

Is conventional power generation still needed to support renewables?



**Towarzystwo Gospodarcze
Polskie Elektrownie**

The easiest way to reduce CO₂ emissions – closing down the biggest coal fired power stations



Towarzystwo Gospodarcze
Polskie Elektrownie

- Easy to create law regulations,
- Easy to control implementation,
- Power generation is the only highly emissive sector of economy having real alternative in form of renewables,
- Modern technologies are available already,
- Relatively high level of own investment sources.



The only path to salvation - renewables

Available and mature technologies:

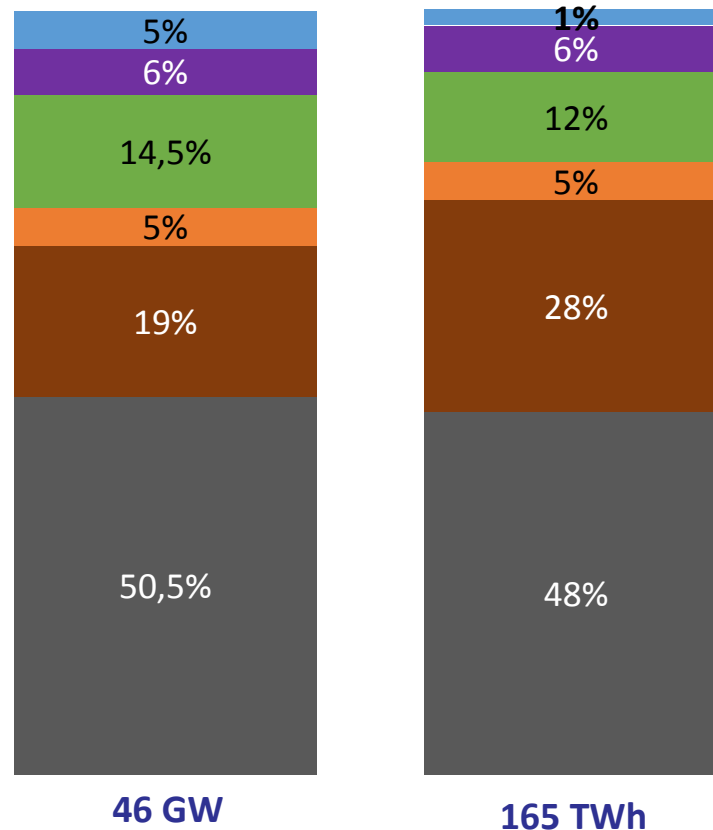
- PV,
- Wind,
- Biogas,
- Biomass,
- Hydro,
- Geothermal,
- Solar,
- Import of green energy,
- Hydrogen.
- Other...



Present structure of power generation in Poland

Structure of fuels:

- Hard coal
- Lignite
- Natural Gas
- Renewables
- Industrial power plants (coal)
- Hydro



Non-dispatchable renewables

Is it possible to cover energy demand only by non-dispatchable renewables in 20-30 years?

Possible demand : 30 GW i 200 TWh

NO!

Realistic coverage of demand:

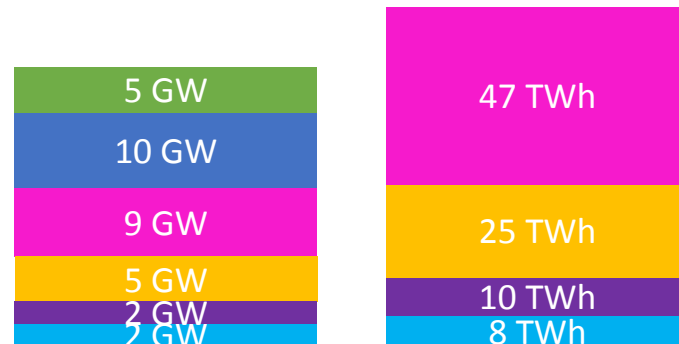
- Wind onshore: 10 GW, 30 TWh
- Wind offshore: 10 GW, 50 TWh,
- PV : 15 GW, 15 TWh,
- Import : 10 GW, 15 TWh



Dispatchable renewables as complementary sources:

- Run-of-river hydro: 2 GW, 8 TWh,
- Biogas: 2 GW, 10 TWh,
- Hydrogen: 5 GW, 25 TWh,
- Biomass: 9 GW, 47 TWh,
(**30 mt, 3.1 million ha**)
- Pumped storage (hydro): 10 GW,
- Min. constant power from Wind and PV (10%): 5 GW.

Total



33 GW

90 TWh

- Wind onshore: 10 GW – 13b Eur (+ 5 GW – 6b Eur for overhaul after 30 years)
- Wind offshore: 10 GW – 22.5b Eur
- PV: 15 GW – 7b Eur (+ 5 GW – 2,5b Eur for overhaul after 30 years)
- RES imports: 10 GW/15 TWh – 2.5b Eur
- Run-of-river hydro: 2 GW – 5b Eur
- Biogas: 2 GW – 14b Eur
- Hydrogen: 5 GW – 24b Eur
- Biomass: 9 GW – 24b Eur
- Pumped-storage hydro: 10 GW – 24b Eur

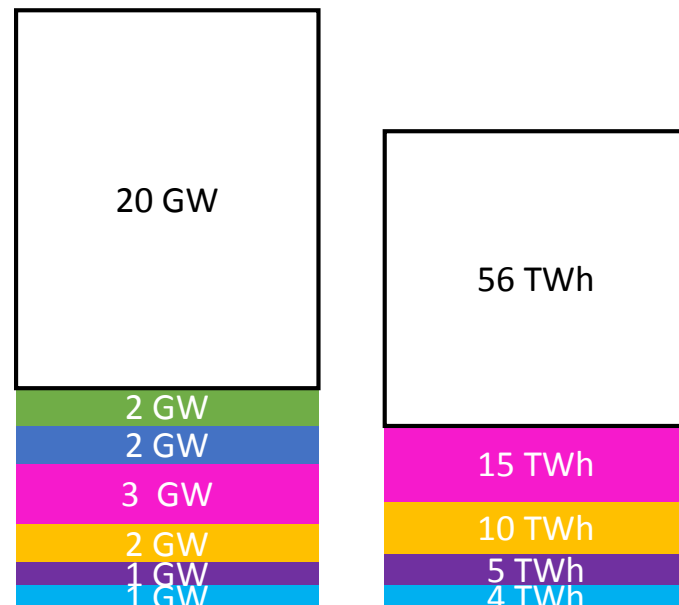


Total: **130,5b EUR** – ca. 5.2b Eur per annum!

Real balancing capability – dispatchable renewables

Responding to demand with dispatchable sources:

- Run-of-river hydro: 1 GW, 4 TWh,
- Biogas: 1 GW, 5 TWh,
- Hydrogen/other new technologies: 2 GW, 10 TWh,
- Biomass: 3 GW, 15 TWh, **10 mt , 1 m ha of crops**
- Pumped storage: 2 GW,
- Non-dispatchable renewables (fraction): 2 GW.



Real dispatchable RES availability 11 GW and 34 TWh.

Dispatchable generation gap: 20 GW generating 56 TWh

Real investment level in power generation

- Onshore wind: 10 GW – PLN 13b Eur (+ 5 GW – 6b Eur for overhaul after 30 yrs)
- Offshore wind: 10 GW – PLN 22,5b Eur
- PV: 15 GW – 7b Eur (+ 5 GW – 2,5b Eur for overhaul after 30 years)
- RES imports: 10 GW/15 TWh – 2,5b Eur
- Run-of-river hydro: 1 GW – 2,5b Eur
- Biogas: 1 GW – 7b Eur
- Hydrogen/other new technologies: 2 GW – 9,5b Eur
- Biomass: 3 GW – 8,3b Eur
- Pumped storage: 2 GW – 4,8b Eur
- Conventionals (gas) + new existing: 20 GW
of which 5 GW new and 15 GW gas – 10,7b Eur



TOTAL: 96,3b Eur for new RES. In 25 years horizon = ca. **3,9b Eur** per year!

as a reminder: optimistically 100% renewable generation – 5,2 billion per year!

- Reconstruction of power generation imposes also huge investments on **distribution – 30.9b Eur**
- We have also **district heating** with 40 GWt of generation and distribution grids – **40.5b Eur**
- Whole economy should cover also the costs of curbing emissions by **other industry sectors + transport (???) b Eur)**



Estimated investment costs in the years 2021 - 2030:

- Modernization and expansion of DH pipelines and substations – 7.1b Eur
- Heat generation:
 - New CHP plants in small and middle towns: ca 1.5 – 3 Gwe – 4.8b Eur
 - Modernization of existing CHP: ca. 7 GWe – 3.6b Eur
 - New heat plants using renewable sources: ca. 8 GWth – 21.4b Eur
 - Other technologies (heat storage and recuperation etc.): ca 1.5 GWth – 3.6b Eur

TOTAL 40.5b Eur!

- Power generation 96.3b Eur (or 100% renew. 130.5b Eur)
- Power distribution 30.9b Eur
- District heating 40.5b Eur

Energy industry TOTAL 167.7b Eur (or 100% renew. 201.9b Eur)

- Other sectors + **xxx b Eur**
- Transportation + **xxx b Eur**

