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# **Pomeranian Voivodship – Present State, Opportunities Coming From Diversification the Directions of Energy Supplies and Perspectives for the Clean Energy Development**

*Tomasz Chyła*

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**Abstract:** The article presents the current state of the domestic power industry, with special emphasis on gas in the energy portfolio, analysing the process of becoming independent from natural gas supplies from Russia. The second part of the publication presents the author's reflections on the energetics industry in the Pomeranian Voivodship, the development of innovative power engineering branches and the perspectives of turning away from high-emission fossil fuels. The author puts particular attention to the planned development of the offshore wind energy sector in the Pomeranian Voivodship, which will be a driving force for the region's economy.

**Key words:** decarbonisation, Offshore Wind Energy, Pomeranian Voivodship

## **1.0 Introduction**

The article is an attempt to analyze the current situation in regional energy market in Pomeranian Voivodship and to describe the perspectives for that market, showing the trends and taking into consideration observed innovative approach of companies and local government institutions. The main problem of this study is contained in the question: How the local decision makers and industry representatives should act during “clean energy revolution” to become a national leader in the use of renewable energy sources? The main problem will be solved by extraction of the following specific problems:

- What the energy revolution looks like in Poland?
- What is a current state of energy market in Pomeranian Voivodship especially when it comes to achieving energy self-sufficiency?
- What are the innovative investments in the area of energetics in analyzed region?

The basic research method to solve the above problems is the analysis of the subject literature and specialist press. The article will be divided into 4 main substantive parts: present status of energy management in Poland, role of Pomerania in modern usage and diversification of natural gas sources, analysis of energy independence and use of renewable energy sources (RES) in the Pomeranian Voivodship and finally a summary.

## **Energy Management in Poland**

In 2006, the installation of the LNG terminal was recognized by the Polish Prime Minister and the Council of Ministers as a strategic investment for Republic of Poland. Nine years after this decision, the first cryogenic tanker arrived at the terminal built at a cost of PLN 3.6 billion, and in 2018 the volume of transshipment reached a planned value of 5 billion cubic

meters of natural gas, which covered about 28% of the country's annual demand (about 18 billion cubic meters a year).

The terminal was the first such large investment to make Poland independent from the supplies of this raw material from the Russian Federation, which in time perspective started the trend of diversification the supply directions of this strategic fuel. In 2022, when the "Yamal contract" (31.12.2022) for the delivery of natural gas by the Yamal gas pipeline will expire, the "Baltic Pipe" is planned to be put into operation (01.10.2022). That strategic investment will allow the transfer of up to 10 billion cubic meters of gas per year from the north-west direction (including 25% of the gas extracted by Polish Oil and Gas Company (PGNiG) from concessions on the Norwegian Continental Shelf). Combined with domestic extraction at a projected level of 4,5 billion cubic meters per annum and augmentation in the regasification capacity of the LNG terminal in Świnoujście up to 7.5 billion cubic meters per year (planned in 2021 thanks to additional regasification installation) and in 2023 ultimately up to 10 billion m<sup>3</sup> thanks to third LNG process storage tank, LNG-to-Rail transshipment installation and the second jetty. Those two investments called "Northern Gate will have an excellent impact on improving the energy security of the country" (Miętkiewicz 2019: 57), moreover will give us the possibility of re-exporting the surplus (about 3.5 – 6.0 billion cubic meters with the estimated annual demand level of 18.5 billion cubic meters) to neighboring states (also dependent on supplies from the East).

The process of making independence from Russian's gas supplies shows the trend of replacing hard coal and lignite (which share in Polish energy mix according to data from 2019 of Polish Energy Networks is respectively 49.3% and 26,1%) (PSE 2019) by a cleaner fossil fuel such as natural gas. Polish energy, which has been for a years based mainly on coal-fired power plants, in the last decade has been undergoing a transition which consist in the substitution of high-emission fuels by renewable energy sources (wind, solar, riverine and geothermal energy), and natural gas, which is a much more environmentally friendly energy carrier (its combustion emits about 40% less carbon-dioxide compared to coal, emissions of nitrogen compounds are also lower, and the emissions of sulfur and dust compounds are almost zero). Turning away from coal (of which deposits in Poland according to data obtained from the National Geological Institute, in 2016 amounted to about 58.6 billion tons for coal, and for lignite – about 23.5 billion tons, for annual consumption approx. 36 million tons for coal (2019) and for lignite - 61 million tons (2017)), strongly correspond to accepted in 2018 the European Union's strategic vision for 2050 (UE 2018) to achieve zero emissions by 2050. Although the Polish side has not declared its commitment to this goal by 2050, decarbonization is an inevitable process, which is the main objective of the "European Green Deal", i.e., a new Economic Development Strategy for the European Union published in December 2019 resulting from the United Nations Framework Convention on Climate Change (COP21) signed in April 2016 and called the "Paris Agreement".

### **Natural Gas in Pomerania Voivodeship**

The decarbonization trend implies a number of investments that are in the planning, execution or operational phases. In addition to the elements mentioned in the article to expand the receiving potential of natural gas supplies by sea called the North Gate, the project of the

FSRU (Floating Storage Regasification Unit) terminal on the Gulf of Gdansk is being considered. In September 2020, a letter of intent was signed, which brings the construction program of a floating LNG terminal with a throughput of 4.5 billion m<sup>3</sup> per year closer to the implementation. This will facilitate development process for the LNG market in our part of Europe and will also strengthen Poland's energy security. The location of the FSRU unit in the Gulf of Gdansk will increase the importance of this part of the coast on the economic map of the Baltic Sea i.e. through the possibility of direct bunkering the LNG vessels. Moreover "small scale" LNG terminal with a gas power plant which is planned (2028), at the end of the Gdynia Outer Port (External Port) will also make way to bunker the ships. The project of Port Gdynia assume also the construction of a barge adapted to bunkering other vessels with LNG (PORT 2020) Access to low-CO<sub>2</sub> fuel for the marine fleet will have a positive impact on the environment. This is important in connection to the changes taking place in the maritime transportation market. From 2015, only ships using marine fuel with a maximum of 0.1% Sulphur content are allowed to sail in the Baltic and North Seas, in addition to the "Sulphur Directive" in the Nitrogen Emission Control Area (NECA) which include Baltic Sea starting from 2021 the newly built ships will need to meet stricter Tier III NO<sub>x</sub> standard. Technologies that reduce NO<sub>x</sub> emissions as required by MARPOL (The International Convention for Prevention of Maritime Pollution For Ships) include selective catalytic reduction (SCR) systems, exhaust gas recirculation (EGR) and the usage of alternative fuels such as LNG (GOV 2019), which seems to be the most economically justifiable alternative in the context of newly built units when raw material prices fall down in global markets. Example of a French CMA CGM shipping company, whose newest container ship, the "Jacques Saade" (ULCV - Ultra Large Container Vessel) powered by liquefied natural gas, has a payload of TEU 23 000 (PM 2020), clearly shows the direction of maritime transportation. Moreover, it indicates that the LNG terminal is highly demand even in the context of augmentation in the level of trans-shipment of ports: Gdansk (Deep Water Container Terminal) and Gdynia (External Port – completion planned in 2028). In addition, the potential of the ports and shipyards (esp. built in 2009 by Remontowa Shipbuilding LNG carrier "Coral Methane") of the Gdańsk Bay indicates that construction of small cryogenic LNG tankers should be a concept worthy of consideration.

Constantly increasing import of gas impact on the decisions to create modern and "clean" plants producing electricity from natural gas. Testament to that is a fact of signing by the biggest Polish companies: PKN ORLEN, LOTOS and ENERGA a letter of intent in November this year (2020) on the construction of a gas and steam power plant in Gdańsk. The investment is preplanned to be ready by July 2026 (LOTOS 2020).

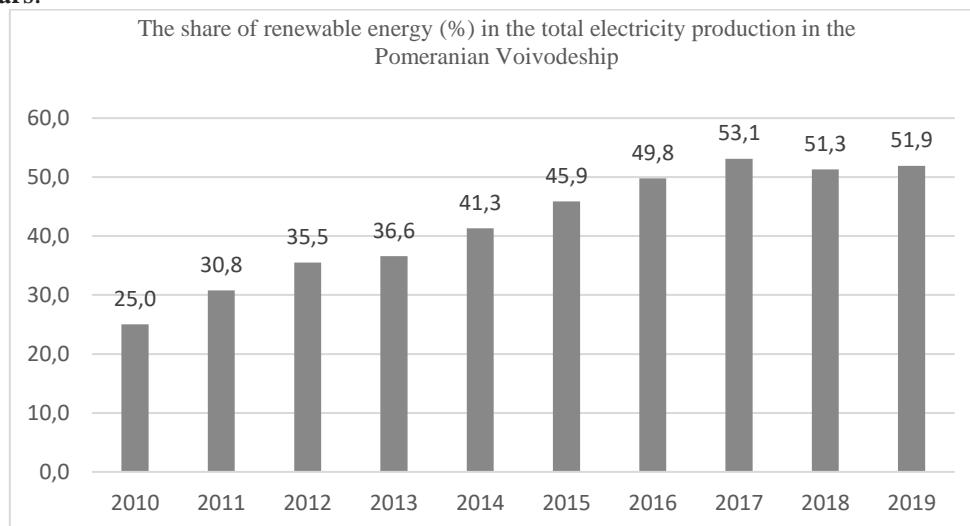
Another example of usage of natural gas in the power industry of the Pomeranian Voivodeship is the city of Władysławowo, which is connected by an offshore pipeline with the Baltic Beta oil rig, and in the unique in European scale CHP (Combined heat and power) plant which use waste gas (byproduct) from the B3 and B8 field to cover its entire demand for electricity and heat of the region.

### **Analysis Of Energy Independence And Use Of Res In The Pomeranian Voivodeship**

On the territory of the Pomeranian Voivodeship (which in 2019 was the 4th among the provinces in respect of usage of renewable energy sources. for electricity production - 51.9%,

in comparison to the average for Poland - 15.5%) (GUS 2020), there are a number of investments related to the renewable and low-carbon energy market, which will be elaborated in the following part of the article. The process of increasing contribution of renewable energy in Pomeranian energy mix is shown on figure 1.

**Figure 1 Share of renewable energy in total electricity production in the Pomeranian Voivodship over the last 10 years.**



Own study: based on GUS (Central Statistical Office) data "Pomeranian Voivodship in numbers 2020"

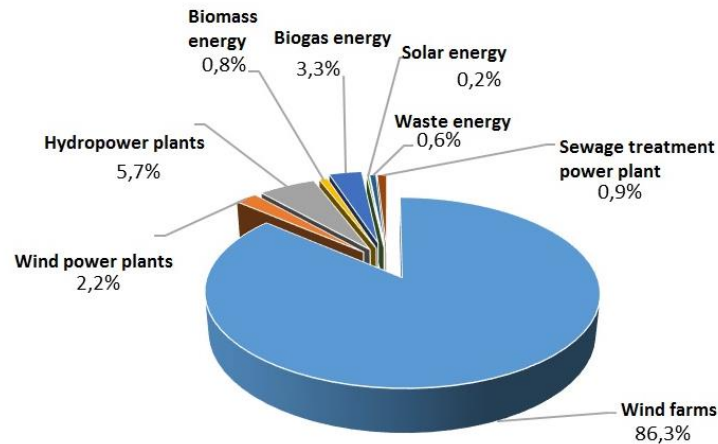
According to the draft "Polish Nuclear Energy Programme" updated in 2020, the most advantageous locations in the context of the future localization of the nuclear power plant are:

- coastal locations – Lubiatowo-Kopalino and Żarnowiec, for this placement environmental and localization research are the most advanced. They are supported among others by significant electricity demand in vicinity and the lack of large, available generation sources in the area, access to cooling water and the possibility of transporting oversized loads by the sea;
- locations currently used by baseload power plants, among others Bełchatów and Pątnów due to the developed transmission net, transport and other infrastructure, the location in the center of Poland and the fact that the construction of nuclear power plant in these areas after halt of the operated power plants will allow to maintain jobs.

[...] Considering the state of progress of the work and other conditions, the site of the construction of the first nuclear power plant will be selected from the coastal locations" (BIP 2020). According to the above document, the first of the planned 2 nuclear power plants will start producing electricity in 2033.

On the territory of the Pomeranian Voivodship, which according to the data contained in the document published in 2018 entitled "Report on the energy sector and peri-energy services in the Pomeranian Voivodship taking into account the prospects for the development of technology" - the production of electricity from renewable sources takes place in various sources and includes: 41 wind farms and 36 wind power plants with a total capacity of about 815 MW [...] (DRG 2020) , which represented about 12% of all electricity production in Poland using wind energy.

**Figure 2 Renewable electricity generation in the Pomeranian Voivodeship in 2017.**



Own study: based on GUS (Central Statistical Office) data

In the context of electricity production in the Pomeranian Voivodeship, which is not self-sufficiency in electricity generation, producing 52% of its own demand, wind, which is the largest energy potential of the region, generates 88,5% of the total generated electricity from renewable sources, which show figure 2. Despite the high participation rate of wind power plants, the Act on investments in wind power plants from May 2016 (so-called Distance Act), stopped the development of this energy sector in Poland. Changes planned by the Ministry of Development by the end of 2020 (including the liberalization of the 10H rule) might reverse this unfavorable trend. The planned amendments are also intended to apply to the mentioned above Distance Act, which requires the minimum distance of wind power plants to be set at ten times the total height of the installation (aforementioned 10H rule) and selected forms of nature protection.

In contrast to, in the opinion of the author, temporary stagnation in the development of onshore wind energy, is the launch and entry into the demonstration phase in September 2020 of the first Battery Energy Storage System (BESS), which is devoted to storage of energy produced mainly from RES by usage of specially developed batteries located in vicinity of the wind farm in Bystra near Gdańsk. The main objective of this investment is to improve safety of the electricity grid, by balancing shortages or excess energy produced that accompany the generation of energy by wind turbines. It should be mentioned that this is not the only one investment in Gdańsk Pomerania, in 2016 an energy storage facility with a maximum power of 0.75 MW and a capacity of 1.5 MWh in the vicinity of Puck was built.

A certain innovation on the national scale is a plan to use offshore wind energy. Citing research of the International Energy Agency, offshore windmills can operate (produce energy) at full power by 30 to even more than 50% per year unlike the land windmills which use full power by 23-40% of the operating time. In addition, the construction of windmills at sea is not accompanied by social protests and the Baltic Sea due to wind conditions, low salinity (corrosion aspect) and moderate depths (economic and technical factor), is an ideal basin for this type of investment.

According to the assumptions contained in the Polish Energetics Policy 2040 (PEP2040) and adopted in 27.11.2020 law about the promotion of electricity generation in offshore wind

farms (so-called offshore law), offshore wind power will be implemented from 2025 and installed capacity will reach: around 5.9 GW in 2030 and about 8-11 GW in 2040. It is assumed that the first Wind Power Plant (WPP) will be built by 2024 and the closest to the implementation process is WPP Baltica-1 (owned by PGE – Polish Energetics Group), which in June 2020 received technical conditions for connection to the transmission network for power up to 896 MW. In 2021, an environmental decision is likely to be issued, which will bring closer a building permission. Except reduction of CO<sub>2</sub> emissions, offshore wind power plants will contribute to the economic development of the Pomeranian Voivodship. The development of this industry can be a flywheel for the economy. The shipbuilding industry and ports will be the entities that will be mostly activated in this process, this will be a huge opportunity for the Tricity (which has the best facilities for this), but also for the whole province. The Polish Wind Energy Association estimates that more than 70 sectors of the economy can participate in profit making, and more than 100 Polish entities can be involved in the process of preparation, construction, and operation of wind farms in the Polish Sea Areas. An undoubted asset of the region is also the human potential: a number of an offshore-branch specialists and the first postgraduate studies in Poland aimed at training the staff of offshore wind energy launched at the Gdańsk University of Technology from 2019. (PG 2019) (lack of source)

60 small hydropower plants are located in the Pomeranian Voivodship, including 31 professional ones, supplying electricity to the central grid. (KOWALCZYK, CIEŚLIŃSKI 2018: 74) Since the differences in the height of the land in the province are small and the decrease in the area is low the maximum power of hydroelectric power plants are: 7.2 MW for the hydroelectric power plant in Bielkówko on the Radunia River and 4.16MW for power plant in Gałazina Mała on the Słupia River. On a provincial scale, classical hydropower plants generate around 0.9% of the energy consumed per year.

Pomerania Gdańsk is distinguished from other regions also by having on its territory the largest Polish pumped-storage power plant in Żarnowec which main task is to equalize the power balance in the electricity system, i.e., allows through the possibility of accumulation of water energy, optimal operation of thermal power plants and in the future nuclear (in this context, in 1983, the indicated complex with a capacity of 716 MW was created).

What is worth noting, also in terms of the usage of biomass energy which is important in the trend of decarbonization, the Pomeranian Voivodship is at the forefront of Poland. On the territory of Pomerania one of the largest power plants in Poland using agricultural biogas to produce electricity in the cogeneration system are located. These are included in the report of the Director-General of the National Agricultural Support Centre of 2019: power plants in Koczale, Darżyno and Miastko (with a total installed capacity of about 2.5 MWe each). An innovative at European scale biomass plantation was also established in Kwidzyn. The fast-growing hybrid poplar was planted on an area of about 25,000 square hectares and is used to produce energy in the International Paper Kwidzyn combined heat and power plant.

When analyzing the potential of the Pomeranian Voivodship, it is impossible not to mention the production of pure hydrogen. Several hydrogen production and recovery facilities are operating at the LOTOS oil refinery in Gdańsk. It is mainly used in several technological processes, however, there is a prospect of a wider use of pure hydrogen (99,999% purity), to drive buses in Gdańsk, Gdynia, Tczew or Wejherowo (the Pomeranian Hydrogen Valley project



implemented under the so-called Hydrogen Cluster, foresees the implementation of this solution by 2024), in the long term the project assumes the usage of hydrogen in regional trains on the Gdynia - Hel line and passenger ships. In addition, the LOTOS Group announced in May 2020 that it intends to obtain electrolyzers (generators that use electricity to decompose water into hydrogen and oxygen) in order to produce so-called "green hydrogen" (hydrogen produced using fossil fuels is "grey hydrogen"), and to verify the possibility of these devices cooperating with the variable generation of electricity from renewable energy sources (especially declining cost of offshore wind energy production creates unique opportunities that are already being used in the Western Europe), which fits perfectly into the utilization of wind energy at sea.

In the context of innovative clusters, we should also mention the local initiative of the Municipal Energy Cluster, which associating 6 municipalities of the Bytowski district, with the aim of gradual ensuring independence from the energy supplier through investments in RES (mainly photovoltaics, heat pumps but also the use of high-efficiency cogeneration in the combined heat and power plant). Another notable local initiative is the one established in September 2020 by Rumia Invest Park "Pomeranian Platform for the Development of Offshore Wind Energy in the Baltic Sea", an initiative which is intended to prepare the region for the challenges and opportunities related to the development of offshore wind energy in Pomerania. (POMORSKIE 2020) (source?)

### Summary

As can be seen from the above examples, innovative approach, human and technical base, R&D potential, local initiatives and, above all, the location on the shores of the Baltic Sea make it possible to assume that, during the ongoing energy transition in the era of the so-called "energy trilemma" when energy sources are required to be both accessible, reliable, stable and sustainable, the Pomeranian Voivodeship has the potential to become a national leader in the use of renewable energy sources and achieve energy self-sufficiency despite small fossil fuel deposits and energy-intensive industries in the area.

In the course of analyses following conclusions can be formulated:

- The investments described above will definitely affect on RES market in the Pomeranian Voivodeship;
- Those projects (especially Offshore Wind Energy) contribute to an overall reduction in the level of emissions generated by the Polish energy system;
- Import of key less-CO<sub>2</sub> energy carriers and development of modern energetics branches especially hydrogen usage and progressive nuclear power plants will allow fulfil the goal of making the Polish climate neutral by 2050 - Pomeranian Voivodeship will have a chance to be an important part of this process.

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