Energy transition in Poland
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Introduction

We present to you our report regarding the Polish power sector. We point out data relevant to the changes taking place. Monitoring these is of key importance for a correct diagnosis of the situation and planning activities accordingly.

The power sector is at the heart of the economy. Its purpose is to guarantee reliable electricity supplies at reasonable prices. The power sector should be able to respond to changes in the regulatory and technological environments, and the decision makers should support this responsiveness. The most important challenges include the reduction of environmental impact and modernization – introducing innovative, effective technologies, digitalization and grid development. The basis for managing change is reliable information.

Transparency of the power sector is crucial at a time of considerable changes such as those currently taking place. Both business and society, the power sector’s customers, should be kept abreast of these on an ongoing basis. We hope that this publication will at least partly fill the information gap, and support the discussion on the achievements and challenges ahead of the Polish power sector in the years to come. We share with you our passion for statistical data, as we believe that they can speak louder than many studies.

There is only one conclusion – the Polish power sector is changing. The greatest change is the reduced share of coal, which fell from 80% to 78% within a year.

Yours faithfully,
Joanna Maćkowiak-Pandera, PhD
Forum Energii
Conclusions

- The Polish power sector is slowly beginning to change.
- The generating side still remains the least diversified in the European Union.
- The share of coal in the energy mix decreased to 78.4%, while the position of RES and gas is growing in strength.
- Due to legislative changes, the development of RES has been suspended since 2016.
- The diversification of gas supplies results in increased gas consumption.
- \( \text{CO}_2 \) emissions have increased in recent years, despite a decrease at the beginning of the 1990s.
- The lack of strategy for development and achievement of goals is the greatest challenge for the Polish power sector.
Generation capacity
Installed capacity in the Polish system in 2017 (GW and %)

- The Polish energy mix is still poorly diversified - most of the installed capacity is provided by coal-fired conventional units.

Source: own analysis, based on data from ARE.
In the last year, the increase in conventional power was the largest in twenty years. This results from, among others, the completion of the investment project of a coal-fired unit in Kozienice and CCGT units in Włocławek, Gorzów and Toruń.

Source: own analysis, based on data from ARE.
Changes in installed capacity in the National Power System (GW)

- Over the last years, the amount of installed capacity in renewable energy sources increased.
- Coal-fired power plant restoration investments in recent years did not result in increased capacity.

Source: own analysis, based on data from ARE.
Changes in installed capacity in renewable energy sources (GW)

- The system of green certificates has contributed to an increase in installed capacity, in particular in onshore wind farms.
- The interrupted development of RES capacity at the turn of 2016/2017 results from significant legislative changes.

Source: own analysis, based on data from ARE.
Electricity production
Electricity production in 2017 (TWh and %)

- In 2017, coal was still the dominant electricity source, however, its share decreased by one percentage point compared to 2016.

Source: own analysis, based on data from ARE.
Energy transition in Poland 2017

Electricity production in 2017 as compared to 2016 (GWh)

- Due to weather conditions and new power capacities 2017 was a record year in terms of production from RES, mainly from wind (approx. 14.9 TWh) and water (approx. 2.6 TWh). Electricity production from gas was also record high – 20% more than in the previous year due to new units.
- Increased electricity production from lignite was the consequence of extended operating times of these units, not new investment projects.
- Late power unit delivery in the Kozienice Power Plant did not increase electricity production from hard coal in the National Power System.

Source: own analysis, based on data from ARE.
Diversification of electricity production (TWh)

- The average mid-term trend shows slow diversification leading to increased electricity production from RES and gas.

Source: own analysis, based on data from ARE.
Changes in electricity production from renewable sources (TWh)

- Initially, low-cost biomass co-firing production developed at existing coal-fired boilers.
- Subsequently, as a result of initiated investment projects, production from onshore wind and dedicated biomass units increased.
- Due to a faltering support system in recent years, electricity production from biomass firing units is limited.

Source: own analysis, based on data from ARE.
Energy balance
Domestic balance of electricity production and consumption (TWh)

- Since 2014, Poland has become a net importer of electricity, mainly as a result of the higher wholesale energy price on the Polish market compared to markets of neighbouring countries.
Changes in electricity demand (TWh and %)

- On average, electricity demand increased by 1.1% annually over the past decade. In the last three years, the dynamic of the year-on-year increase in electricity demand grew to more than 2%; in the last year, it reached 2.27%. These values are lower than forecast.

Source: own analysis, based on data from ARE.
Changes in peak power demand in the National Power System (GW)

- Peak power demand rises more rapidly in the summer period as a result of higher air temperatures and a rise in popularity of air conditioning equipment.
- Since 2006, the maximum power demand increased by 6.5% and in the summer period by 18.5%.

Source: own analysis, based on data from PSE.
Emissions
Total greenhouse gas emissions (million tonnes of CO₂ equivalent)

- The largest reduction of greenhouse gas emissions in Poland occurred at the time of the country’s system transformation. Since 2015, emissions have started to rise again.

Source: own analysis, based on data from EEA, EIONET, KObiZE.
Power sector greenhouse gas emissions (million tonnes of CO₂ equivalent)

- The significant decrease in emissions from power plants and combined heat and power plants in the 1990s resulted mainly from the economic transformation of the country, and the elimination of some industry branches, thus limiting the use of industrial combined heat and power plants.
- The decrease in heating sector emissions in the 1990s was due to investments made to increase energy efficiency.
Gas and dust emissions (thousand tonnes)

- SO$_2$ emissions decreased due to high performance flue-gas desulphurization systems installed in power plants and later on in combined heat and power plants.
- A slower trend in NO$_x$ emissions reduction is the consequence of using less sophisticated technologies (low-emission burners, non-catalytic denitrification systems).
- A significant decrease in dust emissions occurred in the 1990s. Further reductions are a result of retrofitting dedusting systems and construction of wet desulphurization systems.

Source: own analysis, based on data from GUS.
Dynamic of GDP and greenhouse gas emissions changes

- Despite a rapid GDP increase in Poland, greenhouse gas emissions have not been rising as quickly, which indicates the dissociation between economic growth and rise in emissions.

Source: own analysis, based on data from GUS.
Poland vs. the EU
Energy transition in Poland 2017

Electricity production structure in 2016 (TWh and %)

- Poland’s energy system is among the least diversified in Europe.
- In terms of electricity production, Poland’s energy system is the sixth largest in Europe.

![Electricity production structure chart]

Source: EU Commission, DG ENER, Unit A4. Energy datasheets: EU28 countries; own analysis.
Greenhouse gas emissions in Europe in 2015 (million tonnes of CO\textsubscript{2} equivalent)

- Poland is responsible for 8.7% of greenhouse gas emissions in Europe and is the fifth largest emitter.

Source: EU Commission, DG ENER, Unit A4. Energy datasheets: EU28 countries; own analysis.
Comparison of SPOT electricity prices on neighbouring markets (€/MWh)

- Electricity prices in Poland are the highest in the region.

Source: TGE, EEX, NordPool; own analysis.
Wholesale electricity prices in Europe in 2017 (€/MWh)

- Average annual wholesale electricity prices in Poland are usually higher than in other countries from the region, but significantly lower than in the South European countries.

Power sector fuels
Domestic hard coal production (million tonnes)

- For many years, in the Polish mines, a decrease in production related to the availability of resources and production costs has been observed.

Source: Eurostat, GUS, Polski Rynek Węgla; own analysis.
Steam coal consumption in Poland in 2016 (million tonnes)

- **POWER SECTOR**: 37.0 mln tonnes (61%)
- **HEATING SECTOR**: 4.6 mln tonnes (8%)
- **INDUSTRY**: 4.5 mln tonnes (7%)
- **SMALL CONSUMER SECTOR**: 11.8 mln tonnes (20%)
- **OTHER**: 2.5 mln tonnes (4%)

*Source: Eurostat, GUS, Polski Rynek Węgla; own analysis.*
Coal import to Poland with country of origin specification (million tonnes)

- The year 2017 showed a reversal of the recent five-year trend of limiting steam coal imports to Poland.
- Russia remains the main supply partner.

Source: Eurostat, Argus Media; own analysis.
Domestic consumption of natural gas (billion m$^3$)

- Gas consumption in Poland has been increasing slowly.

Source: GUS; own analysis.
Meeting natural gas demand (billion m³)

- In 2016, 84% of Poland’s gas demand was met by imports, mostly from the East. A decade ago the share of imported gas was 79%.
- Domestic production of natural gas has been decreasing steadily: in 2016 it was 400 million m³ (approx. 18%) lower than in 2005.

Source: GUS, PGNiG, Annual report 2016, Gas Market; own analysis.
# List of abbreviations

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<tr>
<td>OZE</td>
<td>Renewable Energy Sources</td>
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<td>GHG</td>
<td>Greenhouse Gases</td>
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<td>CAGR</td>
<td>Compound Annual Growth Rate</td>
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<td>CCGT</td>
<td>Combined Cycle Gas Turbine</td>
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<td>HEPI</td>
<td>Household Energy Price Index</td>
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<td>GDP</td>
<td>Gross Domestic Product</td>
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<td>ARE</td>
<td>Agencja Rynku Energii S.A. (Energy Market Agency)</td>
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<td>PSE</td>
<td>Polskie Sieci Elektroenergetyczne S.A. (TSO)</td>
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<tr>
<td>GUS</td>
<td>Główny Urząd Statystyczny (Central Statistical Office)</td>
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<tr>
<td>KOBIZE</td>
<td>Krajowy Ośrodek Bilansowania i Zarządzania Emisjami (National Center for Emission Balancing and Management)</td>
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<tr>
<td>EEA</td>
<td>European Environment Agency</td>
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<td>EIONET</td>
<td>European Environment Information and Observation Network</td>
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<td>DG ENER</td>
<td>Directorate-General for Energy</td>
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<td>TGE</td>
<td>Towarowa Giełda Energii S.A. (Polish Power Exchange)</td>
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<tr>
<td>EEX</td>
<td>European Energy Exchange AG</td>
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<td>PV</td>
<td>Photovoltaics</td>
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