Energy sector report and services in Pomorskie Voivodeship with development of technology perspectives

WHERE WE ARE, WHERE WE ARE GOING TO, HOW WE COULD IMPROVE OUR EFFECTIVENESS

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✓ Region with high importance for Poland mainly because of access to the Baltic Sea, reloading infrastructure and ports. Very significant potential as the tourist region as well renewable energy sources point of view.

✓ Energy projects should be base on long term activities. Pomorskie Voivodeship has clearly defined direction of development in energy sector.

ENERGY SECTOR IS STRICTLY CONNECTED WITH ECONOMIC DEVELOPMENT. WE UNDERSTAND NECESSITY OF CARRYING ABOUT ENVIRONMENT AND DECREASE OF USE THE NATURAL ENERGY RESOURCES. THE EUROPEAN STRATEGY BASED ON RENEWABLE ENERGY SOURCES ARE THE MOST REASONABLE.

ENERGY GOALS

- DECREASE OF USE THE NATURAL ENERGY SOURCES
- INCREASE THE „GREEN” POWER GENERATION
- INCREASE USE THE RENEWABLE ENERGY SOURCES – POTENTIAL FOR POLAND !!!
- DEVELOPMENT OF DISTRICT HEATING
- THERMO RECONSTRUCTION OF BUILDINGS
Bloomberg New Energy Finance (BNEF) presented the average costs of energy production for renewable energy sources.

Wind Energy Offshore

<table>
<thead>
<tr>
<th>Year</th>
<th>Average Cost (USD/MWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>100</td>
</tr>
<tr>
<td>2019</td>
<td>76</td>
</tr>
</tbody>
</table>

Trend of average energy production cost: 24%

Wind Energy Onshore

<table>
<thead>
<tr>
<th>Year</th>
<th>Average Cost (USD/MWh)</th>
</tr>
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<tbody>
<tr>
<td>2018</td>
<td>50</td>
</tr>
<tr>
<td>2019</td>
<td>45</td>
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Trend of average energy production cost: 10%

PV

<table>
<thead>
<tr>
<th>Year</th>
<th>Average Cost (USD/MWh)</th>
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<tbody>
<tr>
<td>2018</td>
<td>57</td>
</tr>
<tr>
<td>2019</td>
<td>47</td>
</tr>
</tbody>
</table>

Trend of average energy production cost: 18%

Energy storage

<table>
<thead>
<tr>
<th>Year</th>
<th>Average Cost (USD/MWh)</th>
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<tbody>
<tr>
<td>2018</td>
<td>187</td>
</tr>
<tr>
<td>2019</td>
<td>123</td>
</tr>
</tbody>
</table>

Trend of average energy production cost: 35%

„Green” Hydrogen production
The more of renewable energy the cheaper

According International Renewable Energy Agency (IRENA), in 2010-2020 every doubling of installed renewable power decrease the energy production cost:

✓ 14% in case of wind energy offshore,
✓ 21% - wind energy onshore,
✓ 35% - PV.

Coal will be not cheaper

In perspective of 3 years renewable energy could produce cheaper energy than coal power plants.
The consumption of electrical energy in pomorskie voivodeship in 2017 was 8,75 TWh.

Every year demand for electrical energy increase by 2%.

Only households in cities are the area where demand decrease (in 2017 about 4% in comparison to the previous year).

Pomorskie voivodeship is not self-sufficient in production of electrical energy – produce only 52% of the own demand - are going to increase of electrical energy production.

53% of electrical energy is generate from renewables energy sources – primarily the wind energy.

Our strenght points are very good conditions for development of renewable energy sources and distributed generation of power.

Weaknesses includes high level of share the conventional energy sources based on coal and to slow improvement of energy effectiveness.

Electrical energy consumption (2017) - ENERA-Operator and ENEA-Operator data.
Conventional energy sources

Conventional heat and power plants:

- PGE Energia Ciepła S.A. Oddział Wybrzeże EC II w Gdańsku
- PGE Energia Ciepła S.A. Oddział Wybrzeże EC III w Gdyni
- LOTOS w Gdańsku
- Energobaltic we Władysławowie (gas from oil rig)
- Nanice w Wejherowie (kogeneracja gazowa)
- Starogard w Starogardzie Gdańskim

Heat and power plants based on renewable energy sources:

- International Paper w Kwidzynie (based in 60% on renewable)
- MPEC Lębork
- Malteurope w Gdańsku (Organic Rankine Cycle heat and power plant based on wooden chips)

Pumped hydroelectric energy storage Żarnowiec in Czymanowo (716 MW of generation) – is connected to power system.

The main reason of high level of coal in power generation are heat and power plants in Tricity.
✓ Total demand for thermal power equals more than 8 000 MWt (households)

✓ More than 61% of thermal power is generated from coal, 15% from natural gas and 13% from biomass

✓ 50% of inhabitants (71% from cities) use natural gas – increasing of new connections 3% every year

✓ There are visible results the thermo reconstruction of buildings – decreasing demand for thermal power and the same time increasing the quantity of new connections to the district heating systems

✓ District heating is fulfilling the needs for thermal power in about 40%.

Production of thermal power in cities and towns is based on burning of the coal and this is the main source of smog – the change of it will be our challenge.

Demand for thermal power
Source: BAPE

BUP – public buildings
BM – house buildings
BI – others (trade, services, industry)
The most increase and the main source of electrical energy in pomorskie voivodeship is wind energy. There is also stable role of hydroelectric power sources and increase power generation from biogas.
There are special and very good conditions for install the wind power plants in pomorskie voivodeship. Productivity in the best locations is reaching 30%. It is very good result.

<table>
<thead>
<tr>
<th>Lp.</th>
<th>Place of connection</th>
<th>Power</th>
<th>Connection time according to agreement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Onshore</td>
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<td></td>
</tr>
<tr>
<td>1</td>
<td>Słupsk Wierzbięcin</td>
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<tr>
<td>2</td>
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<td>4</td>
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<tr>
<td>5</td>
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<td>6</td>
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<td>31.03.19</td>
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<td>7</td>
<td>Żarnowiec</td>
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<td>31.12.19</td>
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<tr>
<td>8</td>
<td>Żarnowiec</td>
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<tr>
<td>9</td>
<td>Gdańska Błonia</td>
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</tr>
<tr>
<td></td>
<td>Total</td>
<td>1 484,68</td>
<td></td>
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<tr>
<td>1</td>
<td>Słupsk Wierzbięcin</td>
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<tr>
<td></td>
<td>Total</td>
<td>2 245,50</td>
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Productivity = 2 800 MWh/MW (approx. 30%)

Installed wind power on-shore (2017): 815,9 MW

Potencial on-shore: 1 485 MW (connection agreements)
Potencial off-shore : 2 245 MW (planning)

Development of wind energy in pomorskie voivodeship effectively stopped new law („anti-wind”) from 2016.
Investment projects for years 2018-2027 - Polskie Sieci Elektroenergetyczne SA

✓ Improvement of technical conditions for electrical energy transmission between pomorskie voivodeship and southern Poland.
✓ Preparing for distribution of energy from offshore wind farms

- Building of 400 kV line – Żydowo-Kierzkowo (ZDK) – Słupsk (SLK) – start-up 2019
- Building of 400 kV line – Gdańsk-Przyjaźń (GDP) – Żydowo-Kierzkowo (ZDK) – start-up 2019
- Building of 400 kV line – Grudziądz-Węgrowo (GRU) – Pelplin (PLP) – Gdańsk-Przyjaźń (GDP) – start-up 2019
- Building of Pelplin station (PLP) 220/110 kV - start-up 2019
- Building of Gdańsk-Przyjaźń station (GDP) 400/110 kV – start-up 2019

Extension of Słupsk station (SLK) – 2021-2023 and Żarnowiec (ZRC) - 2026 in case of building the offshore wind farms
BIOMASS – YEARLY TECHNICAL POTENTIAL (42 785 TJ/)

- firewood from forest – 2 940 TJ/y
- wood processing wastes – 2 430 TJ/y
- another wooden wastes - 135 TJ/y
- straw and hay – 31 000 TJ/y
- energy plants – 6 280 TJ/y

BIOGAS – YEARLY TECHNICAL POTENTIAL (3 729 TJ)

- animal farms – 1 850 TJ/y
- biodegradable wastes – 1 764 TJ/y
- stabilized sewage sediment – 115,2 TJ/y

Technical potential of biomass and biogas: 46 514 TJ/yearly - (71% of demand for households)

Yearly demand for heat in households equal 65 200 TJ

There are nine biogas plants in pomorskie voivodeship. The first group is based on liquid manure as the substrate and the second one is based on agricultural mixed substrate. The last one has problem with profitability.

In pomorskie voivodeship are also biogas plants based on biodegradable municipal wastes (4 plants) and based on sewage treatment plant sediment (6 biogas plants)
From 2020 more than 205 000 tons of wastes should be develop in another way like storage. There is necessity to build the installation for thermal transform the municipal wastes. From the beginning of 2016, according to EU regulations storage wastes with thermal value more than 6 MJ/kg is prohibited.

The first installation for thermal transforming (burning) of municipal wastes will be build on the Zakład Utylizacyjny Gdańsk area as the Port of Clean Energy.

**160 thousand tons of municipal wastes from 35 pomeranian communes**

Electrical energy (18 MWe)  
Heat (4 MWt)
Improvement of energy effectiveness is the priority activity in EU

There are new goals in limits (saving) of power consumption:

✓ 32,5% till 2023
✓ Postpone until 2030 duty of reaching new savings on the level of 1,5% yearly in comparison to yearly sales of energy to consumers.

Average savings between 5% and 50% depends on the building conditions as well scope of works.

Funding of energy effectiveness

RPO funds in 2007-2013 – 34,47 mln Euro

RPO funds in 2014-2020 – 213,8 mln Euro
Thank you for your attention