



Sandra Badoń, ABB Energy Market Advisory

Poland Energy Market Outlook

European Energy Market Intelligence

Presenters



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Agenda

Introduction to ABB Advisory Services and Reference Cases

Summary of the main recent changes

Current installed capacity and expected changes

Recent electricity SPOT prices

Forecast results

Q&A and Close

Today's **Complex** Markets Make Decision Making Difficult

Need for Energy Market Intelligence Solutions

Market change forcing adaptation or significant business risk

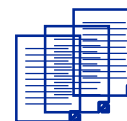
Competitive pressure from startups, renewables and demand response aggregators

Increasing regulatory requirements that limits emissions, incentivizes efficiency and increases costs

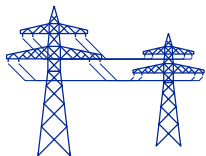
Expanding **volume of data** from smart meters, more discrete time intervals and REMIT reporting requirements



Data comes from **multiple sources**, including ISO/TSOs, governmental agencies, and company websites



Growing transmission congestion and constraints



Some data is structured and complete, **much is not**



Complicated bids and pricing mechanisms



Unique constraints of new types of generation, load and storage



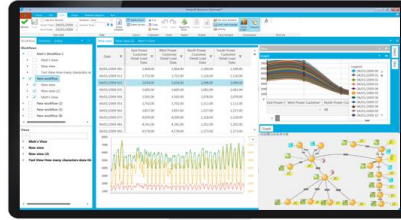
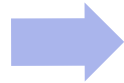
Energy Market Dataset, Simulation, Analysis and Advisory

ABB Energy Market Intelligence Solutions



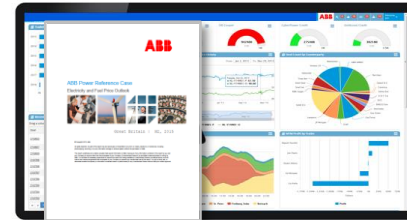
European Dataset

- Plants & Transmission
- Market
- Fuels/Prices
- Load forecasts
- New builds
- Bidding Strategies



Market Simulation (PROMOD)

- Chronological unit commitment and dispatch
- Transmission /Interconnector flows to meet forecasted load



Market Outlook & Forecasts

- Energy Market Outlook
- Intelligence and analysis of markets by country
- Details on assumptions and outputs

Energy Market Advisory

- Experts on energy market modelling, analysis, consulting

Pan European Power Market Data and Model (ENTSO-E)

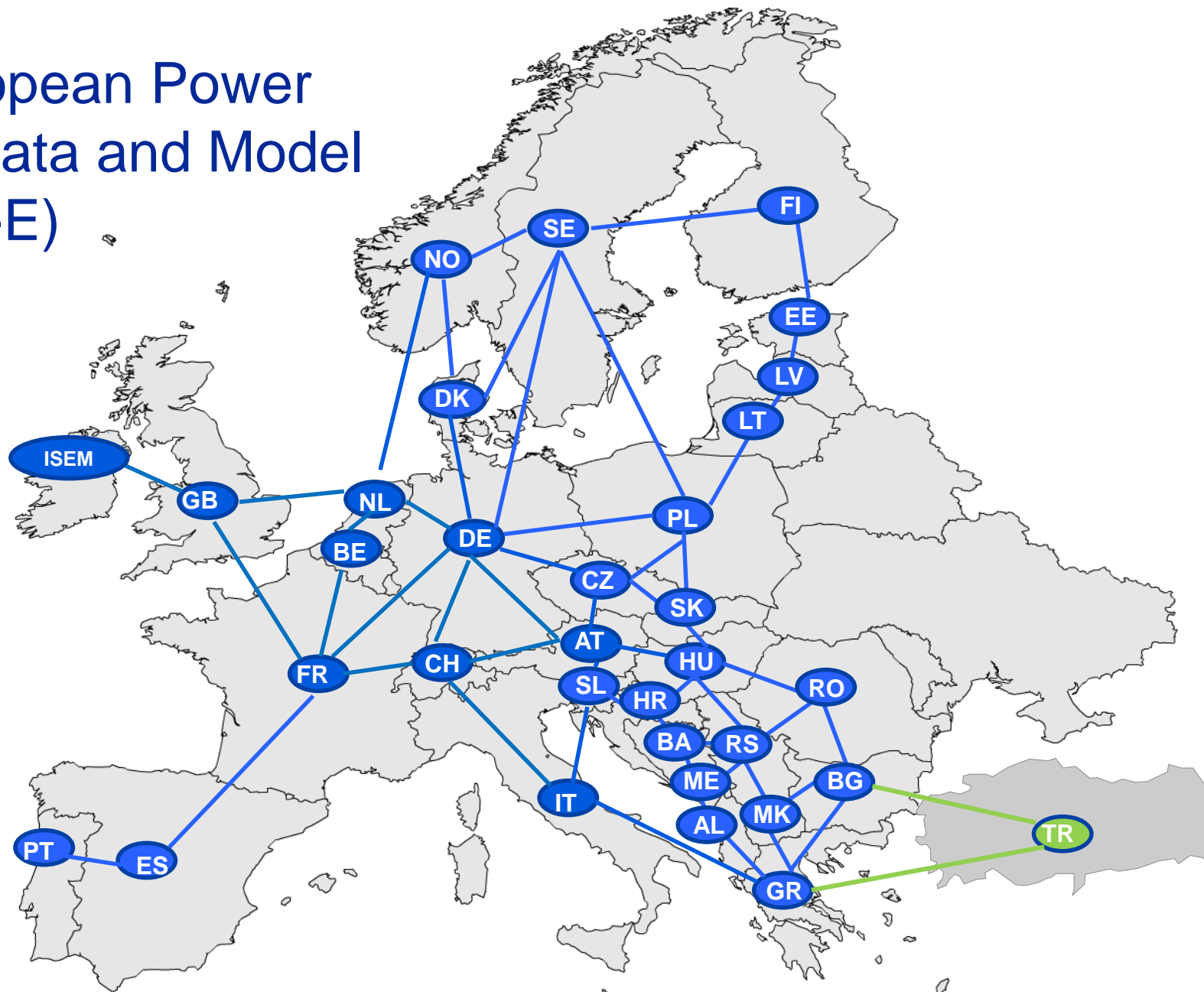


ABB Energy Market Advisory Services

Capability

The ABB Energy Market Advisory team provides energy market expertise and consulting services to support our clients.

- Globally located teams - Assessment of regional and international energy markets
- Energy market forecasting and analysis: prices, fuels, emissions, generation
- Renewable integration analysis
- Generation portfolio analysis
- Transmission studies and congestion forecasting
- Generation and transmission asset valuation, investment analysis and strategy development
- Independent benchmarking and verification of a client's results
- Regulatory Support and Testimony
- Staff augmentation

Reference Case: 25-Year Energy Market & Fuel Outlook

Energy Market Intelligence

Outcomes



25-year fundamental forecast of electricity market and fuel prices, and plant profitability and fuel mix

Position



Independent, transparent, rigorous analysis, delivered in two in-depth reports per year

Tools



Uses ABB's powerful **calibrated market models** and **dataset** to capture complexity in hourly detail



Electricity market prices and clean spreads



Fuel prices (Gas, Oil, & Coal)



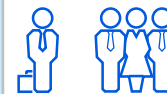
CO₂ prices and emissions



Generation, by fuel type (plant)



Imports/exports



Plant profitability – incumbent and new entrant

25 Year Energy & Fuel Outlook

Reference Case Delivery Choices

Reference case report

- “off-the-shelf” independent report and spreadsheet appendices (flexible options for results content and formatting)
- Includes assumptions/results discussion with key modellers

“Simulation ready” data provision

- Full (or partial) fundamental datasets for European electricity markets, using internally consistent data sources and assumptions
- Contains “out-of-the-box” market forecast for key Western European Reference Case markets

Flexible scenario option

- Using the Reference Case forecast as a starting point, we develop client-specific scenarios and analysis, using either ABB or client data and assumptions
- Quick, easy scenario generation, when you don’t have a dedicated in-house modelling team



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Key points of Polish Energy Market environment

- 2020 European target for Poland
- EU further growth to 27% until 2030
- Dynamic growth of wind and solar power in 2015
- Decommissioning and modernization of many thermal units, due to high fleet age and IED*
- Coal remain as a main source of energy for Poland

* Industrial Emissions Directive

European target

20% of total energy consumption from
renewable sources until 2020



National Target for Poland until 2020



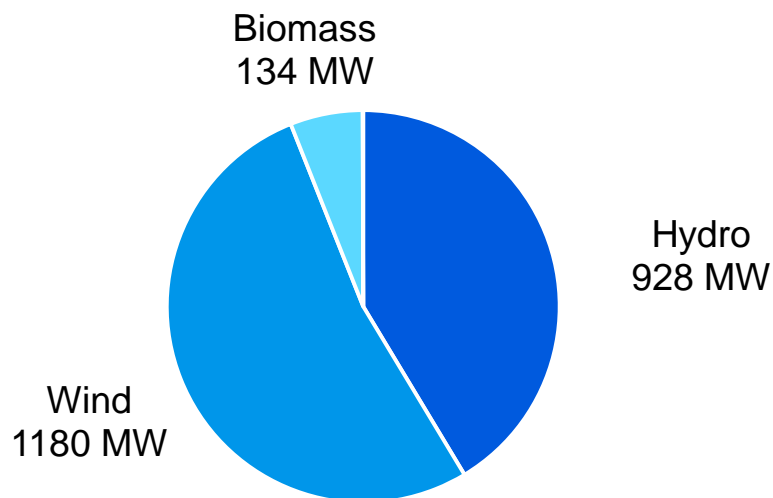
15.48% of total energy consumption from
renewable sources

14% of reduction of greenhouse gas emissions
(reference year 2005)

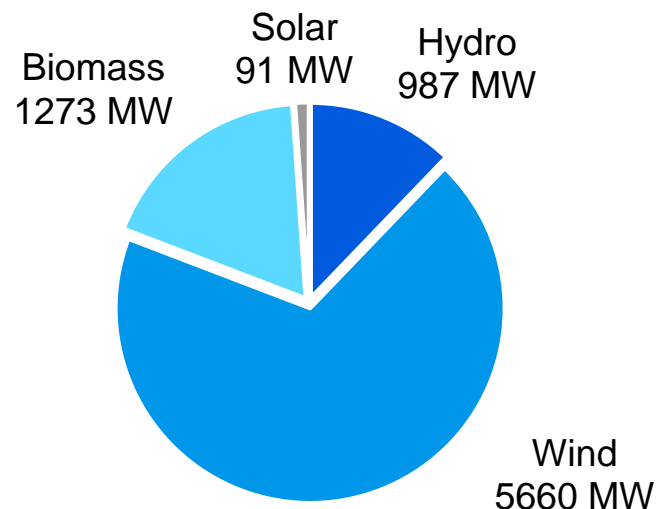
10% of transport fuelled by renewable sources

Renewable installed capacity development

Starting point 2.2 GW
Installed capacity in RES in 2010



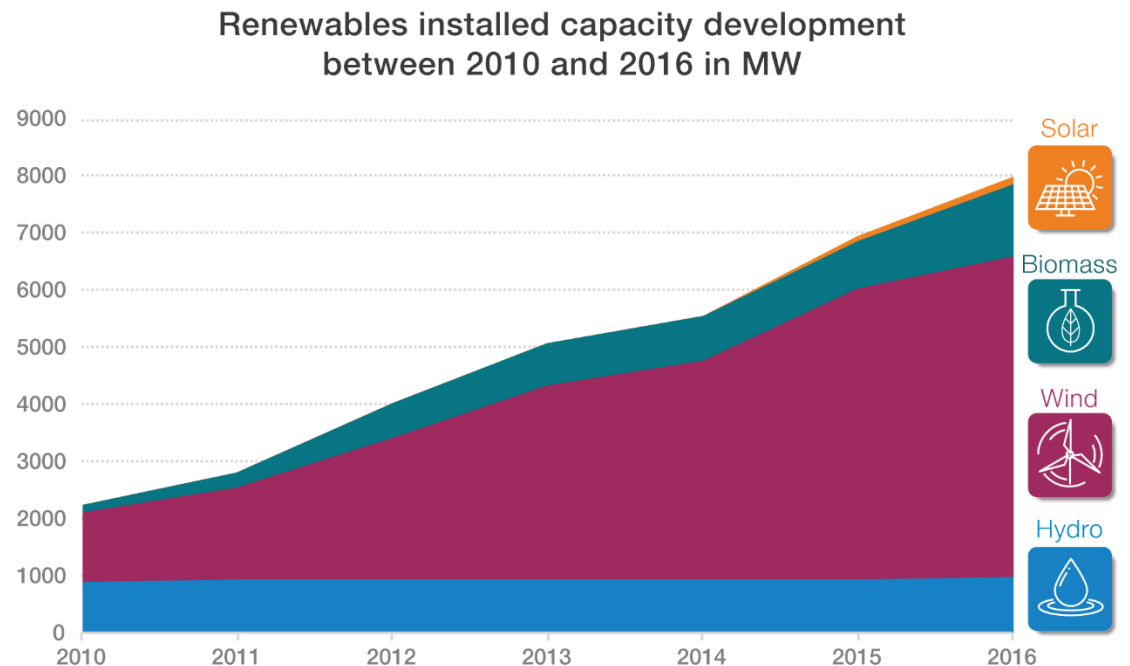
Where we are today 8.3 GW
Installed capacity in RES in 2016*



**Source: Installed capacity in Renewables sources quarterly URE report from June 2016*

Renewable installed capacity development

Even though the numbers seem very promising, Poland might be facing difficulties reaching its target mostly due to recent legislative changes.



Recent Legislative changes in Poland concerning Energy Sector

- February 2015 new ***Renewable Energy Act***
- December 2015 Establishment of the ***Ministry of Energy***
- July 2016 Renewal of the ***Renewable Energy Act***
- July 2016 New ***Wind Farm Investment Act***

February 2015 Renewable Energy Act

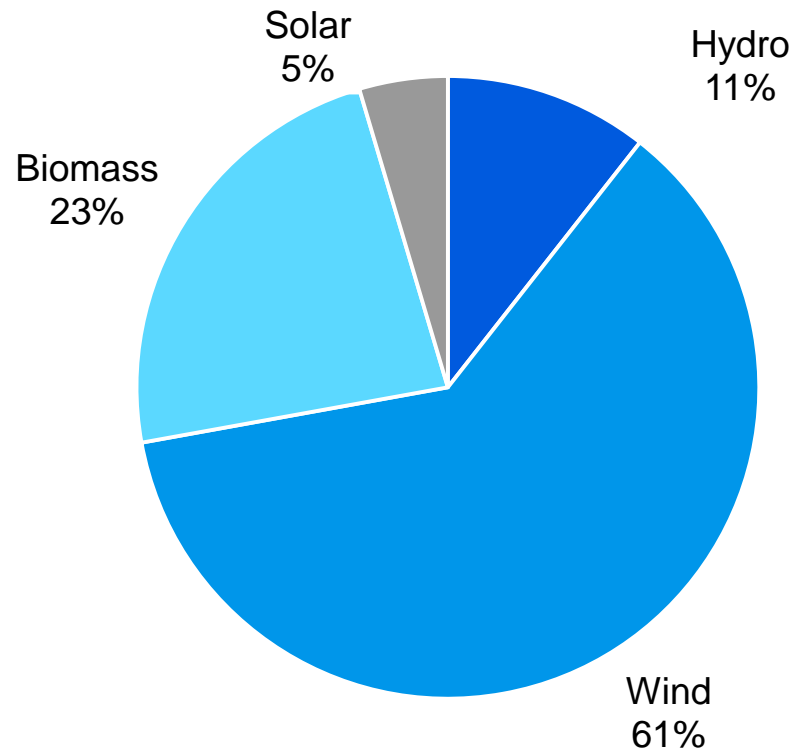
Bullet points:

- Tendering system for renewable energy sources with installed capacity below and above 1 MW
- Different strike prices for each technology basket: wind onshore, wind offshore, biogas, etc
- Separate support system for micro scale installations smaller than 10 kW- PROSUMENT

Referring to the assumptions of the Energy Act from February 2015,

onshore wind was intended to be the leading category in order to fulfill European target for Poland for 2020.

Installed Capacity in Renewable Sources Forecast for 2020



Recent Legislative changes in Poland concerning Energy Sector

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July 2016 Renewal of the Renewable Energy Act

- Tendering system remains in place
- No more fixed support for micro scale installations below 10 kW installed capacity
- Introduction of energy cooperative/clusters for small scale generation investments
- Modified strike prices for each technology basket
- Separate obligation of 0.5% share of electricity generated from agricultural Biogas- Blue Certificates available on TGE* from this week

*TGE Polish Power Exchange

Comparison of the Reference Prices from 2015 and 2016 Energy Act

Technology basket	Strike price in PLN/MWh Energy Act 2015	Strike price in PLN/MWh Energy Act 2016
Biogas < 1MW	500	550
Biogas > 1 MW	470	550
Biogas from sewage	335	335
Biogas from waste	305	305
Onshore wind <1 MW	415	415
Onshore wind > 1MW	385	385
PV < 1 MW	465	465
PV > 1MW	445	445
Geothermal	455	455
Offshore wind	470	470

July 2016 Renewal of the Renewable Energy Act

2016 Auction draft proposal:

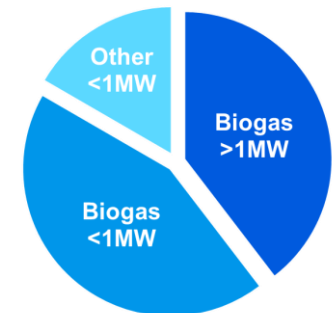
- 3.8* TWh for Biogas technology, for installation smaller than 1 MW, worth 2 million PLN
- 4.2** TWh for Biogas technology, for installations larger than 1 MW, worth 2.3 miliard PLN
- 1.6* TWh for other installations smaller than 1 MW, worth 659 million PLN

Referring to the assumptions of the Renewal of the Renewable Energy Act from July 2016,

Authorities will support stable, predictable sources

such as: biogas and biomass.

Auction 2016 technology distribution*



* According to draft proposal form August 2016

*3 804 996 MWh for biogas, worth 2 000 000 PLN

**4 156 887 MWh, for biogas, worth 2 286 287 784 PLN

*** 1 575 000 MWh, worth 659 137 500 PLN

Recent Legislative changes in Poland concerning Energy Sector

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July 2016 New Wind Farm Investment Act



- New legislation regulates the minimum distance between households, buildings or nature reserves equal 10-times the turbine's height
- Increased operational costs for the wind farm generators
- Limitation concerning Re-powering and upgrading the existing wind turbines

As a result, the wind sector has been directly constrained by the new Wind Farm Investment Act released in July 2016.

99% of potential projects of wind farms do not fulfill the new requirements.

As a result, many power generating companies had to lower wind farms assets' market value and suspend new wind investments.

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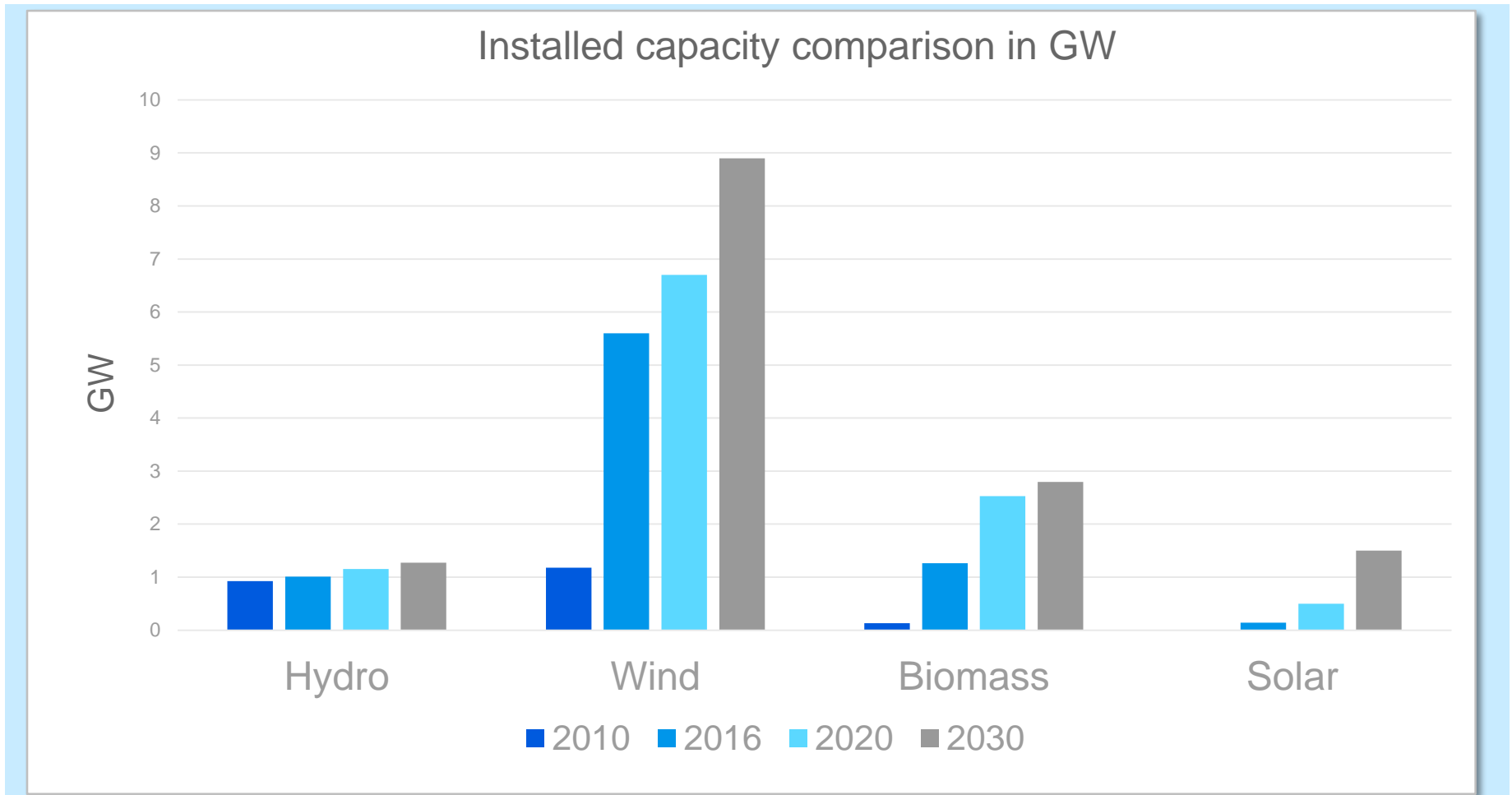
Current installed capacity and expected changes

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Forecast results

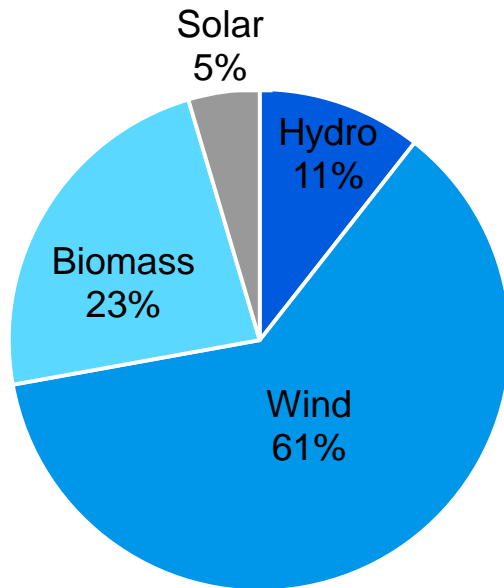
Q&A and Close

Installed Capacity between 2010-2016 Forecast for 2020 and 2030

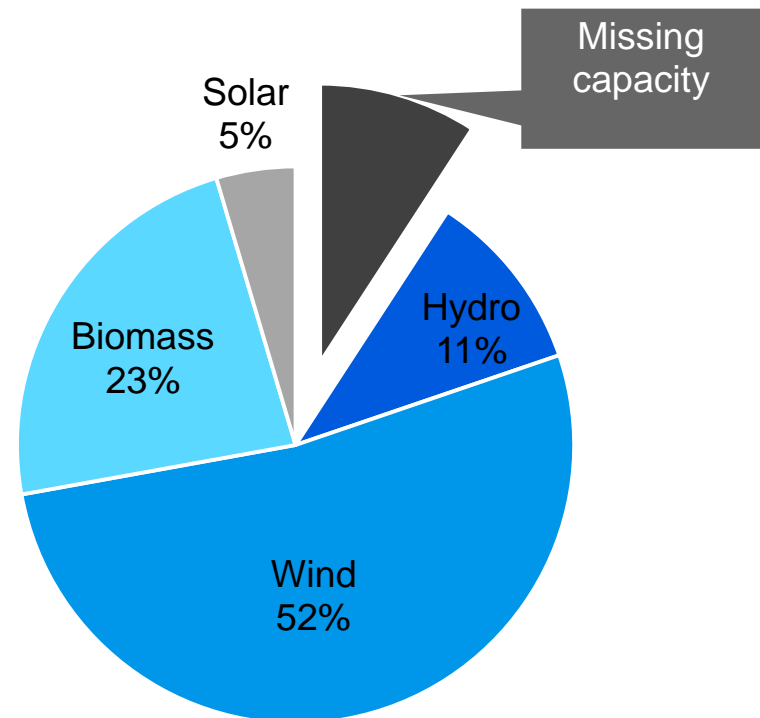


Installed Capacity Forecast for 2020

Installed capacity in
Renewable sources in 2020



Installed capacity modified forecast for 2020



Comments

Wind investments in Poland curtailed

Oversupply of Green Certificates on the market

Decrease in Green Certificates' prices (below 40 PLN/MWh in August 2016*).

Currently lowered Renewable obligation quota (15.5% from RES, 0.5% from biogas in 2017),



Investors might loose their trust to energy public authorities.

Poland might be facing difficulties fullfiling its 2020 National Target

Missing money problem for new investments in the country

Potential solutions to fulfil European target until 2020

- New added capacity from biogas and solar installations in 2017, if wind investments remain suspended at current level
- Development of Nuclear power in Poland:
 - between 200 and 350 MW from NUKE until 2020*,
 - 6000 MW until 2035



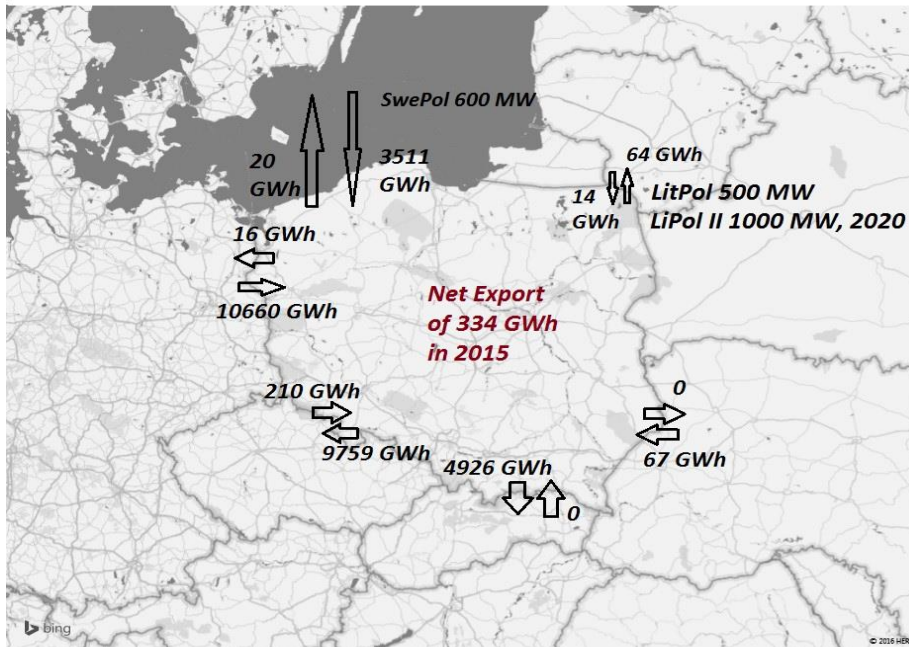
* According to Plan Morawieckiego, Strategy for sustainable Development proposal

Potential solutions to fulfil European target until 2020

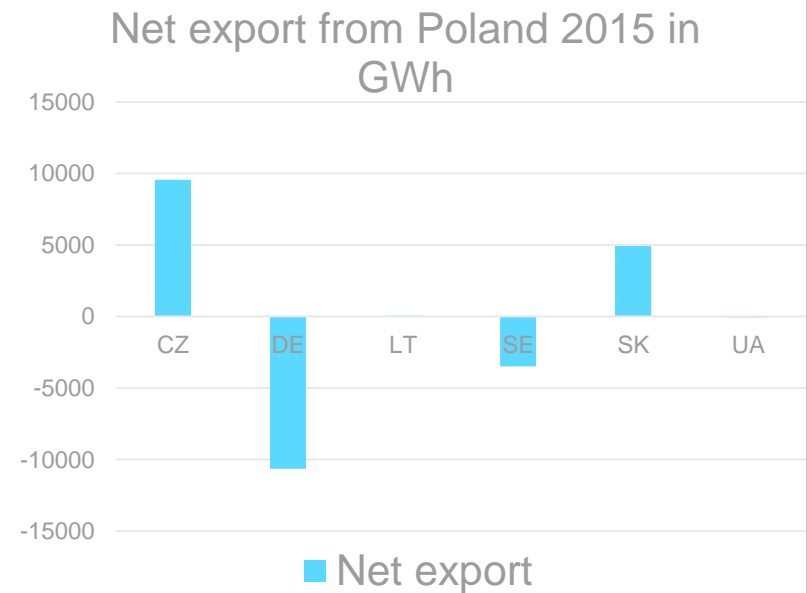
- New added capacity from biogas and solar installations until 2017, if wind investments remain suspended at current level
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- Interconnectors development between Poland and neighboring countries

Interconnectors development

Further development of market coupling and cross border commercial power exchange between Poland and neighboring countries



Source: ABB, ENTSO-E Statistical fact sheet 2015, Physical flows in GWh in 2015



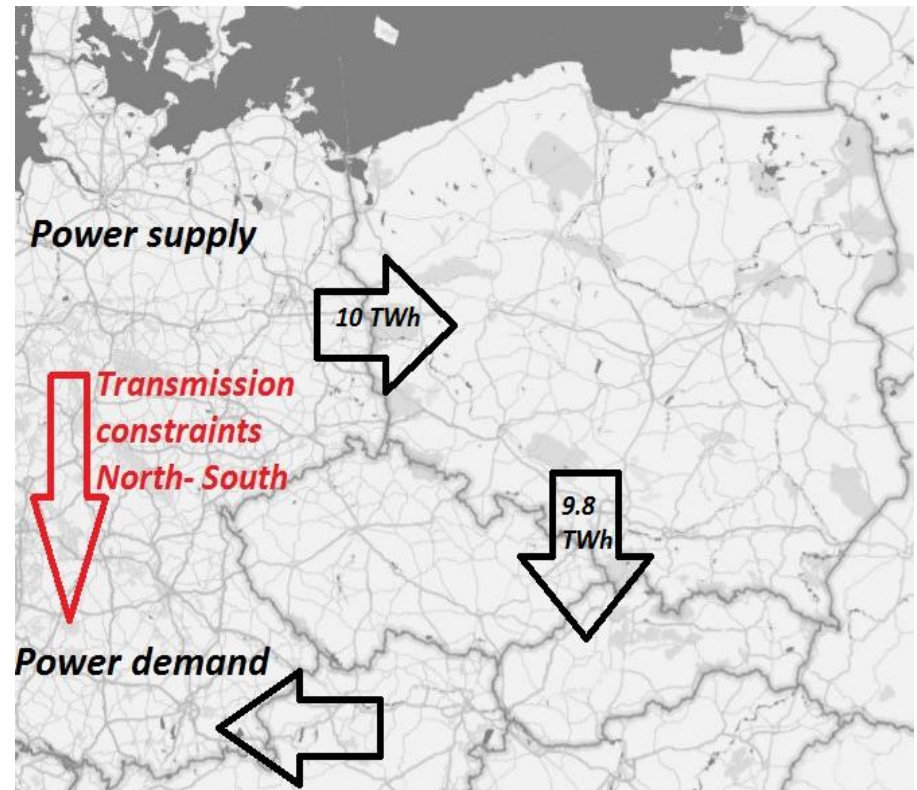
Source: ENTSOE Data Portal

Loop flows phenonema

High power generation from volatile sources
in the northern part of Germany,
as well as lower production
and higher energy
demand in the south, cause
the transmission lines congestion
between South and North of Germany.



Loop flows between Northern Germany,
Southern Germany, Austria, Northern Italy
and Poland



Interconnectors development

Phase shifters were installed in June 2016 in Mikułowa – Hagenwerder station to regulate power flows between Germany and Poland.



Source: PSE; Informacja prasowa dotycząca stacji Mikułowa, 24.07.2016

Interconnector development projects published by PSE*

1. Project 94 „**GerPol Improvements**” between PL/DE/CZ/SL:
 - Transmission line Vierraden-Krajnik voltage upgrade from 200 kV to 400 kV,
 - Phase shifters installation; import capacity upgrade of 500 MW and export capacity upgrade of 1500 MW; completed 2017

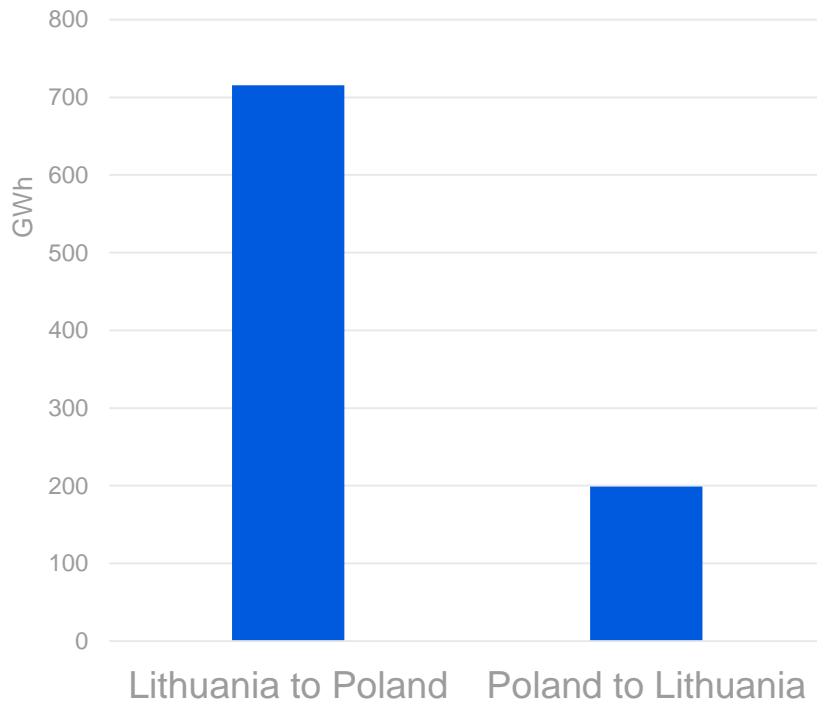
2. Project 58 „**GerPol Power Bridge**”, between PL/DE/CZ/SL:
 - import capacity upgrade of 1500 MW, export capacity upgrade of 500 MW:
 - I phase completed 2020,
 - II phase completed 2030

2. Project 59 „**LitPol Stage II**”
 - *LitPol Stage I*, 500 MW, completed 2016,
 - 1000 MW transmission capacity; completed 2020

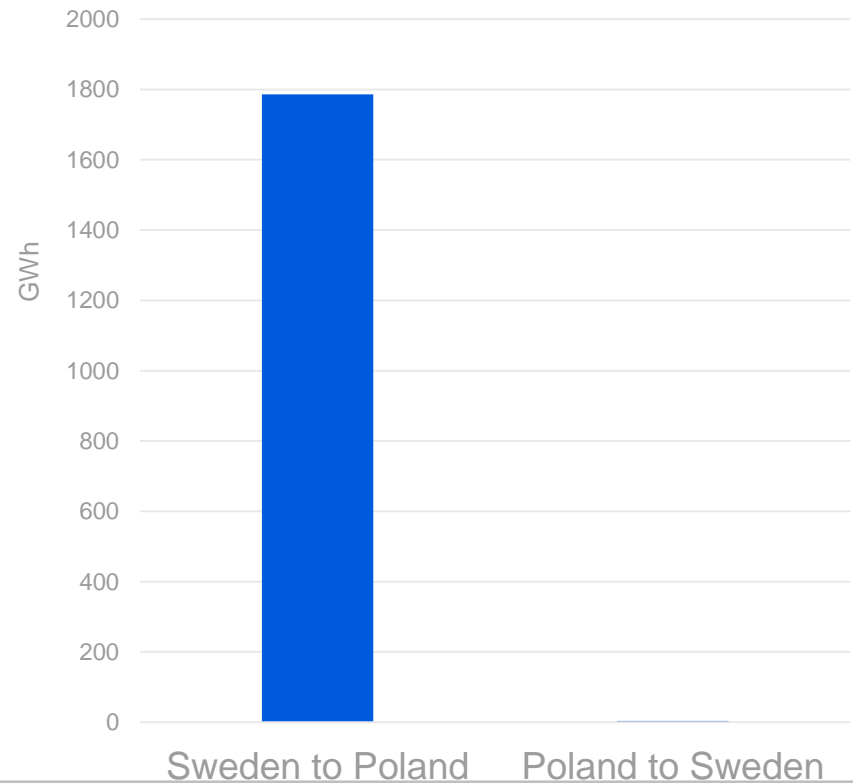
* PSE - TSO in Poland

Market Coupling between Lithuania, Sweden and Poland

Commercial flows between
Lithuania and Poland in 2015 in
GWh



Commercial flows between Sweden
and Poland in 2015 in GWh



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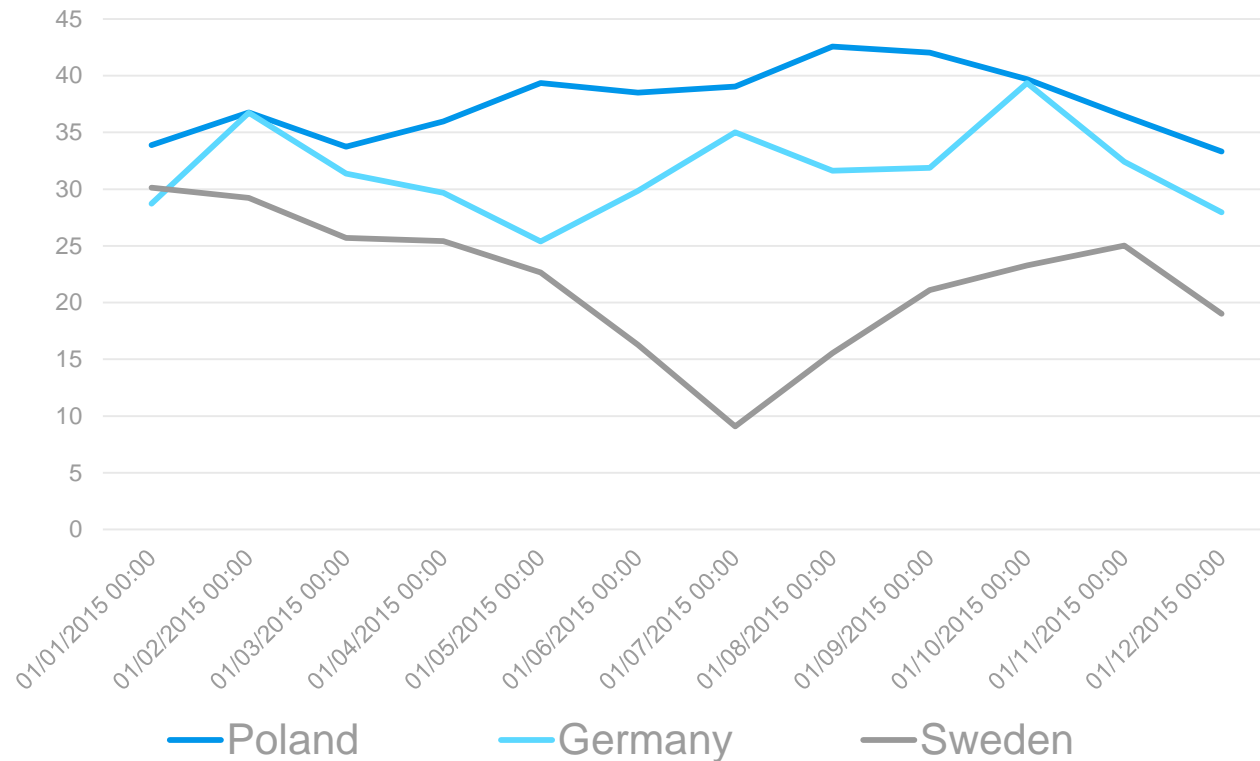
Forecast results

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Market Clearing Prices in 2015

SPOT Prices comparison between Poland, Germany and Sweden

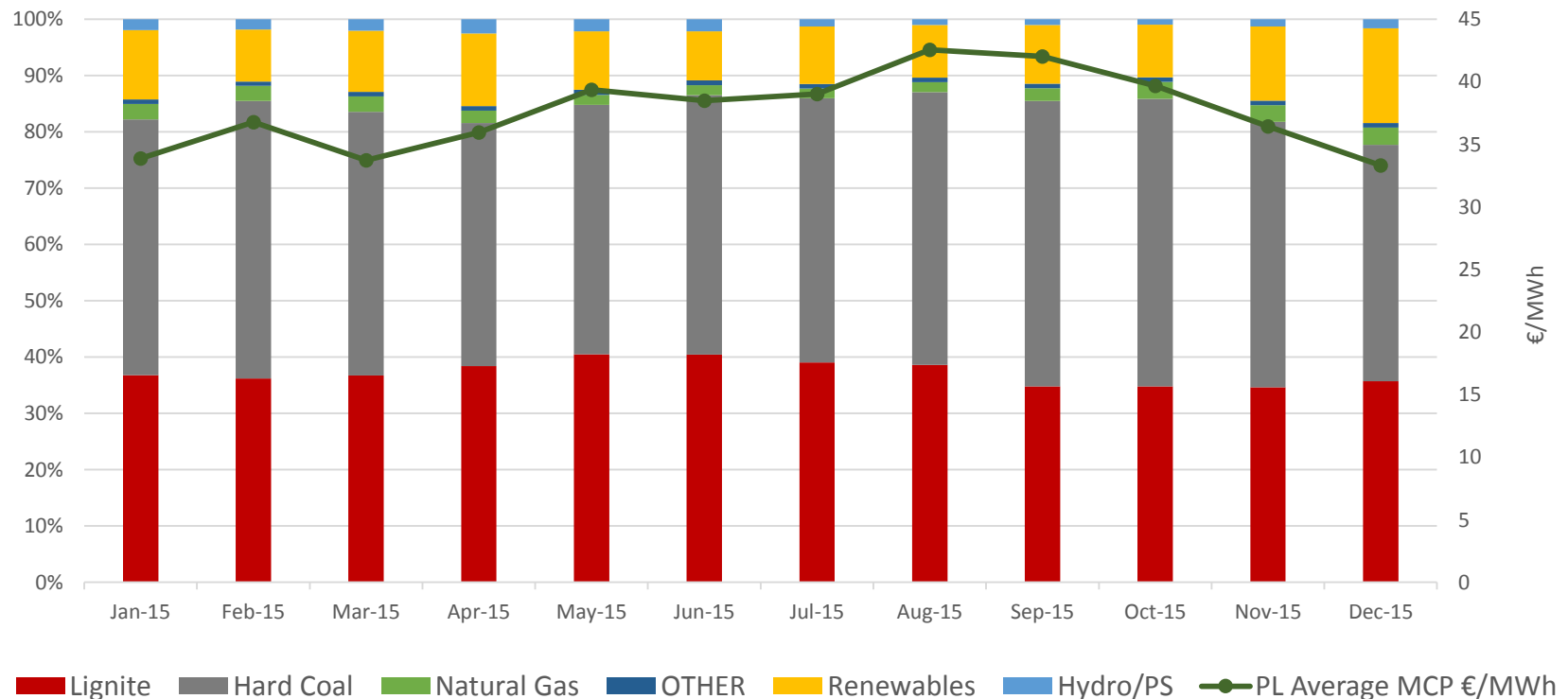
Average MCP in 2015 in €/MWh



Source: TGE, EPEX, EEX, Nordpool

Generation by fuel type with MCP in 2015

Historic Polish Generation by fuel type and Market Prices



Source: TGE, ENTSO-E

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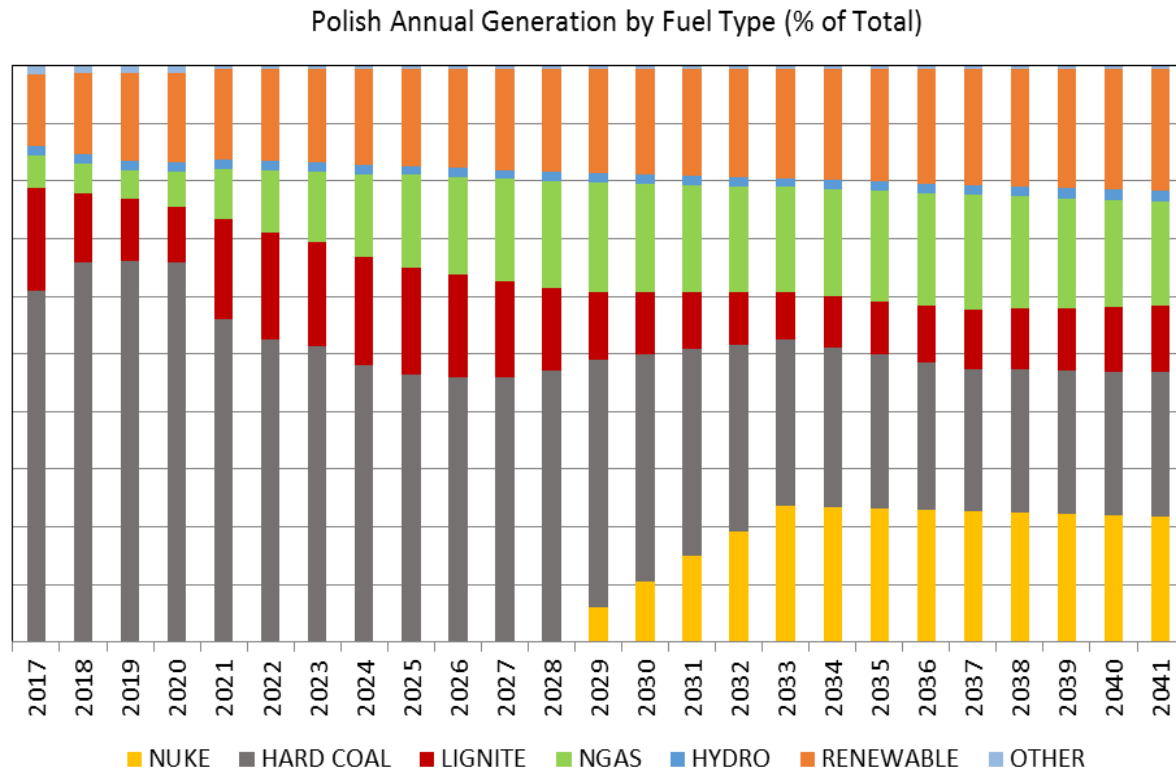
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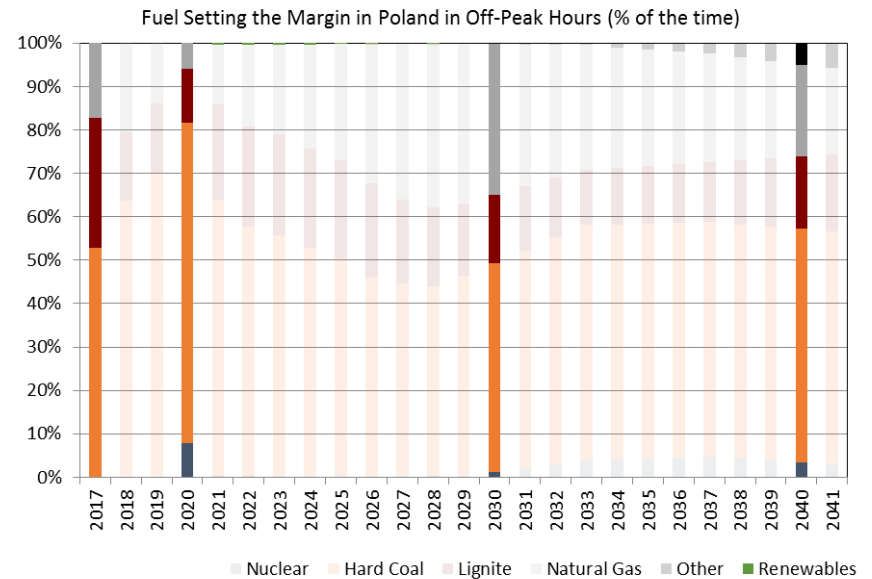
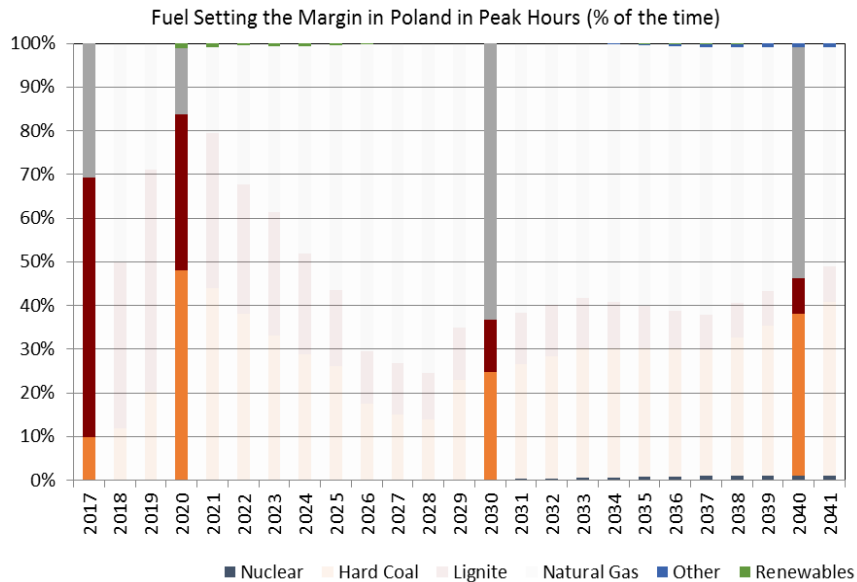
Q&A and Close

Generation by Fuel Type

25 Years Forecast

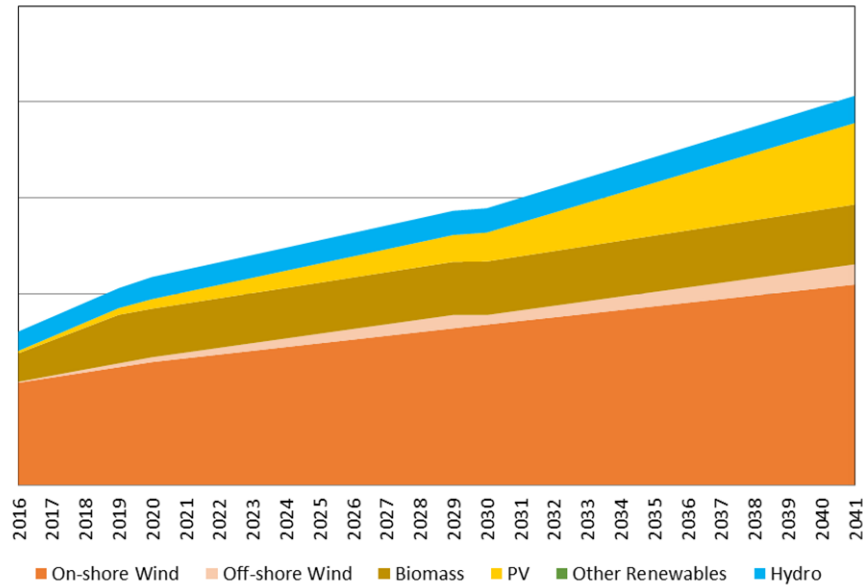


Fuel Setting the Margin in Poland for Peak and Off-Peak hours

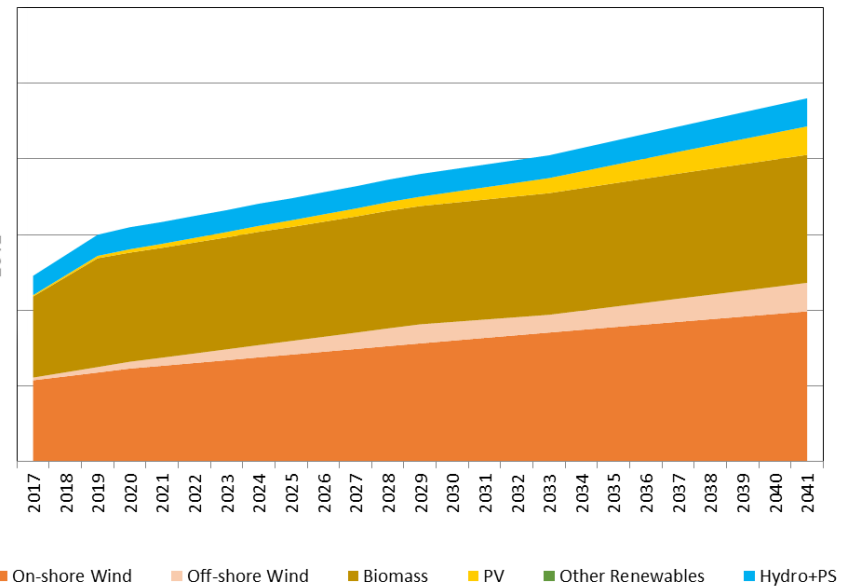


Renewables Installed Capacity and Generation 25 Years Forecast

Polish Renewable Capacity Forecast by Technology (MW)



Polish Renewable Generation Forecast by Technology (GWh)

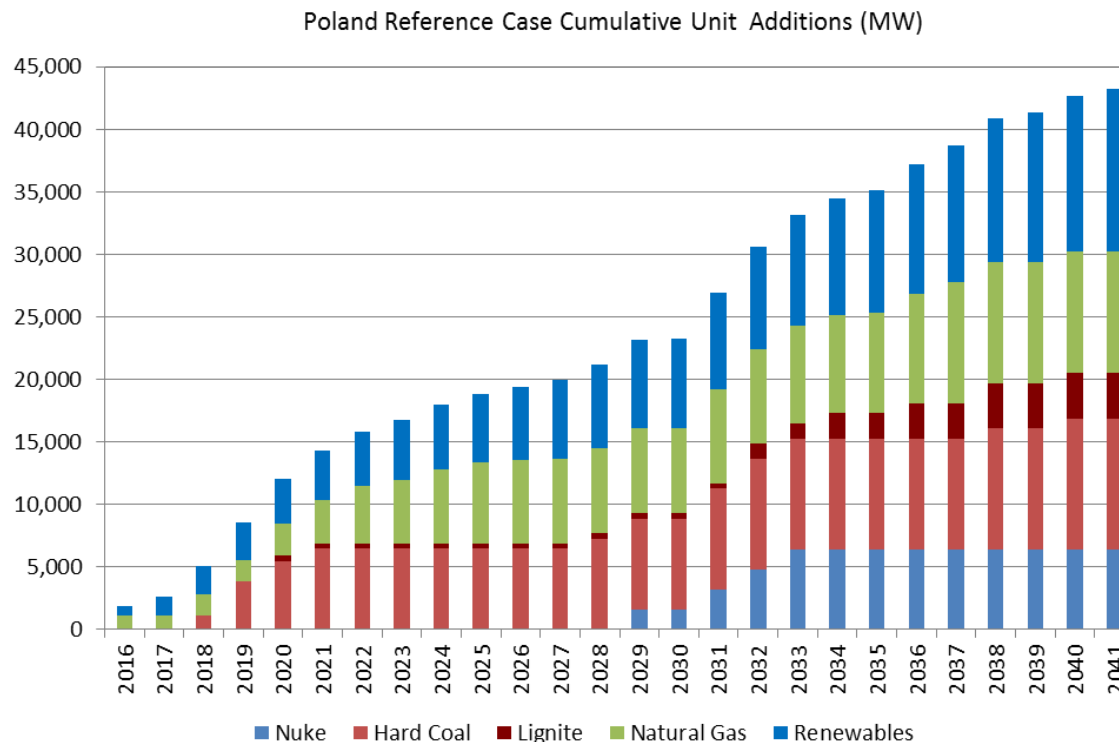


% in Total

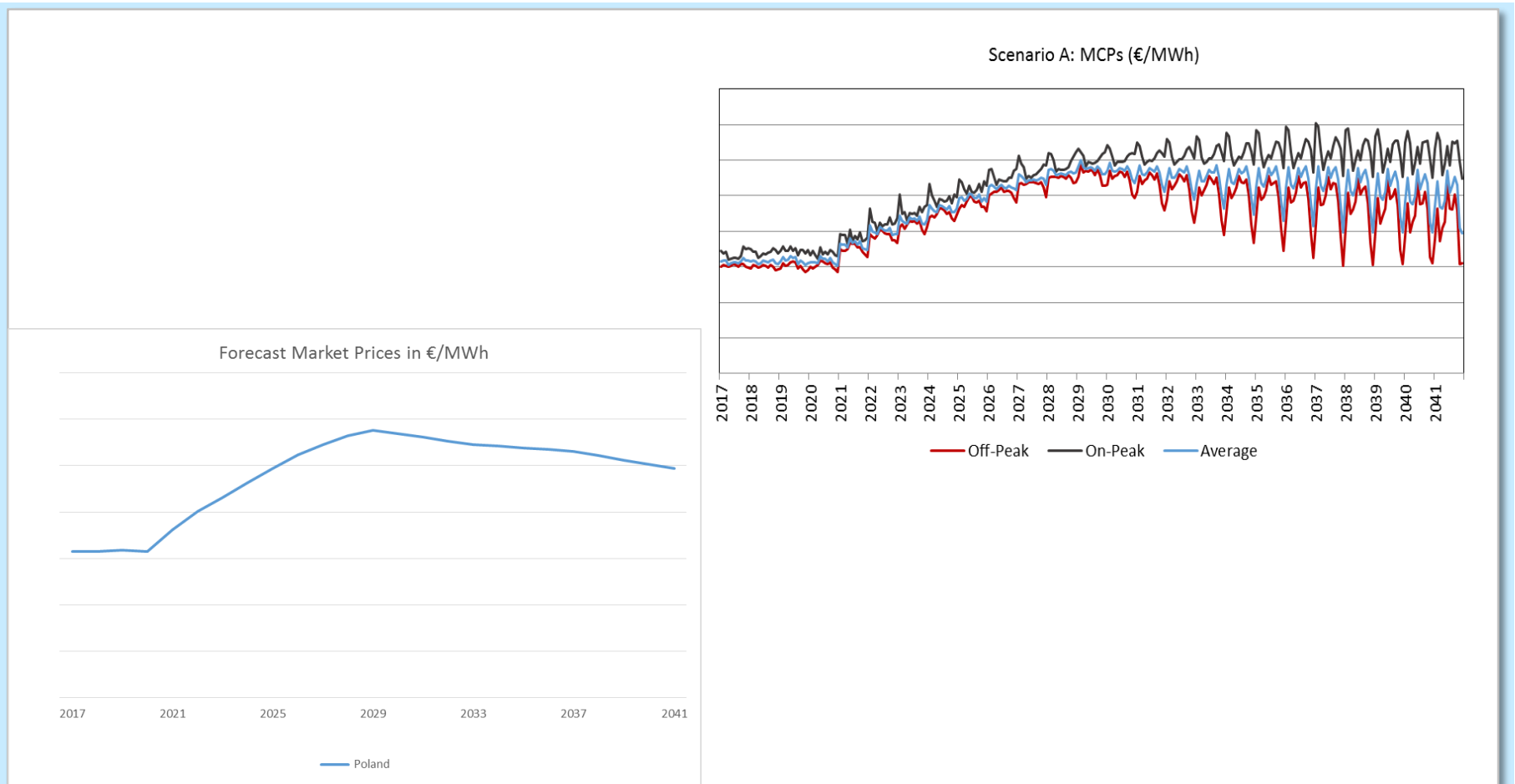
Future Energy Mix development in Poland

In our Reference Case assumptions, based on individual power plant research, the share of newly added units will be divided between different categories.

It means around 12 GW newly added capacity until 2020 and 23 GW until 2030.



Polish Electricity Market Price Development 25 Years Forecast



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Contact ABB's Market Intelligence Services

This webcast was an overview of ABB's 25-Year Energy Market Outlook report for Poland. The full report is much more comprehensive and includes detailed descriptions, results and analysis. The reports are available for Poland and other European countries.

For enquiries on the webcast or to subscribe to ABB's Reference Case report please contact:

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