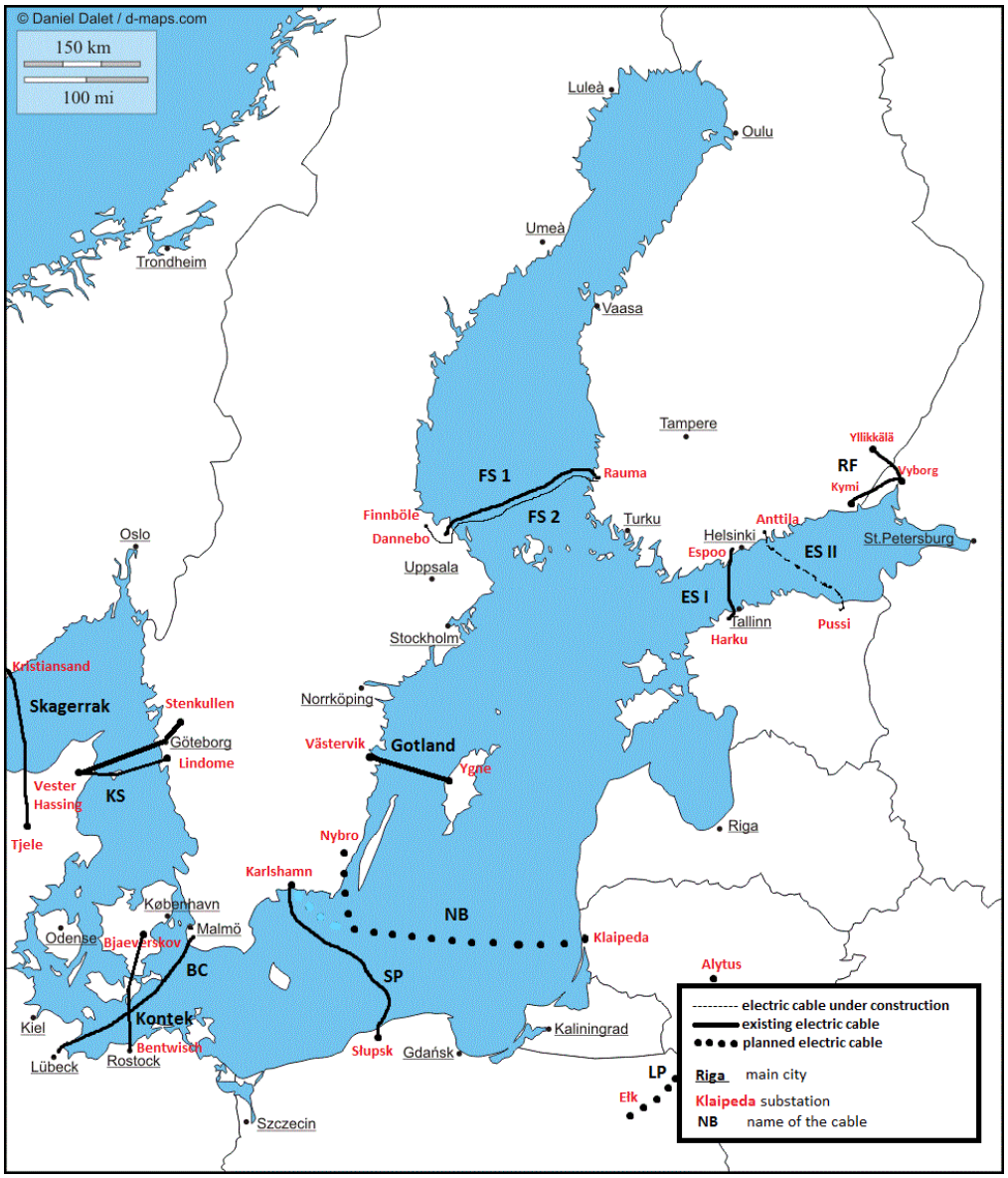
In order to strengthen the integration of the Baltic energy markets with Northern Europe there are also plans to build NordBalt high-voltage direct current (HVDC) Light Swedish-Lithuanian connection with a transmission capacity of 700 MW. The 450 km long cable will link the grid of Baltic States with Nordic countries and develop integration of emerging joint Baltic electricity market with the Nordic and European markets. Its advanced system will provide stability and fast restoration after connection perturbation. It is also destined for further pan-European electricity network integration. The cable will link Nybro in Sweden with Klaipeda in Lithuania. It should be ready for operation in 2016[95]. The European Union decided to grant the project € 175 million for the construction activities and reinforcement of Latvian electricity transmission system[96].

One of the priorities of the European Union's energy infrastructure development project is Baltic Energy Market Interconnection Plan (BEMIP), aiming at natural gas and energy markets integration within the Baltic Sea Region and joining Western European

[90] FS2, 2012.
[91] TLS, 2012.
[92] NPS, 2012.
[93] PSEP, 2010.
[94] FINGRID, 2012.
[95] ABB, 2010.
[96] NB, 2012.

Electricity System to the Baltic States[97]. One of the EU's top priority projects is to provide better integration of Baltic States energy market with Western Europe power system. It contains plans of constructing a Lithuanian-Polish power interconnection. This, so called LitPol Link will have planned capacity of 500 MW in 2015 and 1000 MW fully operated[98] transmission line Alytus- Ełk with the modern back to back station situated in Alytus[99].The map below presents the main electric cable investments in the Baltic Sea Region.

Map 1. High-voltage direct current electric links operating in the Baltic Sea Region: Baltic Cable (BC), EstLink I&II (ES), Fenno-Skan 1&2 (FS), Kontek, Konti-Skan (KS), LiPol Link (LP), NordBalt (NB), Russian-Finnish connections (RF), SwePol Link (SP)



Sources: LPL 2009, PSEP 2010, ABB 2012, FINGRID 2012.

[97] WNP, 2012c.
[98] WNP, 2012b.
[99] LPL, 2009.

4. Natural gas pipelines and liquefied natural gas terminals

4.1 Gas pipelines

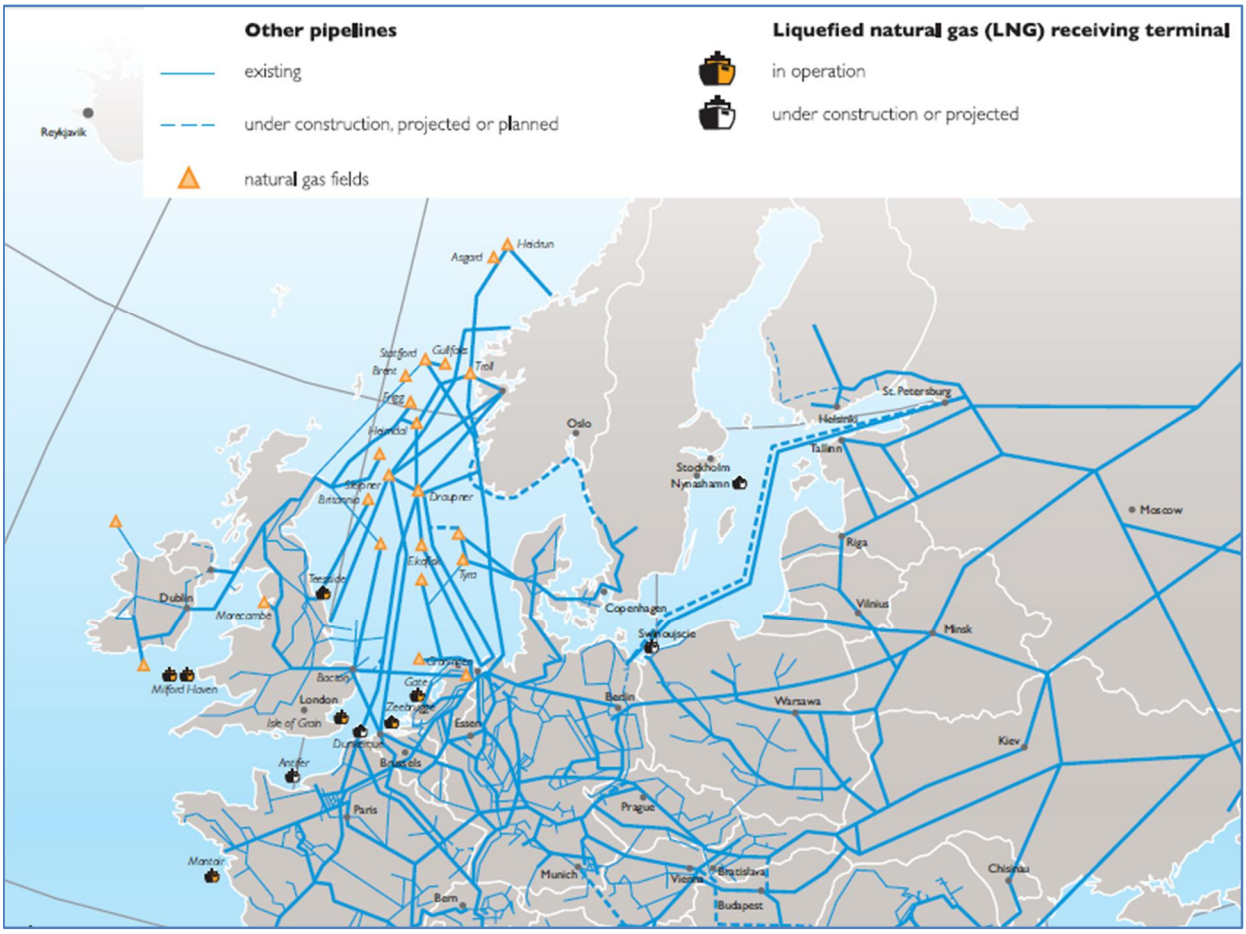
In the future more and more fuels used by shipping or industry will be LNG, thus this chapter of the report consists of existing and planned natural gas networks, as well as the plans of constructing new LNG terminals within the Baltic Sea Region. The purpose of this chapter is to introduce the LNG terminals investments in the Baltic Sea Region and supplement the information presented in the maps further in this report of the new investment projects.

In order to make the operation of Klaipeda LNG terminal in Lithuania effective, there is a need to build a new gas pipeline between Klaipeda and Jurbarkas and at the same time extend the northern branch from the port to Siauliai. There is also an on-going process of implementation of the Syderiai underground gas storage facility, moving slowly with the possibility to end in 2020. In Estonia, the currently working pipeline has to be expanded to facilitate pumping gas from the Muuga port to a terminal, which is yet to be designed and then to Incukalns, which would possibly become a gas storage for gas transferred from Klaipeda during the warm season due to the variety of seasonal gas amounts[100].

In July 2012 Lithuania announced an international tender for a pipeline to connect the planned LNG terminal in Klaipeda with the country's gas transmission grid. The company, that wins, will be bound to build the connection by the end of 2014. Furthermore, Lithuania and Latvia intend to build a bi-directional interconnector pipeline, with access to Latvia's massive but under-used Incukalns storage site. But in order to engage any commercial investor and keep the overall cost of LNG terminal projects in the Baltic States on reasonable levels, the projects require a release of the existing pipelines from Gazprom's control[101].The map 2 presents a European natural gas grid in 2011.

[100] BCIJ, 2012.
[101] TJF, 2012.

Map 2. The European Natural Gas Grid in 2011



Source: ESR 2011, 14.

Since 2011, new projects have been presented and new constructions have started. The main international gas pipelines within the Baltic Sea Region are described below. The BSR's crucial projects, regarding gas pipelines in the region are also listed. Most of them are of a great importance for the energy supply security and effective functioning of the entire infrastructure within the region, what is explained below.

Amber

Being a part of BEMIP, there are also plans to build a gas interconnection between Poland and Lithuania. In July 2012 an agreement between the countries' national gas companies for gas interconnection feasibility study was signed. According to the estimates, gas pipeline would be 562 km long, with a capacity to transport 2,3 bcm of natural gas a year to the Baltic States, with the potential to expand up to 4,5 bcm if additional investments are included. The project is highly important for the energy security assurance and integration of the Baltic States markets, to which an access to the EU's gas market and the global LNG markets will be provided with an additional reverse flow[102]. The gas interconnector will also allow diversifying suppliers, especially

[102] WNP, 2012c.

from the Baltic States' current dependence on Russian Gazprom. Furthermore, Lithuania is planning on leasing a floating liquefied natural gas import facility in 2014[103].

The feasibility study should be ready by the beginning of 2013. It is also co-financed by the European Commission through its Trans-European energy Network Program, aiming at diversification of gas supplies. According to the plans, the route would start in Rembelszczyzna gas compressor station near Warsaw and run to the Jauniunai station next to Vilnius. The companies involved in the project expect that a major part will be financed from the EU funds as it is one of the EU's priorities to eliminate energy islands in Europe[104].

Baltic Pipe

Baltic Pipe is a 230 km long planned submarine pipeline which would connect Redvig in Denmark and Niechorze in Poland with the capacity of 3 bcm a year. The European Union has decided to support the project with a sum of € 3,2 million, which covers half of the cost of technical design[105]. The analyses on the route should be ready by the end of 2012. Researches on the sea bottom have been finished in order to mark out the route of the pipeline and estimate the real costs. Currently, there are plans to introduce gas flow in both directions. Poland sees the pipeline as an export route for surplus gas from its planned LNG terminal in Świnoujście, while Denmark expects to import the Russian gas through Poland[106].

Balticconnector

Balticconnector is a proposed natural gas pipeline, linking the Finnish, Estonian and Latvian natural gas grid. It is also a part of the EU's BEMIP. The pipeline will provide two-way gas flows between Finland and Estonia and more gas supply capacity and flexibility for the whole region. The project consists of an offshore gas pipeline, compressor stations on both landfalls and connecting onshore pipelines to the existing grids[107]. There are two alternative routes for the pipeline, one 80 km long from Inkoo in Finland to Paldiski in Estonia and the other one, 140 km long from Vuosaari in Finland to Paldiski as well. The project has been created by Finnish Gasum and Estonian Eesti Gaas[108].

JAGAL

Jamal-Gas-Anbindungs-Leitung, is a German section of the Yamal-Europe pipeline, operated by a German-Russian joint venture company, Wingas. The pipeline transports Russian natural gas into eastern Germany through Poland and Belarus. Over 100 km long JAGAL I connects Mallnow, next to the Polish border with Baruth, situated south of Berlin. JAGAL II consists of a 230 km long pipeline from Baruth to Rueckersdorf. Overall system capacity is approximately 24 bcm of natural gas yearly[109].

[103] UPI, 2012.
[104] UPI, 2012.
[105] WNP, 2009.
[106] Forsal, 2012.
[107] Gasum, 2011a.
[108] Gasum, 2011b.
[109] OGA, 2006.

Nord Stream

Nord Stream is a submarine gas pipeline connecting Russian natural gas supplies, near the city Vyborg with the European grid near Greifswald in Germany, which allows transporting gas for the upcoming 50 years. It consists of two 1224 km long lines, with the total capacity of 55 bcm of gas a year. Line 1 was put into operation in November 2011, while Line 2 was ready in April 2012 and started its operation in October 2012. Nord stream is a long term private investment, of which Nord Stream AG is in charge, a joint venture of Russian, German, French and Dutch companies of energy sector. The project will enable a long term energy security in the European Union and reduce climate changes. The financing comes partly from Nord Stream's shareholders with 70% external project financing from the bank market[110]. Furthermore, a feasibility study performed by the Nord Stream Shareholders' Committee confirmed the possibility to extend the Nord Stream by one or two lines[111].

OPAL Pipeline/NEL Pipeline

Ostsee Pipeline Anbindungsleitung – Baltic Sea pipeline link is a natural gas pipeline in Germany, situated alongside the German eastern border. The 470 km long OPAL pipeline connects the Nord Stream on the German coast with the Czech border next to Olbernhau. Its annual capacity is 36 bcm of gas, which provides energy to approximately 17 million households[112]. The North European Gas Pipeline, NEL will connect Germany and north-west Europe through Nord Stream to Russian gas supplies. The pipeline will transport gas through an existing trans-regional pipeline system in the country, 440 km towards the west[113]. NEL pipeline is supposed to reach its full capacity of 55 bcm a year in 2013 due to delays caused by the need to reroute the pipeline after the local opposition, making it more expensive and longer[114].

Yamal–Europe pipeline

Yamal–Europe is a transnational gas pipeline, passing through Russia, Belarus, Poland and Germany. This export corridor reinforces flexibility and reliability of Russian gas supplies to Western Europe. The EU considered the Yamal–Europe pipeline as a priority of Trans-European Networks investment project. In 2006 the pipeline reached the capacity of 32,9 bcm of gas a year. It is over two thousand km long, starting from Torzhok gas transportation unit in Russia, consisting of 402 km in Russia, 575 km in Belarus and 683 km in Poland. At Torzhok, it takes gas from the Northern Tyumen Regions (SRTO) – Torzhok gas pipeline. The final western point of the pipeline is the Malnow compressor station, where it connects to the JAGAL route. The owner of the pipeline in each country is Gazprom itself or in a joint venture with the country's company[115]. To secure the gas supplies transported from Yamal Peninsula, a new generation gas transportation system is planned before 2030. Gas from Yamal will be transported through the 1100 km long Yamal–Ukhta section and then further along Ukhta–Gryazovets, Gryazovets–Torzhok, Gryazovets–Yaroslavl and Ukhta–Pochinki. The overall distance of Yamal gas transportation with the new pipelines included will be over 2500 km. In order to become a key element of Unified Gas Supply System of

[110] NordStream, 2012.
[111] NS, 2011.
[112] WINGAS, 2012a.
[113] WINGAS, 2012b.
[114] BMB, 2012.
[115] GE, 2011.

Russia in the future, the new transmission system will exceed 300 bcm annual gas delivery capacity from Yamal Peninsula fields[116].

4.2 Liquefied natural gas terminals

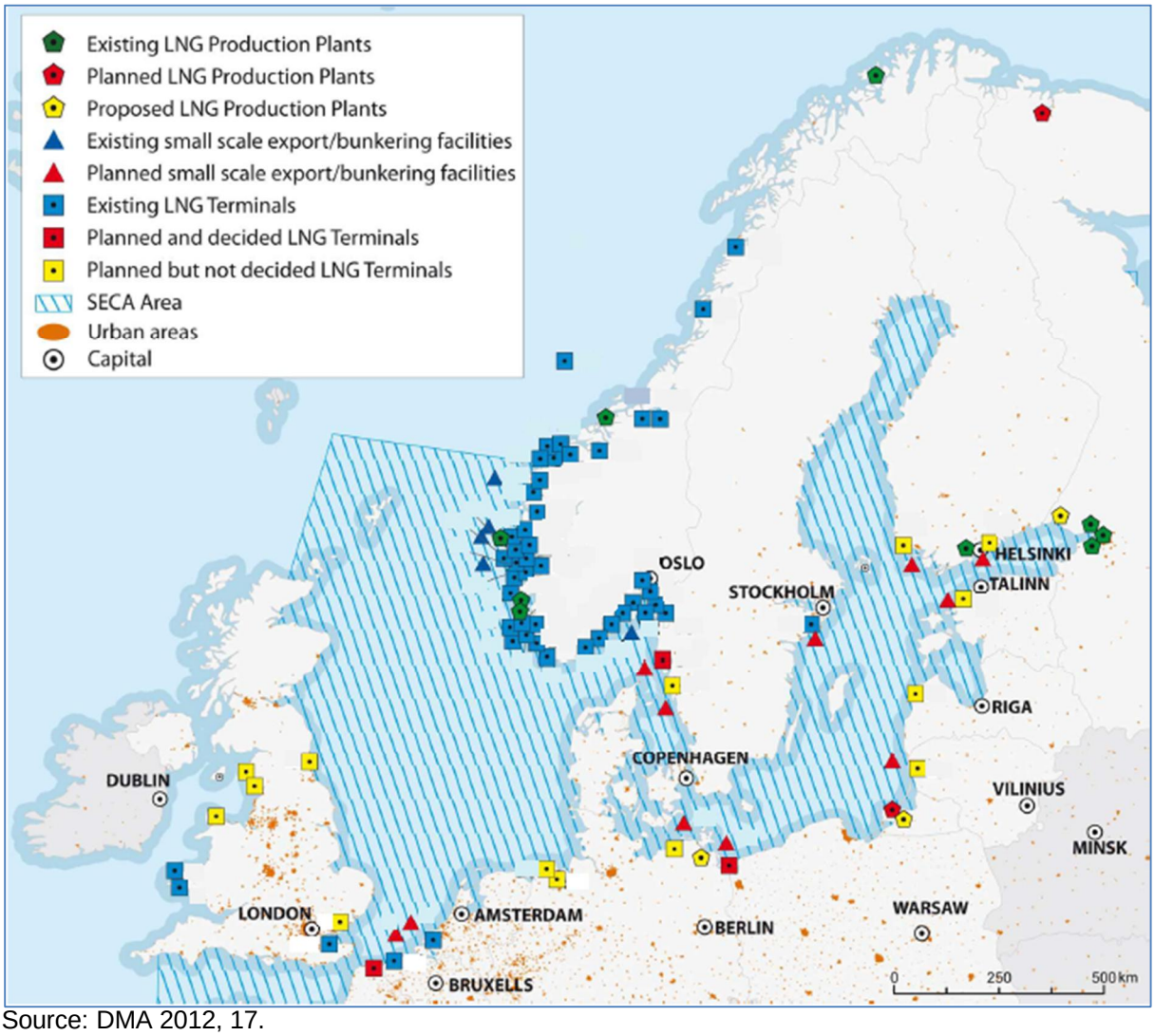
The need for environmentally friendly fuel is growing and liquefied natural gas is one of them, expected to reduce carbon emissions, facilitating the transportation. Thus, the representatives of eight Baltic ports gathered in Copenhagen to sign a partner agreement related to the project called 'LNG in the Baltic Sea Ports' co-financed by EU TEN-T Multi-Annual Program. Those ports are Aarhus, Helsingborg, Helsinki, Malmö-Copenhagen, Tallinn, Turku, Stockholm and Riga. The purpose of the project is to develop a harmonized approach towards LNG bunkers filling infrastructure in the Baltic Sea Region. Each of the ports mentioned are going to develop their port infrastructure to offer LNG bunker for ship-owners in the future. The project was introduced by the Baltic Ports Organization due to the new SECA (sulphur emission control area) rules, covering the Baltic Sea, North Sea and English Channel. The project also consists of a so called 'stakeholder platform', allowing discussion among many parties involved in infrastructure development such as ship-owners, gas infrastructure and bunkering companies or energy traders. A harmonized development to LNG bunker filling infrastructure will allow reducing the installation costs and building up knowledge and 'know-how' for other ports interested and also shifting vessels between ports in the area with no threat of losing the access of LNG bunkers. The total estimated eligible cost for the common actions is approximately € 4,8 million, half of which will be provided by EU TEN-T Program. The project is to be completed by the end of 2014[117].

At present, there are only a few working installations for the handling of LNG in the Baltic Sea Region. However, many countries are working on the projects concerning an establishment of large scale import terminals for LNG in order to increase the diversity of energy supply and to provide alternative supply routes for gas in the Baltic Sea countries. Before 2015, large import terminals were expected to come into operation in Tallinn, Klaipeda, Swinoujscie, Lysekil and possibly in Riga, but due to many factors they seem to be delayed. Regarding bunkering of LNG, within a few more years it could be possible in Helsinki, Gdansk, Gävle, Oxelösund and Trelleborg. Increase of the LNG capacity among the Baltic ports is crucial for the region and its energy security[118].

LNG in Northern Europe/Scandinavia is mostly used to small-scale distribution and operation. There are large scale imports into the natural gas grid due to the Nynäshamn terminal in Sweden, operating since May 2011. Even though currently the focus is on smaller LNG terminals and receiving terminals, there are plans for new large import terminals to be built in Northern Europe and within the Baltic Sea Region[119]. The map below presents the LNG infrastructure in Northern Europe. The map shows the location of the existing, planned and proposed LNG terminals and production plants within SECA.

[116] Gazprom, 2012.
[117] POT, 2012a.
[118] TG, 2011.
[119] DGC, 2012.

Map 3. Liquefied natural gas infrastructure



Source: DMA 2012, 17.

As can be seen on the map above, there are plans to establish many small and medium scale terminals in Denmark, Norway, Sweden and Finland, and small scale facilities such as LNG bunkering berths in Germany and other western countries. Apart from what is shown on the map above, there have been new proposals and projects announced by the countries' energy companies or governments, which are presented below.

The location of the existing LNG terminal infrastructure and most of the planned ones are visibly connected with the extensions of the natural gas network. The main purpose of LNG terminals in the Baltic Sea Region is to deliver natural gas to the network, increase supply security and diversify the gas supply, which is a priority for the eastern countries dependent on Russian gas supply. Thus, the terminals located in

Nynäshamn, Turku and Lysekil focus more on supplying industrial customers and transport sector with natural gas in locations where the gas network does not exist[120].

Operating

The natural gas for the LNG terminal in Nynäshamn in Sweden comes from the Stavanger LNG plant situated in Norway, operating since the end of 2010. The plant produces 300 thousand tonnes of LNG a year and approximately 16% of it is transported by tanker to Nynäshamn and then distributed throughout the Baltic Sea Region. There is a double-walled concrete tank with a storage capacity up to 20 thousand m^3 of LNG. This equals to around 12 million m^3 of gas, as LNG is able to regasify to six hundred times its liquid volume[121].

As there is no pipeline network to transport gas in Sweden, the LNG is pumped into storage tanks on trucks and transported straight to customers or to a pipeline link, in which it can be fed into the existing gas network. To meet the LNG demand, the companies responsible for Stavanger plant and Nynäshamn terminal have expressed willingness to double their production capacity. However, they will still be classified as mid-sexed plants, offering many possibilities, such as location next to industrial parks and cities[122].

Under construction

Poland is planning to construct a liquefied natural gas (LNG) terminal in Świnoujście, at the Baltic Sea coast. The terminal, which is supposed to be operational by June 2014, will allow receiving 5 bcm of liquefied gas annually with the possibility to expand the capacity up to 7,5 bcm. However, due to the main constructor's bankruptcy, the project will be most probably delayed. The construction of the terminal was announced to be a strategic investment for the country[123] and a part of a strategy to reduce the country's dependence on Russian supplies. The cost of the project is approximately € 950 million, of which € 200 million will be financed by European Bank for Reconstruction and Development[124]. Thanks to the terminal, the Poland's gas demand could be satisfied up to 40%. The terminal will help to create one of the important Central European gas network strand build by interconnectors such as Croatian island Krk and Romanian Constanta. Those ports are the foundation of North-South natural gas corridor, which will enable the purchase of cheaper gas from Qatar and the trade of gas within Europe without participation of Gazprom[125]. The North-South natural gas corridor is a strategic link between energy systems of the Baltic Sea, Adriatic and the Black Sea, aiming at elimination of internal bottlenecks and progress of short-term deliveries through optimisation of existing infrastructure with an emphasis on existing LNG plants and storage facilities[126].

Regarding Sweden, Preem and Norwegian Skangass have already decided to construct the Scandinavia's largest LNG import terminal next to Preem's refinery in

[120] DMA, 2012.
[121] LG, 2012.
[122] LG, 2012.
[123] WNP, 2012d.
[124] HT, 2011.
[125] DGP, 2011.
[126] NGVA, 2011.

Lysekil on the west coast of Sweden. The approximate cost of this investment is € 55 million and the completion of the project is to be by the end of 2013. Skangass will become the operator of the terminal, expected to deliver to Preem around 200 thousand tonnes of LNG annually[127].

Planned

150 km away from Świnoujście, Germans are planning to build their own LNG terminal in Rostock with the initial throughput capacity between 2 to 5 bcm annually. The company responsible for the project, Vopak, specified benefits of the terminal such as easy access to the German and Polish market. The final decision has not been made so far, as the works on feasibility study are still conducted[128].

A terminal for LNG could be completed in Gothenburg by 2015. It is the largest port in the Nordic region, intended to supply LNG to both shipping and industry by Swedegas and Royal Vopak companies, which assure that the terminal will be open to all parties interested in supplying the Swedish gas market. They are ready to start working on a feasibility study of a project, which is also supported by the Port of Gothenburg. As the LNG is easily transported by sea, rail and road, it could reach all parts of the country with no current gas infrastructure, making the project of strategic value. The estimated tank capacity of the terminal is 20 thousand m^3, with possible further expansion depending on market demand. Natural gas will be delivered to the terminal by special vessels by the sea. There will not be a need for vessels to enter a special terminal to refuel or bunker with LNG[129]. To be in accordance with EU's principles, the ownership and operation of energy infrastructures will be separated from producing and selling energy. The initial throughput is estimated at 0,5 bcm a year[130].

In Lithuania, the company Klaipėdos Nafta is implementing the LNG terminal project in Klaipeda. An agreement with Norway's Höegh has been already signed, covering a ten-year lease of a maritime platform for importing liquefied gas, with regasification devices, which is a Floating Storage and Regasification Unit (FSRU), being at the same time a central element of this terminal. The ship gas storage facility is supposed to come to the port of Klaipeda in the end of 2014, so that LNG terminal is due to be ready by 2014. It will be moored to the quay and connected to the gas pipelines, with a daily capacity of 170 thousand m^3 for storage and 11 million m^3 for regasification as required. This amount is equal to the average gas consumption in the country during the winter (2-3 bcm a year). The gas will be received from ordinary gas tankers. There is also a contract signed already with an American company for gas supplies from 2015, which guarantee a 30% lower price than the Gazprom, the only one gas supplier for Lithuanian market, offers[131].

The Floating Storage and Regasification Unit could supply Latvia either through gas pipelines or by shipping the vessel, but at the same time there is no counter-indication to serve the whole Baltic region[132]. Lithuania's project for its own LNG terminal crosses out the partnership with Latvia's project for building regional LNG terminal in Riga. Moreover, if Lithuania is able to satisfy its gas demand thanks to the Klaipeda terminal,

[127] MS, 2012.
[128] DGP, 2011.
[129] POG, 2012.
[130] SG, 2012.
[131] OSW, 2012.
[132] TBC, 2012a.

the country will not be interested in Poland's gas supplies from the terminal in Świnoujście[133].

After local gas production in Estonia stopped, the country became a gas importer. Currently, all gas supplies come from Russia directly or through Latvia. In summertime, Russian exports satisfy most of Estonian gas demand but during the winter, gas has to be held in the underground storage facility in Latvian Incukalns. In order to raise the country's energy security level and reduce dependence on Russia's supplies, there are plans to build a LNG terminal in Estonia. The government has pointed a state-owned company Elering to start working on this project. Elering in cooperation with the Port of Tallinn in May 2012 has chosen the company Vopak LNG as a strategic partner for the Tallinn LNG terminal project. They will also start a feasibility study, covering technical and economic details, the cost of the construction and the need for EU's funds. The European Union will give funds for the construction of LNG terminal only if it covers all the Baltic States. As Estonian gas market is small, it should also include Latvia, Lithuania and Finland[134].

Lithuania has already resigned from the race for EU's funds by renting FSRU, while Latvia has proposed Riga as the best location for an LNG terminal, starting a conflict with Estonia's proposal for Tallinn LNG terminal. As the countries were unable to reach an agreement on the most suitable location for the LNG terminal, a study by European Union will be done and the final decision will be given by autumn 2012[135].

Latvia's proposition for a Baltic regional LNG terminal near Riga has strong advantages of central geographical location in the region, capacity of creating a larger terminal and a specific geology, favouring underground storage sites. Nevertheless, firstly Riga has to enforce the EU's Third Package of energy legislation in the country; otherwise Russian control over Latvia's pipeline will ruin the favourable position over other proposals. Meanwhile, the Estonia's proposal could possibly involve a joint venture with Finland[136]. However, the Port of Riga has the biggest problems with ice within the Baltic ports, and the Latvian-Estonian pipeline is able to supply only their own gas markets excluding the Finnish one. Thus, thanks to the Estonian proposal for a regional LNG terminal in Tallinn, Latvian market will be satisfied and there will still be a need for building a new pipeline with Finland, called Balticconnector. A full-scale terminal with a yearly capacity of 2 bcm should be ready by 2018[137].

In April 2012, the Finnish company Gasum announced a plan to build its own LNG terminal in Southern Finland, for the country's own needs. The potential future locations are Joddböle in Inkoo parish or Porvoo. However, the company did not mention the planned Balticconnector gas pipeline with Estonia, which would make the construction of the Estonian terminal much more economically feasible. Thus, in case of giving up on a pipeline project, Estonian LNG terminal will be smaller and destined to supply only the Baltic States gas markets. Both Finnish and Estonian LNG terminal projects are based on two stages, firstly to differentiate national gas supply channels and then to guarantee regional terminal volume[138].

[133] OSW, 2012.
[134] TBT, 2012.
[135] TJF, 2012.
[136] TJF, 2012.
[137] TBT, 2012.
[138] TBC, 2012b.

A large Finnish LNG import terminal, if completed, would enable the imports of 25-50 % of the country's current gas consumption, which equals to 1-2 bcm of natural gas annually. It would also connect Finland to the international gas market and ensure continued access to gas at a competitive price and during the winter peak periods of power consumption. Imported LNG will also allow replacing oil-based fuel reserve solutions in the gas network. The approximate cost of investment amounts to € 200-400 million. The completion, including a full import, storage and network injection capacity is predicted by the end of 2018, but firstly the project's environmental impacts researches have to be conducted[139].

Furthermore, the Port of Turku and Finnish company Gasum have signed a letter of intent for the construction of an LNG import terminal in Pansio harbour in May 2012. If all arrangements are completed, the terminal will be in operation in 2015. Gasum considers Pansio well suited for the terminal location with the possibility to build tank storage with the capacity of 20 thousand m^3. From Pansio, LNG would be transported to the port of Turku by bunker vessels or tank trucks. Moreover, there is a possibility to build a pipeline network for transmitting LNG in gas form from the terminal to industrial facilities. Now the city of Turku will make corrections to the plan of Pansio area and Gasum will go on with technical planning of the terminal. The estimated cost of the investment is about € 60 million[140].

According to the 'North European LNG Infrastructure Project' prepared by Danish Maritime Authority, there are also several other locations in the Baltic Sea Region under discussion about establishing LNG terminals, for example Helsingborg and Sundsvall in Sweden, Hirtshals in Denmark and Silae in Estonia[141]. In 2011, there was one LNG plant in operation in Russia – Sakhalin II[142].

[139] Gasum, 2012a.
[140] POT, 2012a.
[141] DMA, 2012.
[142] EDI, 2011.

5. Oil pipelines and terminals

5.1 Oil pipelines

Baltic Pipeline System 1

Baltic Pipeline system was designed to transport crude oil from the fields of Western Siberia, Timan-Pechora and Volga-Urals petroleum provinces to a terminal on the coast of the Gulf of Finland for exports. It consists of the main pipeline Yaroslavl-Kirishi and a major pipeline Kirishi-Primorks along with an oil terminal in Primorks, situated near St. Petersburg[143]. The system also uses an existing oil pipeline in Russia, linking Kharyaga through Ukhta with Yaroslavl[144]. In 2006, the pipeline reached its full designed capacity of 1,3 million barrels a day (some 65 million tonnes a year). It helped to develop the infrastructure in Russia and use opportunities on the world markets[145].

Baltic Pipeline System 2

Russia is ready to start exporting crude oil through the Baltic Pipeline System's (BPS) second trunkline, which starts from Unecha in Bryanks region[146] and ends at Ust-Luga maritime terminal. The oil is transported on tankers through the Baltic Sea and North Sea to European customers. The BPS-2 is designed for a total capacity of 50 million tonnes yearly and planned to carry 30 million tonnes capacity in 2013 and 38 million in 2014. An additional 12 million tonnes a year are supposed to be delivered to SurgustNeftegaz's giant Kirishi refinery. The BPS-2 pipeline is 1000 km long with an additional 170 km branch off to Kirishi. The approximate cost of construction was 4 billion US dollars. Oil exports were scheduled to operate fully from April 2012 onward. The pipeline is in operation since late March 2012. The BPS pipelines were designed in order to reduce Russian reliance on overland transit countries, connect directly with Western Europe by maritime route, control total pipeline capacities available in excess of Russia's exports, and also to devalue Druzhba pipeline section in neighbour countries through under-utilization[147].

Druzhba Pipeline

Druzhba Pipeline is the world's longest pipeline so far, remaining a leading service for oil transportation to European countries. It started its operation in 1962 in order to meet the oil needs of Hungary, East Germany, Poland and Czechoslovakia. It carries oil for 5327 kilometres. Each country was in charge of building its own section, which then would become the country's property. Former Soviet territory's section of the pipeline is 3004 km long and consists of the route Almetievsk-Kuibyshev-Unecha-Mozyr-Brest with the Mozyr-Brody-Uzhgorod branch line. This section was built not only to deliver oil to the countries engaged in the project, but also to ensure supplies to oil processing plants in the western region of Russia and the exports of oil to other countries through the Baltic port of Ventspils[148].

From Mozyr the pipeline divides into two routes, northern through Poland and Germany and southern through Ukraine, Slovakia, the Czech Republic and Hungary, both with

[143] LR, 2012.
[144] IFPA, 2012.
[145] TSPT, 2006.
[146] Velesstroy, 2011.
[147] RDPF, 2012.
[148] PI, 2009.

the capacity of up to 1,4 million barrel of oil a day (some 70 million tonnes a year)[149]. The northern branch of Druzhba connects the Plock-Gdansk pipeline in Plock in Poland with a terminal in Gdansk, used for oil re-exports[150]. Next to the Polish-German border in the city of Schwedt, Druzhba pipeline connects with the German MVL pipeline to Spergau next to Leipzig and an oil terminal in Rostock[151].

The southern branch of Druzhba pipeline splits again in Uzhgorod in Ukraine into lines to Szazhalombatta in Hungary[152] and through Slovakia and the Czech Republic to Litvinov next to the Czech-German border[153].

Over its lifetime, Druzhba pipeline system has been providing a reliable and uninterrupted supply of Russian oil and helped to reduce the costs of transport. The construction works on the second stage of Druzhba pipeline were started in 1965 in order to satisfy growing oil demand, following the route of the first line, built in separate sections by the different countries interested for a length of 4412 km. In 1973, two thousand km Ust-Balyk-Almetievsk pipeline came into operation, letting the Druzhba system connect with the oil fields in Western Siberia. After decades of its construction, Druzhba remains a key link in the European energy section[154].

All the pipelines mentioned in this report, including Baltic Pipeline System, Baltic Pipeline System 2 and Druzhba Pipeline are pictured on the map below. The map also presents the Odessa-Brody Pipeline linked to the Druzhba Pipeline in the City of Brody. Starting from Szazholombatta, where the Druzhba Pipeline ends, there is another oil pipeline partly shown on the map, which is not of the interest of this report.

[149] EIA, 2012.
[150] TNYT, 2007.
[151] OPG, 2006.
[152] PI, 2009.
[153] CP, 2011.
[154] PI, 2009.

Map 4. Druzhba pipeline, Baltic Pipeline System 1&2[155]

Source: ED 2012.

Regarding the Druzhba Pipeline, there is also a third branch of the pipeline shown on the map above, which goes to Lithuania and Latvia. It was used to deliver 16 million tonnes a year in the aggregate, but since the oil transfer has been stopped for Latvia in 2002 and Lithuania in 2006, this branch is no longer operating at all[156]. Generally, the oil that had flown by this branch will be pumped through Baltic Pipeline System-2, to the new port in Ust-Luga[157].

In addition, Russian company LukOil is planning to build a new pipeline between the port of Primorsk and the marine oil terminal based in the port of Vysotsk. The project is still under discussion and the company is working on technical and economic studies. The estimated time for reaching its full capacity will be two years, if the project is approved[158]. Ust-Luga and other oil terminals in the Baltic Sea Region are presented below.

5.2 Oil terminals

Brofjorden

Preem AB's refinery 'Preemraff Lysekil' and terminal are situated on the west coast of Sweden in Brofjorden. The refinery's capacity is 11,4 million tonnes per year. At the

[155] BPS2 does not go through Belarus.
[156] ED, 2012.
[157] Transneft, 2012.
[158] PN, 2012.

port there are one crude oil jetty for ships up to 500 thousand dwt[159] and five jetties for products (up to 80 thousand dwt). Terminal is accessible all year long. Fairway depth into the crude jetty is 28 m[160].

Būtingė

Construction of Būtingė oil terminal in Lithuania was finished in spring of 1999. In July of the same year, the first tanker was loaded with crude oil. Since 2006, when the supplies of crude oil to the Mažeikiai Refinery through the main oil pipeline Druzhba were stopped, the company managing the terminal, Public Company ORLEN Lietuva has been using the terminal to import crude oil for its own needs. In 2009, there were 8389 million tonnes of crude oil unloaded in this terminal[161]. The terminal is generally composed of a pumping station, fire fighting system and wastewater treatment plant. The onshore pipeline connects the terminal with the Mažeikiai Refinery Pump station, for a length of 91,6 km. 2,2 km long crude oil pipeline connects the terminal with the shore-line. The offshore pipeline, located 20 meters deep in the Baltic Sea, connects the terminal facilities and the crude oil single-point mooring[162].

Fredericia

Fredericia Port in Denmark has an advantageous geographical location for freight service through fairways against the Baltics and Scandinavia. The depth of water is 15 m, enabling large oil tankers to approach the Shell oil export terminal at Fredericia Port. Around 200 oil tankers are operated during the year. The water current along the terminal can run up to 6 knots, adding large forces to the mooring lines of the oil tanker. In order to increase safety, there has been mooring load monitoring systems installed on each of the renewed quick release hook stations[163].

Gdańsk

The liquid fuel terminal has four berths for the handling of crude oil and its derivatives. Technology is used in a closed system, which is safe for the environment. There are also closed handling docks, anti-spill barriers and a fire fighting system. Through the system of pipelines and handling stations of PERN, the Polish company utilizing the oil pipeline Druzhba, and Gdansk Refinery, fuels can be delivered to refineries and plants in the country and the eastern part of Germany. The annual throughput capacity equals to 34 million tonnes. The terminal is owned by the Liquid Fuel Handling Company Naftoport Ltd[164]. Cargo handling jetties of Naftoport are situated in closed basins of Naftoport Oil Terminal at the North Port of Gdansk, protected with breakwaters and secured against oil spills thanks to the permanent and pneumatic dams. The depth of the water fairways is 17,5 m, their width 350 m, and length 7,2 km. The terminal can receive tankers of 6000 – 300000 tonnes dwt with the length of up to 340 m and the maximum draught of 15 m[165]. PERN is going to construct and operate a new oil terminal in Port of Gdansk. PERN has already started a tender procedure for a new terminal, which is to be commissioned by 2013 and put into operation in 2015. The capacity of the new oil terminal will be 700 thousand cubic meters on the area of 29 ha.

[159] Deadweight tonnage. It is a measure of how much weight a ship can safely carry.
[160] MBA, 2012.
[161] OL, 2010.
[162] BOTP, 2012.
[163] TQM, 2010.
[164] PGA, 2012.
[165] NOT, 2011.

The terminal will strengthen the country's energy security and help to secure the crude oil supplies for Poland's refineries. The estimated cost of this investment is around € 182 million[166].

Gothenburg

Torshamnen is the crude oil terminal at the Port of Gothenburg in Sweden. It is a hub for the whole Scandinavian market. Around 20 million tonnes of oil and other energy products are handled each year as half of the crude oil enters Sweden through the Port of Gothenburg and its three ports Tora Harbour (Torshamnen), Skarvik Harbour and Rya Harbour. At Tor Harbour, crude oil is loaded and discharged, while the Skarvik and Rya Harbours are in charge of refined oil products, renewable energy products, chemicals, and small volumes of crude oil. There are 24 berths and 4 million cubic meters of storage capacity, of which 3 million are in cisterns and around 1 million in underground caverns[167].

Kaliningrad

The Kaliningrad Port authorities are in charge of the management and regulations of the Port of Kaliningrad, which is accessed from the Baltic Sea through a 24 nautical mile canal to Kaliningrad Bay. Maximum draft for vessels is 8 meters and maximum beam is 25 meters. Regarding tankers, maximum permissible length is 140 meters. It is throughout the year accessible ice-free port. The Port of Kaliningrad operates customs offices at the Sea Commercial Port and Fishery Port, and at the terminals in Baltiysk and Svetly[168].

The Port of Svetly is situated in the middle of the Port of Kaliningrad Sea Channel and handles fuel oil, coal and frozen products. The maximum draft of the port is 4,5-5,5 meters. Located in Svetly, the Port of Kaliningrad's LukOil Terminal loads export oil cargos. There are three loading berths with a storage capacity of about 120 thousand cubic meters. The LukOil Terminal has a loading capacity of approximately one thousand m^3 in an hour. The terminal can accommodate tankers of up to 170 meters with the maximum draft of 9,4 m for outward passage in laden condition. The Port of Kaliningrad Oil Terminal's berth is around 310 m long, with a tank storage capacity of 35 thousand m^3 and a loading capacity of about 8 thousand m^3 per day. The BNK Baltiysk Oil Handling Terminal at the port has one loading berth with a storage capacity of 15 thousand m^3 for cargo and a possibility to load up to 600 m^3 per hour[169].

Kalundborg/Stigsnæs

The port of Kalundborg is located on the north western part of Zeeland, 100 km west of Copenhagen in Denmark. It is accessible all year round and protected from strong weather. The port is divided into three parts: Inner harbour of Kalundborg, handling mainly dry bulk cargos; Statoil Terminal, handling all kinds of petroleum products on vessels up to 150 thousand dwt; and Asnaes Terminal in charge of coal and fuel oil products on vessels up to cape size. The port of Stigsnæs is located on the south western part of Zeeland, connecting to the entrance of the Baltic Sea. It is accessible all year round, consisting of three terminals: Gulfhavn Oil Terminal, handling petroleum products on vessels up to 125 thousand dwt; Stigsnæs Oil Terminal, in charge of

[166] DB, 2012.
[167] GEP, 2012.
[168] WPS, 2012.
[169] WPS, 2012.

petroleum products on vessels up to VLCC-size; and Stigsnæs Coal Terminal[170]. At terminal Gulfhaven 2 there is a possibility for storage and transhipment of heavy fuel oils of up to 340 thousand cubic meters[171].

Klaipeda

The Oil Terminal in Klaipeda, Lithuania has been in operation since 1959. The reconstruction of the terminal by its operator, the Stock Company Klaipedos Nafta, was started in 1995 and completed in 2002. The reconstruction included the demolition of old facilities and building of new objects. Since then, the Company is able to load tankers of up to 100 thousand tonnes in capacity. The oil terminal consists of Pauostis railway station, two four-track railways trestles for discharging and loading of crude oil and oil products, process pipelines, boiler house, storage tanks, two jetties, mechanical and biological waste water treatment facilities, and oil vapour combustion equipment. The capacity of the terminal equals to 9 million tonnes of crude, light and heavy oil products per year. Furthermore, the shortest land routes to the most important industrial regions of Eastern Europe starts from Klaipeda[172].

Liepaja

According to the project for the terminal for oil products transhipment and storage for Liepaja, the terminal will be located in the special economic zone in Liepaja, Latvia, within the city with railway and road infrastructure. The annual transhipment capacity is estimated at around 1,6 million tonnes. The equipment of the terminal consists of a railway overpass for 2x15 tank cars, dark and light oil products tank batteries, pump station for transhipment separately for dark and light oil products, and a berth for tanker servicing. The terminal is intended to hold a specialized niche player position in the market, by providing services for small and customized cargo capacities. The Port of Liepaja is also one of the key base oil transhipment hubs in the region[173].The cargo turnover of the Liepaja port consists of crude oil of Lithuanian origin, used in petrochemical production and oil products. The planned development of two specialized container handling facilities should be finished by 2017. Regarding liquid bulk cargos; their total capacity will reach 1 million tonnes per year. Oil and its products are handled generally in Karosta canal basin, and some additional liquid bulk cargos handling facilities are planned in the future[174].

Naantali

Naantali is situated in the south western part of Finland. The refinery located in Naantali has a refining capacity of over 50 thousand barrels a day and it produces around 3 million tonnes of petroleum products annually. There are also over 1 million cubic meters of crude and product storage capacity. All the crude oil refined at Naantali is delivered by sea but raw materials also come in by rail. All tankers operating in the Baltic Sea with the maximum draft of 15,3 m can berth at Naantali. Around 350 vessels berth yearly at the harbour. It also handles around 4 million tonnes of petroleum annually[175].

[170] PKS, 2012.
[171] NS, 2012.
[172] OTC, 2012.
[173] TT, 2012.
[174] PL, 2012.
[175] NO, 2012a.

Porvoo/Sköldvik

The Port of Sköldvik in Porvoo is an oil port, handling most petroleum product transhipment in Finland, situated 30 km east of Helsinki. It is a part of the Neste Oil Ltd Porvoo refinery, concentrated in production of premium-quality, low-emission traffic fuels. Its refining capacity is approximately 200 thousand barrels a day and the refinery produces about 12,5 million tonnes of petroleum products a year. There is 7 million cubic meters of crude and product storage capacity. This port is the largest port in Finland in terms of volume of cargo throughput – 19-20 million tonnes of crude oil and petroleum products pass through the harbour yearly[176].

Primorsk

The oil terminal in Primorsk started its operation in December 2001, which considerably decreased Russia's dependence on Latvian, Lithuanian and Estonian harbours used for the countries' oil exports. Russian Transneft has so far invested € 550 million in the new transport route. The company has claimed that around 12 million tonnes of oil will be transported through the Primorsk terminal, which is equal to approximately 240 thousand oil barrels daily. The terminal composes of ten large oil tanks with the capacity of 50 thousand tonnes each. The oil is transported from the oil fields of Siberia by pipeline[177].

Primorsky Trade Port is Russia's major port in the North-West for exports of crude oil and petroleum products. Primorsk Oil Terminal is also the termination of the Baltic Pipeline System, main pipelines Kstovo-Yaroslavl-Kirishi-Primorsk, also called the North Project and JSC Transnefteproduct. According to the Novorossiysk Commercial Sea Port CEO, Rado Antolovic, the potential of crude oil and oil products throughput at Primorsk Trade Port is around 120 million tonnes annually. He has said that the port would be able to handle containers, iron ore, coal and fertilizer in case of modern and developed railway infrastructure implementation. Furthermore, the construction of the Ermilovo-Primorsk branch line could raise the port traffic volume to 500 thousand tonnes a year[178].

Riga

The Baltic Oil Terminal joint venture and Belnaftakhim concern are going to build and fully equip an oil terminal at the Free Port of Riga. The capacity of the terminal will be 10 million tonnes of oil and oil products a year. It will consists of 27 ha and two jetties. The total volume of tank battery will be 370 thousand cubic meters[179]. The terminal will be accessible for vessels of up to 100 thousand dwt. It is designed for receiving and shipping of dark and light oil products, crude oil and petrochemicals by railway, sea and road transport, and also for bunkering[180].

Rostock

An unbiased service company, Großtanklager Ölhafen Rostock GmbH, is the operator of the oil harbour of Rostock in Germany. The company is in charge of three tank farms, with a total capacity of 700 thousand cubic meters, used for storage and

[176] NO, 2012b.
[177] HS, 2001.
[178] SE, 2012.
[179] ODB, 2008.
[180] BOT, 2012.

handling of mineral oils, vegetable oils and other liquid products. The six berths at the oil harbour can put ashore the oil and fuels of up to 100 thousand dwt, stored and transported on by tank truck, tank wagon and pipeline. The berths and the tank facilities are linked with refineries in Schwedt, Boehlen and Leuna through pipelines. There are also five loading and unloading rails available, and a modern filling platform with six loading platforms. Modern facilities like vapour recovery units or a fully automatic dispatch system follow high safety and environmental standards, and provide a safe storage and fast handling of the products[181]. At the oil harbour there is also a biodiesel plant with an annual capacity of 150 thousand tonnes of biodiesel and 18 thousand tonnes of glycerine. In 2011, the amount of crude oil handled in Rostock dropped by 1,7 million tonnes[182].

Sillamäe

Alexela Sillamäe is an independent operator company that runs a terminal handling oil products and bunkering on a territory of 11,5 ha at the Port of Sillamäe in Estonia. The infrastructure of the terminal consists of 16 reservoirs with a total capacity of 292,5 thousand cubic meters, including 3 reservoirs of 12,5 thousand m^3 used for light and heavy oil products, 8 reservoirs of 30 thousand m^3 for light and heavy oil products, and 5 reservoirs of 3 thousand m^3 for bunkering of different types of fuels and blending equipment. In addition, there is a combined double sided railway pier able to accommodate 44 rail-tank cars on both sides. The estimated working capacity is 5 million tonnes a year. The pump station composes of 16 discharging and 7 loading pumps with a capacity of up to 6 thousand m^3 per hour. There are also two deep-sea berths able to receive ships of 150 thousand dwt, waste treatment facilities, fire safety water pumps station and boiler-house[183].

St. Petersburg

Since June 1995, there has been a new construction program of a terminal and commissioning of new capacities by the company named Petersburg Oil Terminal. The tank farm has increased capacity to 354 thousands m^3. As of 2010, there are 108 tank places, 7 wharves, capacity of ships received of 100 thousand tonnes, and the terminal capacity of 12,2 million tonnes a year. In June 2011, Petersburg Oil Terminal started the implementation of the next stage of its long-term investment program until 2020, including building of a third 40 thousand cubic meters oil product storage tank[184].

Tallinn

The Port of Tallinn consists of the Muuga, Paldiski South and Paljassaare Harbours, handling petroleum products, the transit of which is concentrated into the Muuga Harbour with its three major terminals engaging storage and transhipment of liquid bulk: Vopak E.O.S., Vesta Terminal Tallinn and Oiltanking. In addition, there is Neste Eesti, involved in retail and wholesale of liquid fuels and lubricating oils, and Nynas, taking care of imports and marketing of bitumen and its products, terminals operating at the Muuga Harbour as well as Alexela Terminal in the Paldiski South Harbour and Scantrans in the Paljassaare Harbour, both processing oil products. Most of the cargo supplies come from plants in Russia, Belarus and Kazakhstan. The highly advanced, existing infrastructure allow the transit from Eastern Europe to Western Europe,

[181] SR, 2012.
[182] RP, 2012.
[183] PS, 2012.
[184] POT, 2011.

America and Asia. The total storage capacity equals to 2 million cubic meters. There are 13 berths with the maximum depth of 18 m and a loading rate of tanker vessels of up to 8 thousand m^3 per hour. This ice-free port allows a year-round navigation with a capacity of transhipment of 40000 billion tonnes of liquid bulk annually, with an additional plan to build a new terminal into the Western part of the Muuga Harbour on an area of 20 ha, which is already permitted to start the construction[185].

Ust-Luga

In March 2012, a new crude terminal at Ust-Luga, where the Baltic Pipeline System-2 terminates, was launched in Russia. At the first stage the terminal will have a capacity of 30 million tonnes annually, which will be expanded to 38 million tonnes in 2014[186]. The company Transneft foresees the growth of crude oil exports via Baltic ports to be 24% quarter-to-quarter. In the second quarter, the terminal is scheduled to load 3,6 million tonnes of crude oil. By the end of 2011, Transneft announced planned export volumes from the Uts-Luga terminal through the BPS-2 of 10 million tonnes and 20 million tonnes. However, the operation of the Ust-Luga terminal will cause the losses of Gdansk and Primorsk seaborne traffic[187]. As of September 2012 the current annual throughput capacity was 30 million tonnes[188]. This facility is expected to tranship 15 million tonnes of crude oil for 2012[189].

According to traders, the exports from the Ust-Luga terminal will keep pressure on price of Ural crude, which is already trading at its lowest since the beginning of 2012. It is also an alternative for Iranian crude. The terminal is able to handle around 400 thousand barrels a day[190].

Ventspils

Liquid cargo area in Ventspils in Latvia consists of nine berths able to accommodate vessels of 150 thousand dwt. Ventspils Nafta Terminal Ltd is the largest BSR oil and petroleum product transhipment terminal operating in a port's liquid cargo area. Crude oil and petroleum products are delivered by pipeline or railways. The tank farm of the enterprise has a capacity of over 1 million cubic meters with a possibility of storage of the products for the clients. The company also provides chemical analysis of oil and petroleum products. JSC Ventbunkers administer various light and dark petroleum products, as well as offering forwarding and ballast-bilge water collection services. The storage capacity of the terminal is 275 thousand m^3 and transhipment intensity amounts up to 10 million tonnes a year. There is also JSC Ventamonjaks, a terminal for handling chemical products, including ammonia, different spirits, methanol, oil and petrochemicals, and Baltic Juice Terminal for the transhipment and storage of fruit juice concentrates[191]. The Ventspils terminal was designed to handle 16 million tonnes of oil and 10 million tonnes of oil products[192].

[185] PPP, 2012.
[186] NRBOP, 2012.
[187] WMN, 2012.
[188] RBC, 2012.
[189] PoNe, 2012.
[190] MW, 2012.
[191] POV, 2012.
[192] BGRBC, 2012.

Vysotsk

The site of the terminal is on Vysotsky Island, in the Gulf of Finland, in Russia. The operator of the terminal, the Russian company LukOil, has put in operation Phase III of transhipment and offloading complex. The designed annual capacity of the terminal is 11,6 million tonnes of oil products. The construction took four years, after which the terminal started the exports of crude oil shipment and then light and dark oil, produced in the company's petroleum refineries. There are three moorings, of which two enable receiving ships of 100 thousand dwt. One is designed to receive river-sea class tankers, delivering fuels to the port through Volgo-Balt system. However, majority of deliveries are transported by railway. There are also three trestles to discharge products, of which construction excludes accidental oil spillage. A closed discharge system allows oil products to be pumped from tanks through pipelines directly to an oil storage reservoir and then supplied to the tanker through pipelines as well. The terminal is also equipped with heating cables, which prevent the pipeline from freezing in the winter, state-of-the-art purification systems for wastewater treatment and fire-fighting system. Moreover, all facilities are constructed on special platforms to protect soil and subsoil water. In 2006, the aggregate storage capacity reached 460 thousand cubic meters[193].

[193] MM4, 2006.

Table 4. Oil terminals within the BSR

Harbour	Location	Size/Capacity	Special notions
Brofjorden	Brofjorden, Sweden	1,4 million cubic meters	storage capacity
Būtingė	Būtingė, Lithuania	8389 million tonnes/year	unloaded in 2009
Fredericia	Fredericia, Denmark	18,4 million tonnes/year	throughput capacity
Gdańsk	Gdańsk, Poland	34 million tonnes/year	throughput capacity
Gothenburg	Gothenburg, Sweden	20 million tonnes/year	handling capacity
Kaliningrad	Kaliningrad, Russia	170 thousand cubic meters	total storage capacity
Kalundborg/ Stigsnæs	Kalundborg, Denmark	1,7 million cubic meters	combined capacity of Kalundborg, Gulfhavn, Stigsnæs and Ensted oil terminals
Klaipeda	Klaipeda, Lithuania	9 million tonnes/year	terminal capacity
Liepaja	Liepaja, Latvia	1,6 million tonnes/year	transhipment capacity
Naantali	Naantali, Finland	4 million tonnes/year	handling capacity
Porvoo/ Sköldvik	Porvoo, Finland	19-20 million tonnes/year	throughput capacity
Primorsk	Primorsk, Russia	12 million tonnes/year	estimated throughput capacity of the terminal
Riga	Riga, Latvia	10 million tonnes/year	handling capacity
Rostock	Rostock, Germany	2,9 million tonnes/year	handling capacity
Sillamäe	Sillamäe, Estonia	5 million tonnes/year	estimated working capacity
St. Petersburg	St. Petersburg, Russia	12,2 million tonnes/year	terminal capacity
Tallinn	Tallinn, Estonia	2 million cubic meters	total storage capacity
Ust-Luga	Ust-Luga, Russia	38 million tonnes/year	estimated terminal capacity in 2014
Ventspils	Ventspils, Latvia	10 million tonnes/year	transhipment capacity
Vysotsk	Vysotsk, Russia	11,6 million tonnes/year	terminal capacity

Sources: Compressed information from this chapter.

6. Future outlook of the BSR energy networks

The demand for energy is constantly increasing and the use of fossil fuels is growing considerably, despite the evolving share of alternative sources of energy. The use of energy for each country or region is different, especially in terms of energy sources due to the outcome of the country's natural resources and political decisions. For instance, the existence of nuclear power strongly depends on political decisions, political and geographical stability, as well as on economic development.

After the accident in Fukushima, Japan, some European countries decided to abandon nuclear energy use, but on the contrary, some are planning to increase the number of nuclear reactors and the output of energy produced from nuclear resources. Nuclear power plants enable reducing carbon emissions, which are created while using fossil fuels. Furthermore, costs of producing energy in nuclear power plants are lower than production in coal or wind power stations. Nevertheless, renewable energy use alone would not be enough to satisfy market needs[194]. There is a need to use renewable resources on a large scale but in order to replace high dependence on fossil fuels, there has to be an additional source of energy in use.

Disruptions to the energy supply are very likely to affect large parts of societies and even the population. Electricity is an important source of energy, as it is essential for all other forms of energy supply. In order to secure the continuous supply of electricity, there has to be sufficient electricity infrastructure ensured between the countries able to exchange their supplies. Demand for international electric connections is steadily growing and there are many new electric cable connections to come in the near future.

EstLink connections of electricity markets between Baltic and Nordic countries stimulate electricity trade and allow the surplus of energy to be easily exported between the partners, increasing their energy supply security. Thanks to the cables, in an open electricity market the capacity will bring effective operation and flow of energy both ways with no congestions. Swedish-Finnish Fenno-Skan electricity cables will reduce transmission losses in the Nordic grid and raise operational reliability[195]. Fenno-Skan will also decrease temporary price differences of electricity and improve power system security within the Nordic electricity market. SwePol Link allows integrating the Continental Europe with Nordic countries and an effective use of resources.

The aim of most electric cable projects is to promote trade of electricity between the Baltic and Nordic electricity markets and increase the security of electricity supply in the region. For instance, the common Lithuanian-Polish projects are crucial for the energy sector and its development in the region. LitPol Link and the planned gas pipeline will assure alternative supplies of the resources, their functionality and simplify access to energy for countries' inhabitants. Within the EU's energy policy both Polish and Lithuanian entrepreneurs can work on common projects in the sector of nuclear energy, natural gas or shale gas as well[196].

A variety and further expansion of energy supplies are needed, as there are countries that are too dependent on one supplier of energy. For instance, as there is almost no alternative for natural gas and liquid fuels imports to Estonia from Russia, an undersea cable connection with Finland and continued cooperation with Baltic States would increase the country's energy security.

[194] EJ, 2012.
[195] SVK, 2012.
[196] WNP, 2012b.

By taking into account instability of gas supplies from the east, and in order to increase energy security, satisfy energy supply by reasonable cost and protecting the environment, some countries have to improve their cooperation in the matter of energy infrastructure. In order to use resources effectively, high efficiency is needed, including advanced cooperation in energy flows.

In general, fossil fuels make up 85% of total primary energy consumption of BSR's countries. Natural gas dominates, with a 39% share in the consumption, followed by oil with 26%, solid fossil fuels with 20% and nuclear energy with 7%. Renewable energy, including hydropower, constitutes 8% of the total primary energy consumption within the Baltic Sea Region in 2011.

As the Baltic Sea Region is mostly dependent on gas supplies, there has to be a sufficient gas infrastructure provided for countries within the region. The changes will mainly concern liquefied natural gas terminals and unconventional resources. The liquefied natural gas market will be progressively growing due to the rise in demand. The Baltic Sea Region's natural gas market is in convenient position due to the access to production from CIS countries. It will also take advantage of the growing supply of LNG. The expanding non-conventional production potentials and the intensifying marine transport of liquefied natural gas will drive the lead of the future development. If the resources of shale gas in Poland are bigger than estimated, it will not only satisfy the country's domestic market and increase its independence from the eastern supplies, but it will be possible to export surpluses in the future due to a new LNG terminal, which would not only change the country's but also the whole region's energy landscape[197]. So far, those are only projections and there is still a lot to be done.

The second largest source of energy is oil. Oil movements within the BSR are dominated by the exports of Russian crude and refined oils through three pipelines: Druzhba, Baltic Pipeline Systems 1&2. All the BSR countries are influenced by Russian oil supply, which is not seen to be changed in the near future. As most of the countries in the region are strongly dependent on oil, there are new oil terminals being built in order to enable easier and more efficient exchange among the countries. The Russian oil terminals at Vysotsk, Primorsk and Ust-Luga will allow the country's direct flow of oil with no additional transit through the Baltic States. Thus, the primary export route through the port of Ventspils in Latvia, Butinge in Lithuania and Tallinn in Estonia have already lost their previous importance due to the closing of the third branch of the Druzhba Pipeline. However, as crude oil will be the first fuel which will not be able to satisfy rising demand, it has to be gradually replaced by other energy sources in order to meet energy demands.

The countries are slowly going away from fossil fuels use on behalf of renewables, which have recorded the highest increase among the various sources of energy over a past few years. However, this is still not sufficient enough to reduce the fossil fuels dependence in case of most of the countries. Thus, countries' energy policies are playing a major role in restructuring the energy consumption profiles and in enabling effective use of available resources in order to boost the countries' energy independence and energy supply security.

[197] DGP, 2012c.

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