

## GLOBAL GROWTH POLAND 2019

### NORWEGIAN TECHNOLOGY

#### Supporting Poland in the Challenge of Air Pollution



### The energy sector in Poland - on the threshold to a profound transformation

#### General data

Energy generation in Poland is mainly based on fossil fuels, among which the first place belongs, and will most likely belong for a long time, to coal and lignite, which stand for over 50% of the total energy consumption. Crude oil plays also a significant role with a share of over 25%, and natural gas with 13%. By 2020 renewable sources should reach the level of 12% (15% as far as electricity generation is concerned). Poland is the second largest producer of hard coal and the third largest producer of lignite in Europe. In terms of electrical power generation Poland is on the 6<sup>th</sup> place in the EU.

Until recently the wide usage of coal in energy generation made Poland one of the most energy independent states in Europe, however the situation has recently started to change due to the fact that Poland's import of hard coal has been increasing, mainly from Russia.

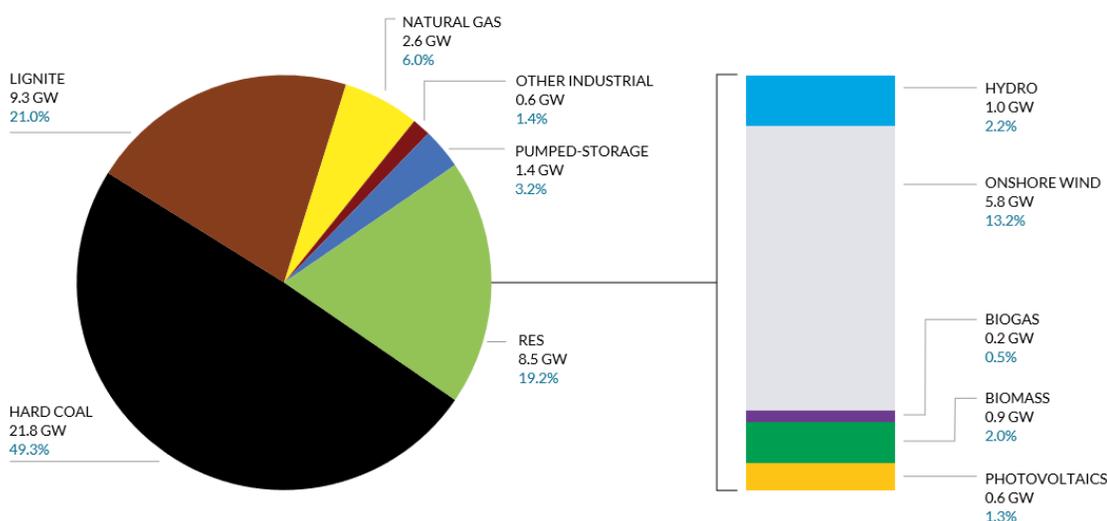
The Polish national power system consists of a generation system, a transmission system, and a distribution grid. The generation system comprises 17 so called system power plants, which stand for 88% of produced electricity, approx. 400 industrial power plants, 1200 combined heat and power plants and heating plants, and installations based on renewables. The power system altogether has over 40 TW of installed capacity and produces annually over 160 TWh of electricity.

The Total capacity of interconnectors of the Polish electric power system with other EU member states is 2000–3000 MW (depending on system operation configuration) and is limited by transmission capacities within the domestic system. The current capacity of cross-border connections achieves the goal recognized by the Council of Europe which requires a minimum 10% transmission capacity of cross-border connections in relation to installed capacity in the domestic electric power system.

**Fig. 1 Installed capacity in the Polish power system**

Installed capacity in the Polish system in 2018

- The share of installed capacity in lignite and hard coal decreased from 72% in 2017 to 70% at the end of 2018.
- The share of installed capacity of gas units increased by 1 p.p.



Source: based on data of the Agencja Rynku Energii S.A. (ARE).  
As of 31.12.2018

## The electricity market

At present, the electricity market is practically competitive however the household market is regulated on the basis of cap-prices (maximum prices) set by URE, the Polish Energy Regulatory Office. The total number of entities trading in the electricity market is approx. 340.

Trading of electricity is done on the Polish Power Exchange (TGE). Energy prices in Poland have risen considerably over the recent two years. The wholesale prices increased from 170 PLN to almost 300 PLN (70 EUR), i.e. reaching a level significantly higher than in many other European states. It was difficult to accept from political point of view. The parliament passed the law that has frozen prices of electricity for end users the 2019 on the level from 30.06.2018. Energy companies will get a compensation from dedicated state entity. This law was passed only for 2019 but the outlook for 2020 is very unclear.

The electricity market is undergoing a transformation and responding to challenges and development opportunities, i.e. creation of a single energy market or the willingness of consumers to participate in the market. The biggest challenge is implementation of Clean Energy Package which is going to happen in 2020.

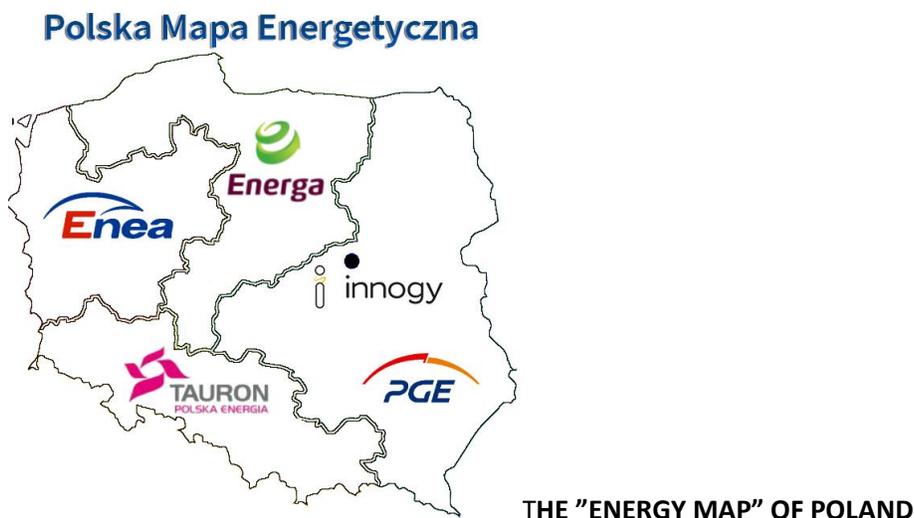
The capacity market was introduced in 2018 to secure the existence of coal plants which are necessary for energy security. Capacity market should also be trigger for investments in new power plants, storage and DSR – auctions are technologically neutral. Until now there were three auctions with the average closing price 213000 PLN per MW. Coal plant could benefit from capacity market no longer than 2038.

### The largest players in the electricity market – vertical consolidation

In the effect of consolidation processes, which started before Poland entered the EU in 2004, the market has a high degree of concentration. The three largest producers hold currently more than 50% of the installed capacity and produce nearly 2/3 of Poland’s electricity.

Presently, the market is dominated by four large generation and distribution holdings, all present on the Warsaw Stock Exchange, though in a large extend owned by the State Treasury:

- **PGE** – the company manages among others over 40 power stations and heat and power plants, 8 operators of distribution grids, 7 retailers and 3 lignite mines
- **Tauron** – the group owns most of the coal-fired plants in the most highly industrialized part of the country in the south with a joint capacity exceeding 5 TW, 35 hydro plants and several wind farms
- **Enea** – operator of the coal-fired plants in central and eastern Poland and distributor of energy in western Poland
- **Energa** – operator of 47 hydro plants as well as several coal-fired plants, dealing with distribution in the north and in the centre of the country.



Among other important players one should mention:

- **ZE PAK** – the second biggest producer of energy from lignite in western Poland (Pątnów –Adamow-Konin), producing 12% of Poland’s electricity.
- **Innogy** – DSO in Warsaw.

- **PGNiG** – the Polish state-owned oil and gas company, which since several years is dealing with electricity and heat.

### Renewables and dispersed energy sources

The Polish RES fuel mix consists mainly of wind, biomass and hydro, see Fig. 1. The largest installed capacity is in wind power (6000 MW). The EU roadmap for Poland regarding the increase of the share of RES in the energy mix has been followed in principle, **however** due to the unstable legal regulations and frequent policy changes, it will surely be very difficult for the country to reach the goal set for 2020, which is 15%.

The fastest growing type of RES during the decade 2006-16 was onshore wind, where the installed capacity increased from 153 to 5807 MW. However, the PiS government passed in 2016 the new Wind Farm Investment Act (the so called "10H Distance Act") which introduced, among other things, strict, difficult to meet in Polish reality requirements for the distance of wind farms from residential buildings. The ruling party is very reluctant to onshore and this resulted in a strong slowdown in onland wind power development.

The main financial instrument for developing RES in Poland, the Tradable Green Certificates system – TGCs (so called **Green Certificates**). It was implemented in 2005. It was functioning quite well in the first years, however, due to lack of balance caused by a large amount of green certificates which appeared on the market as a result of combustion of biomass in large power stations fueled mainly by coal, their value fell to such level that that the market players generating electricity from RES have experienced financial difficulties. In recent years the GC market was very volatile which affected several wind farms.

For small scale, dispersed RES installations are concerned, the RES Act of 2016 included a provision introducing **feed in tariffs for prosumers**. Such tariffs are dedicated to individual energy technologies, applied by the investors to sales of energy from RES to the grid within 15 years. In the case of micro-installations with installed capacity up to 10kW, a guaranteed price for sales has been introduced. Most of the installations are PV, individual wind farms and some hydro.

In order to bring the country to meeting the EU 15% target of renewables' share in electricity generation, from Dec 2016 the **RES Auction System**, has been in operation. Once a year the Minister of Energy announces the demand for energy from renewable sources and sets the price bar. The Ministry announces the reference prices. Investors bid below this reference price to receive support. The support system comes in the form of a guarantee that the investor will be able to sell energy at the same price (increased by inflation levels) for 15 years. The system has strengthened after the 2 years of operation, and in 2018 the awarded volume was 10,5 TWh per year for a range of technology baskets: onshore wind, PV, biomass, SHP and biogas, where wind and PV were largest. The figures for the 2019 auction is scaled at 8,2 TWh/year, and they give an even larger potential for investments in onshore wind and PV. Furthermore, in June 2019, a new regulation, giving the possibility of applying feed-in tariffs (FIT/FIP) by a wider group of biogas producers, enters into force. This will be followed by regulations allowing inserting of biomethan to the gas distributions network.

New amendments passed to RES act were passed by Parliament in 2019. According to it, the large RES Auctions will be continued in the coming years, and the system will be prolonged by 2039. However from 2020 only a handful of fully permitted onshore wind farms will qualify for the auctions (the 10H distance rule), so large solar farms become much more competitive. The new RES Act amendment introduces also more favourable provisions for prosumers (increasing the installed capacity to 50kW), Contract for

Difference support (CfD) rules, provides favourable changes for biomass generators , as well as rules for grid connection for RES.

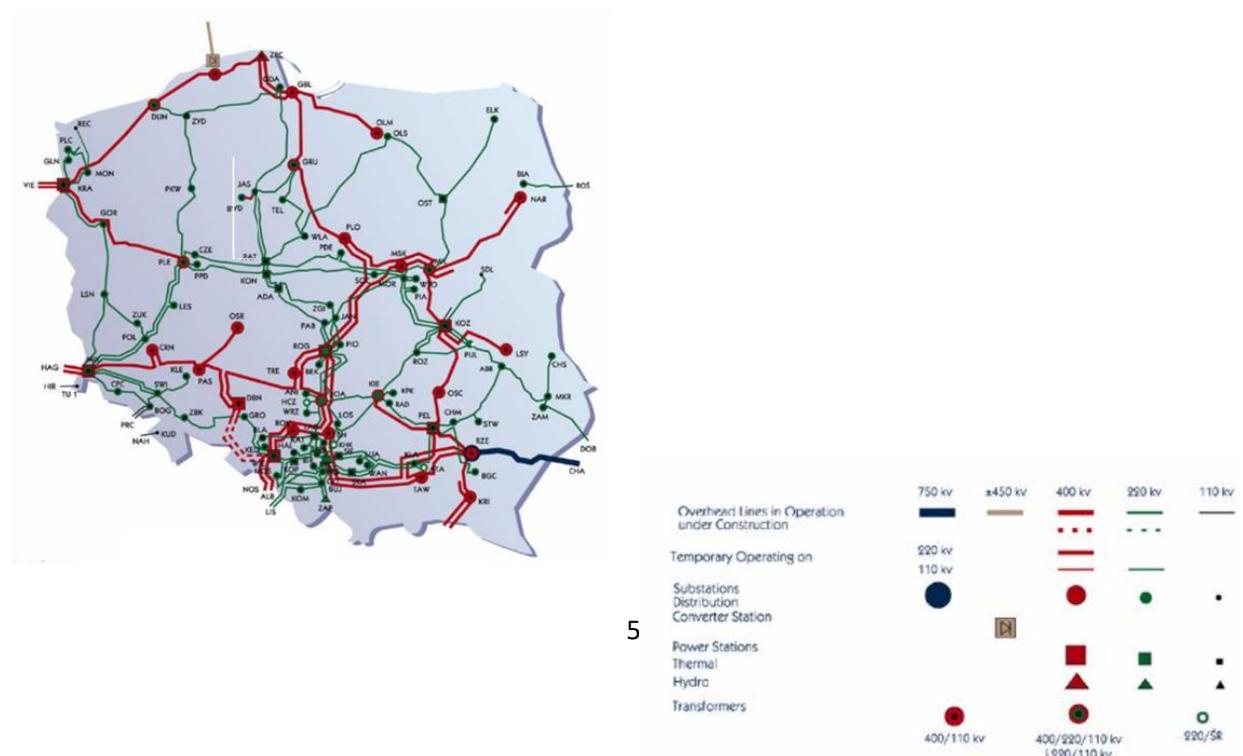
Furthermore, the government declares that in order to use the RES potential in a manner which is safe for the system, energy clusters and energy cooperatives will be created, which should ensure balancing at the local level, by linking various technologies to energy storage capacities. Individual use of renewable energy sources should also be accompanied by energy storage. RES support mechanisms are intended to promote solutions ensuring maximum availability, with relatively the lowest cost of energy generation and satisfying local energy needs.

The RES Act ought to be a confirmation of the acceptance of RES as an element of the Polish energy sector – one which is here to stay and will continue to replace the still dominant coal-fired generation. It is expected by the energy experts that the Polish renewable generation will finally get a much needed boost after the delays experienced on the EU 2020 path.

### The power transmission and distribution system

The operator of the Power transmission system in Poland, PSE, has at its disposal a grid of the highest voltage which consists (Jan 2019) of:

- 267 lines with a total length of 14 695 km, including:
  - 1 line of 750 kV voltage with a length of 114 km
  - 102 lines of 400 kV voltage with a total length of 6 826 km
  - 164 lines of 220 kV voltage with a total length of 7 755 km
- 106 extra-high voltage (EHV) substations
- under-sea 450 kV DC connection between Poland and Sweden, with a total length of 254 km (127 km belongs to PSE).



According to the energy strategy, the grid infrastructure development will involve extension of the domestic transmission grid under seven investment programmes, which will also contribute to streamlining cross-border flow of energy. The quality of supply to final consumers does not only depend on the density of the grid, but also requires moving medium-voltage power lines underground (Poland will work towards achieving the UE average in terms of the indicators of the duration and frequency of power outages). In order to improve efficiency of operation in emergency situations, a digital communication systems between distribution system operators will be put in place, and infrastructure will be equipped with control appliance. In addition, smart grids will be deployed to integrate the activities and behaviours of all entities and users connected to such grids.

### **The district heating sector**

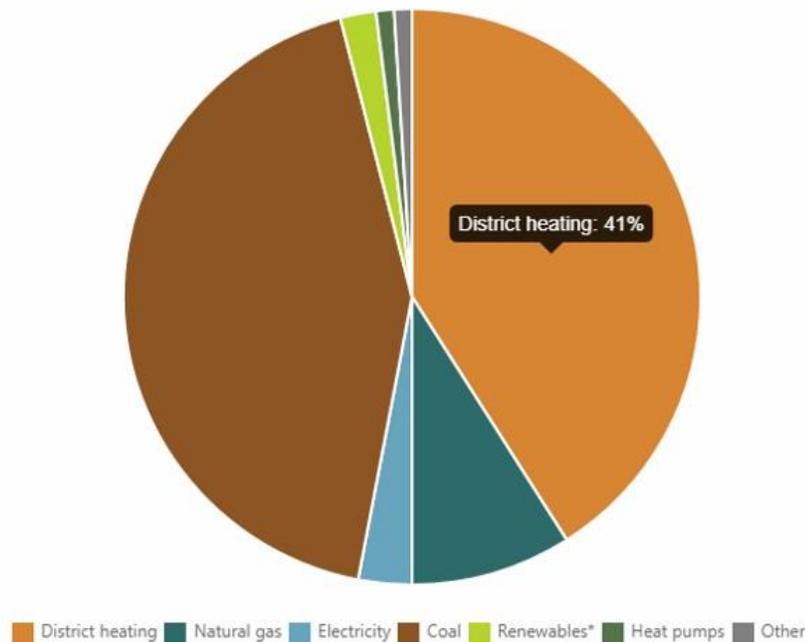
The district heating system in Poland is well developed and plays a more important role than in other European countries. It consists of combined heat and power plants in larger cities and about 400 hundreds of heat plants in smaller towns and communities. Most of them are coal-fired. All coal -fired heat stations still cause significant air pollution and can not fulfill the standards of MCP Directive after 2025. Therefore coal should be replaced by gas, biomass or waste. In the countryside individual houses are heated in most cases by obsolete inefficient coal stoves, usually using low quality fuels, and causing high air pollution. In next years they probably will be replaced mostly by heat pumps.

The Cogeneration Support Act passed in 2019 opens chances for development CHP plants. Projects can bid for premium in purchase of electricity. Small CHP (to 1 MWe) get feed-in-tariff but its value is still not known (Minister of Energy is going to fix it regulation). The first auction is planned in 2020.

Between 2011 and 2013, heat production in district heating has been decreasing in Poland as a result of the thermo-modernisation process in existing buildings and a very small market for new developments. After 2013, the residential investment market grew a little, but new investments are concentrated in own energy power plants on a micro scale. From 2013 to 2015, the total district heating sales to customers slightly decreased from 67.7 TWh to 60.1 TWh. There has been a steady expansion of district heating networks, reaching a total length of around 20,460 km by 2015.

As shown in the graph below, district heating systems cover approximately 41% of heat demand of the Polish residential sector. About 43% of buildings are still heated by individual heating and stove installations using solid fuels, mainly coal. Heat pumps are used on a small scale to provide heat and warm water with a minor share of 1%. In 2015, around 70% of district heat was generated from direct renewable sources and recycled heat.

### Share of energy sources used to satisfy heat demand in the residential sector in 2015. Total (in %)



Poland invested 1,068.9 million EUR in district heating in 2015. Poland's electricity policy until 2030 assumes a two-fold increase in production of electric energy generated by highly-efficient co-generation by 2020, as compared to 2006. The share of electricity generated in highly efficient CHP plants is constant around 18-19%.

During the last ten years, district cooling applications have been installed in industrial contexts, mainly for air cooling in mines, as well as for cooling industrial structures, and heat and power facilities. This has resulted in capacity growing significantly by six times in four years, increasing from 7 MWth in 2009 to 43 MWth in 2013. However, in the period between 2013 and 2015, the situation of the district cooling sector in Poland has remained unchanged

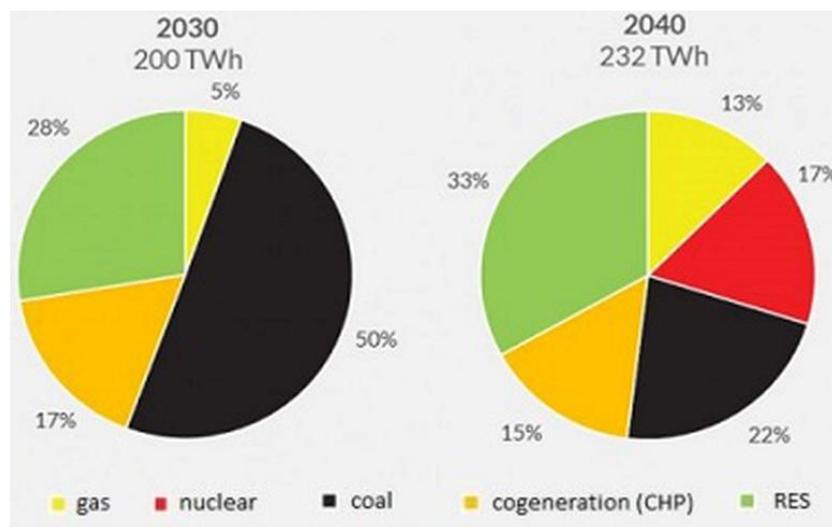
### The problem of smog

Air pollution is one of the most serious environmental problems in Poland. During COP-24, the UN Worldwide Climate Summit in Katowice in December 2018 the media highlighted the fact that many Polish cities score very high on the EU list of places with most severe air pollution. The society is becoming more aware of the health hazards and is demanding quick and radical measures to be taken by the central and local governments in order to improve the situation. One of the first local government that reacted was the Krakow municipality, which implemented a programme offering co-financing of new, more efficient heating stoves for individual households. Many other regions followed this example. Also on central level new programmes supporting termomodernization of building and implementation of renewable energy sources have come in force.

### The new strategy for the Polish energy sector, EPP2040

In Dec. 2018 the Ministry of Energy published a draft strategy version of the new Energy Policy for Poland (EPP2040) and National Energy and Climate Plan for the European Commission which is now in consultation with EC. Both documents are not exactly consistent but are a response to the main challenges faced by the Polish energy sector in the nearest decades and sets the strategic directions. According to this strategy the goals regarding energy mix for the next two decades are following:

**Fig. 3. Energy mix for Poland in 2030 and 2040 according to EPP2040**



Meeting the targets below will be a success indicator for the government (the final target for 2040 has not been outlined):

- 60% of electricity production will come from coal in 2030 (now it is more than 80%)
- 21% of final energy consumption will come from RES in 2030 (now it is approx. 12%)
- Nuclear energy will be introduced in 2033
- CO<sub>2</sub> emissions will be reduced by 30% in 2030 (according to the 1990 levels)
- Energy efficiency will increase by 23% by 2030

Reaching all the above goals would cost, according to Ministry of Energy's estimates, PLN 400 billion (NOK 900 billion).

The main source of energy will be coal. Poland has two sources of coal: hard coal and lignite. The exploitation of the latter is less controversial, because most accessible mines will cease to be operational after 2035-2040 and the government has no plans to build new lignite coalmines. However, it is determined to support hard coal mines. It plans to build a new 1000 MW coal-fired power plant in Ostrołęka. Currently, the consumption of hard coal in the Polish energy system is ca 74 million tonnes, of which 15 million is imported coal. The government anticipates that national production of hard coal will be maintained at 33-36 million tonnes per year in the 2030s.

The gap, after lignite coal ceases to be extracted, will be filled by two sources: **gas and nuclear**. The government plenipotentiary for strategic energy infrastructure said that gas will be treated as a transition source of energy and will help Poland in its energy transformation. Poland's current, annual gas consumption amounts to 17 billion m<sup>3</sup> (of which 25% is supplied locally). The government is determined to diversify gas supplies and become more independent from Russian gas. It plans to expand the LNG terminal in Świnoujście and **build the Baltic Pipe by 2022**. The latter would allow Poland to import even up to 10 billion m<sup>3</sup>. The government's commitment to this project is a good sign for the Norwegian gas industry. 30% of gas consumption could be supplied through the LNG terminal. Simultaneously, the government is planning to invest in the expansion of gas infrastructure (pipelines and storage facilities) as well as inter-connectors with neighbouring countries.

**Nuclear energy**, in the long run, will replace lignite coal. The government plans to build the first 1000-1500 MW block by 2033 and add new blocks every two years to reach between 6000 and 9000 MW by 2043. The Ministry estimates the cost of 1000 MW to be between PLN 20 and 25 billion (NOK 45-56 billion). It anticipates that 10% of produced energy will come from nuclear power plants by 2035. Initially, the first block was supposed to be built by 2034 (according to the timeline of the previous government). However the current government has not secured the sources of funding, nor has decided on the location. (Experts are critical of the reality of government plans.)

Poland wants to base the RES mix on two sources: photovoltaic (PV) and offshore wind, supplemented by biomass in district heating. 21% of final gross energy consumption will come from RES, whereas renewables will correspond to 27% of produced energy. The Ministry recognises PV as a stable source of energy, which could be dispersed throughout the country, especially in the regions with intensive insolation. According to the government, offshore wind is a more stable and predictable source of energy than land based wind. The government assumes offshore wind farms will be included in the energy mix after 2025. However, the private company Polenergia (working together with Equinor ASA) anticipates that the first wind farms will be operational around 2021. This is also an area of opportunity for Norwegian companies.

According to first version of the EPP 2040 onshore wind will be excluded from the mix in the 2030s however in the National Energy and Climate Plan there are no such plans. Nevertheless, there are The last auction for onshore wind farms will take place in 2019. Taking into account Polish problem with national RES goals for 2020 and 2030 the probability of resignation from onshore wind is rather low. Other renewable energy sources would have a marginal role.

Finally, the government wants to promote and invest in cogeneration (simultaneously producing energy and heat) as an additional means to maintain coal production and increase renewable energy intake (from biomass).

The problem of air pollution has not been addressed in the document. According to WHO 33 out of the 50 most polluted cities in Europe are in Poland. The government has been slow to realise the seriousness of the problem. However, due to mounting public concern, a new programme called “Clean Air” has been announced. The PLN 100 billion programme will help Polish household to retrofit and install cleaner heating devices.

### Examples of opportunities for the Norwegian companies:

The highest demand for new solutions is expected to be in the following areas:

- Energy saving technologies for the industry, communities and households.
- Investments and technologies in renewable energy sources, i.e. biomass, biogas, wind, photovoltaics and hydropower.
- Modern grid technologies for the transmission systems undergoing modernization and for the power distributions on small scale, especially in the context of RES development
- Smart grid and smart metering systems.
- Technologies enabling storage of electricity.
- Usage of hydrogen as energy carrier.
- Clean coal technologies

### SOURCES:

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- IEO, Institute of Renewable Energy, <https://ieo.pl/en/>
- Wysokie Napiecie, [www.wysokienapiecie.pl](http://www.wysokienapiecie.pl)
- Polish Agency of Trade and Investment, [https://www.paih.gov.pl/files/?id\\_plik=19609](https://www.paih.gov.pl/files/?id_plik=19609)
- Energy Strategy for Poland, <https://www.gov.pl/web/aktywa-panstwowe/polityka-energetyczna-polski-do-2040-r-zapraszamy-do-konsultacji1>

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