IOŚ-PIB

Centre for Climate and Energy Analyses

KOBiZE

LIFE Climate CAKE PL

Scenarios for the low-carbon energy sector in Poland and the EU until 2050

Economic transformation challenges
arising from the 2050 EU climate neutrality objective
LIFE Climate CAKE PL

22nd November 2019, Warsaw

MEESA – Model for the European Energy System Analysis

OBJECTIVE: ANALYSIS OF THE CLIMATE & ENERGY POLICY

- Energy model as a tool supporting the CGE model:
  - input: macroeconomic data from CGE
  - emission reduction targets, energy supply strategies
  - conventional power plants, cogeneration, nuclear units
  - extending share of renewables
  - energy storage, DSR
  - output: energy mix, emissions, investments, energy cost
- Eventually: modeling the demand side in Poland
  - individual heating systems (particle emissions)
  - impact of electric cars on energy system

MODEL STRUCTURE AND MAIN ASSUMPTIONS

- Electricity and district heating system for 28 EU Member States (plus Norway and Switzerland)
- About 50 energy technologies in each country
- Time horizon 2015-2055; specific demand structure defined for each year (different seasons, day types and day periods).
- Demand scenarios for electricity and district heating:
  - currently based on PRIMES 2016 Reference Scenario
  - eventually based on CGE modelling results or other scenarios
- Base year calibration for each country (Eurostat, IEA, JRC-IDEES, WNA, ENTSO-E):
  - capacity installed and projected
  - electricity and heat production, fuel consumption, CO_2 emissions
  - specific load curves for each country
  - cross-border exchange capabilities (current and future)
- Assumptions regarding domestic energy policy:
  - phasing out coal energy sources
  - plans for nuclear energy

Test results

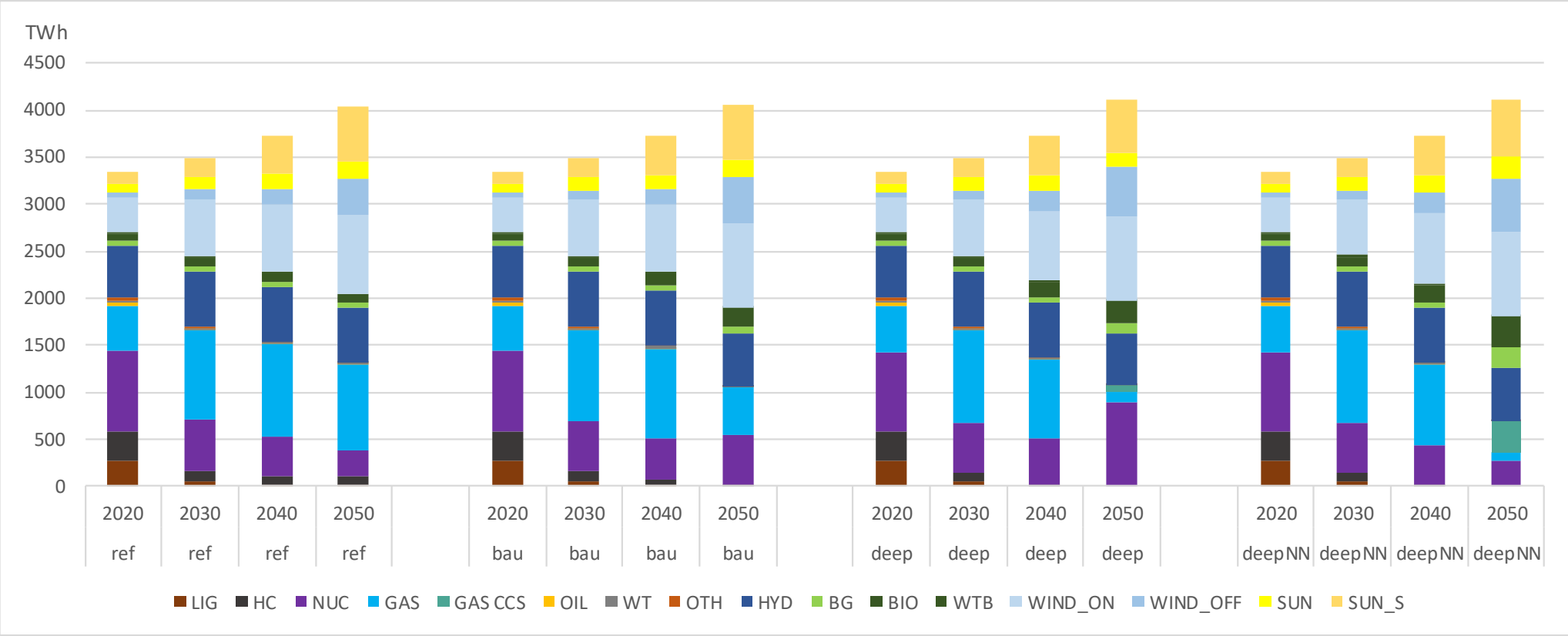
LOW EMISSION SCENARIOS FOR EU ENERGY SECTOR

- Fuel and CO_2 emission prices - WEO 2017 - Current Policies Scenario
- Technologies cost and parameters - Technology pathways in decarbonisation scenarios 2018 (Asset project)
- Gradual approaching 50% RES target for each country (individual path for the region takes into account current situation and overall RES potential)

Scenario	Assumptions
REF	Domestic plans of coal phase out and nuclear power withdrawal – emission reduction by **60%**
BAU	Forced emission reduction by **80%** - other assumptions same as in REF
DEEP	Deep emission reduction by **95%** - other assumptions same as in REF
DEEP NN	Deep emission reduction by **95%** - without new nuclear power plants in the EU (apart from units currently under construction)

LOW EMISSION ENERGY SECTOR IN EU

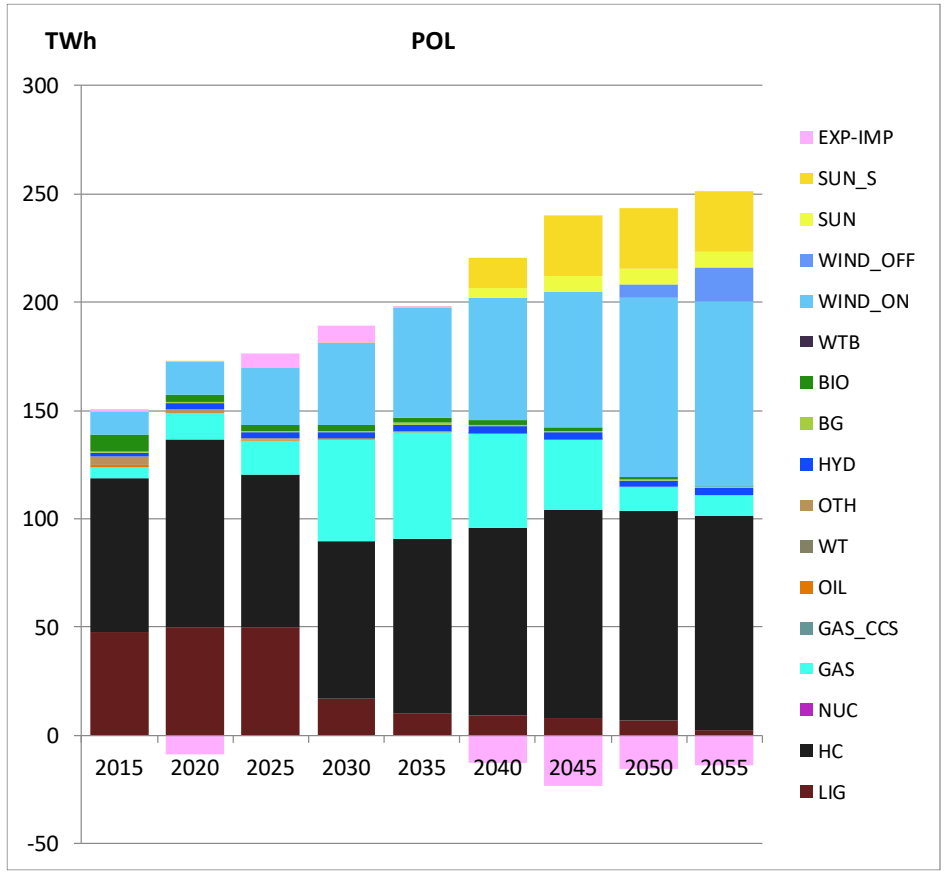
- Electricity generation – **EU28 + Switzerland and Norway**



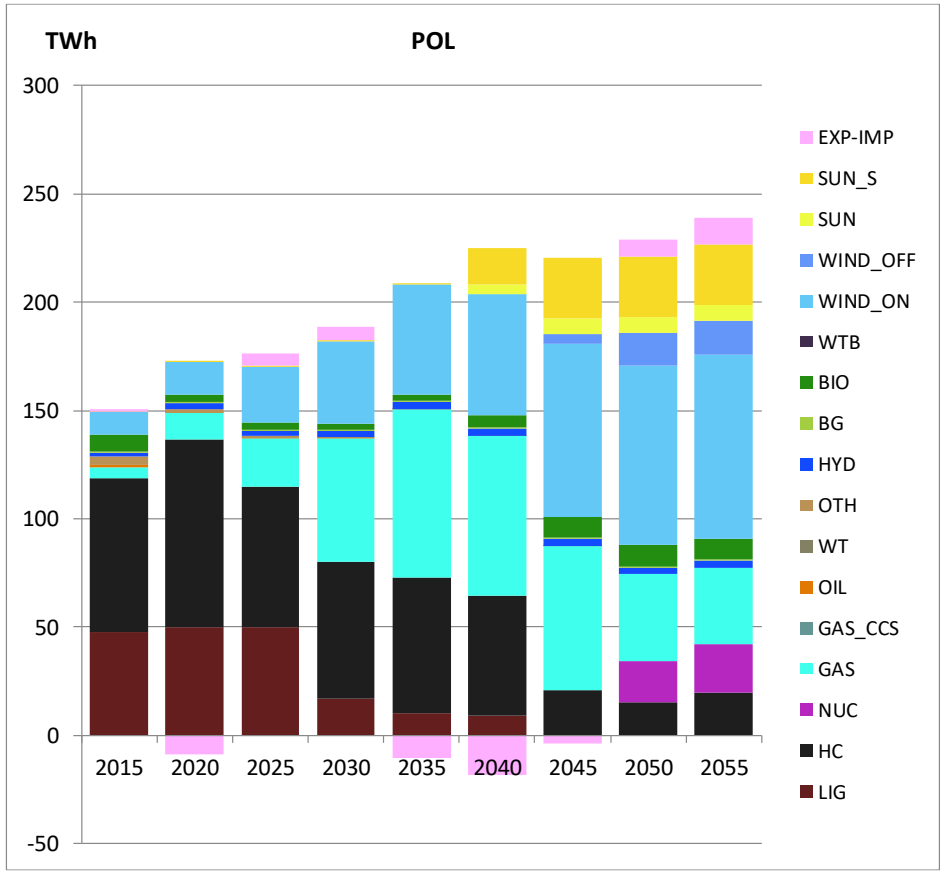
LOW EMISSION ENERGY SECTOR IN EU

- Electricity generation - **Poland**

REF



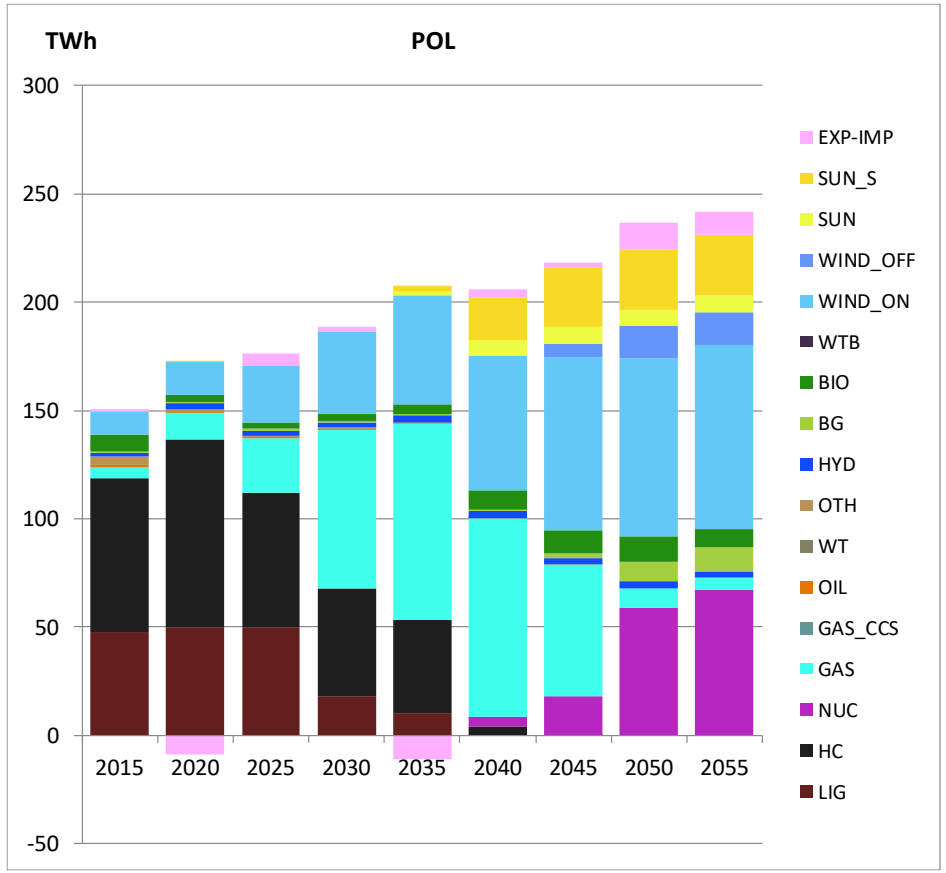
BAU



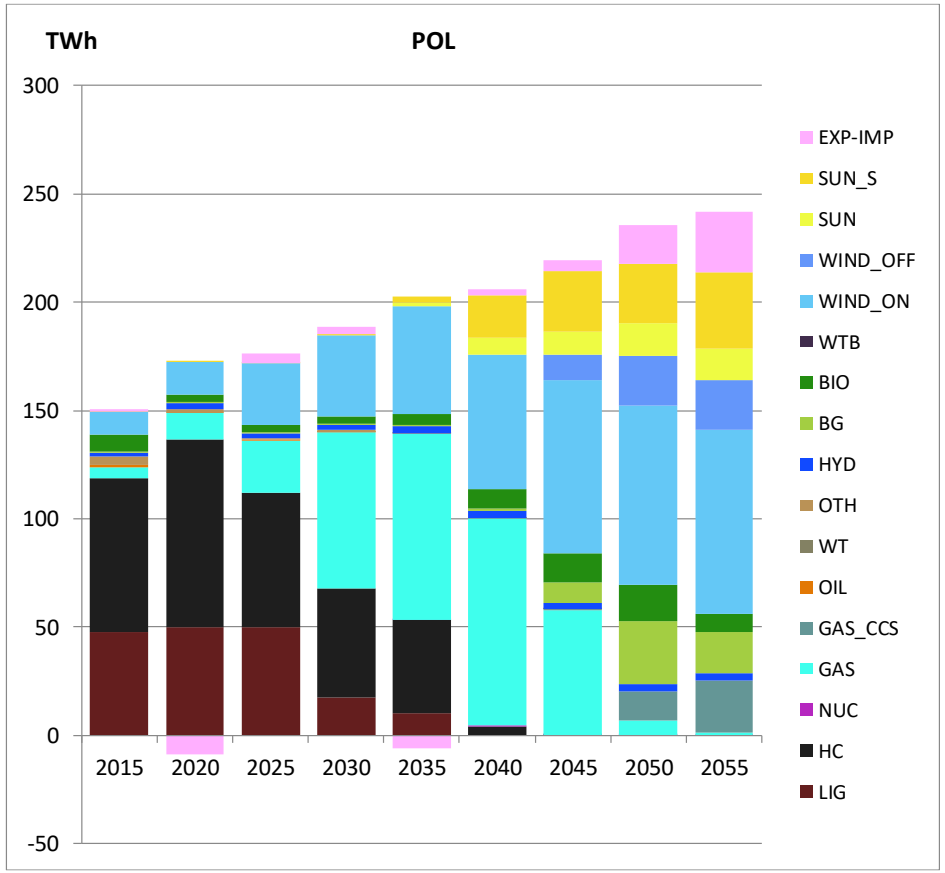
LOW EMISSION ENERGY SECTOR IN EU

- Electricity generation - **Poland**

DEEP



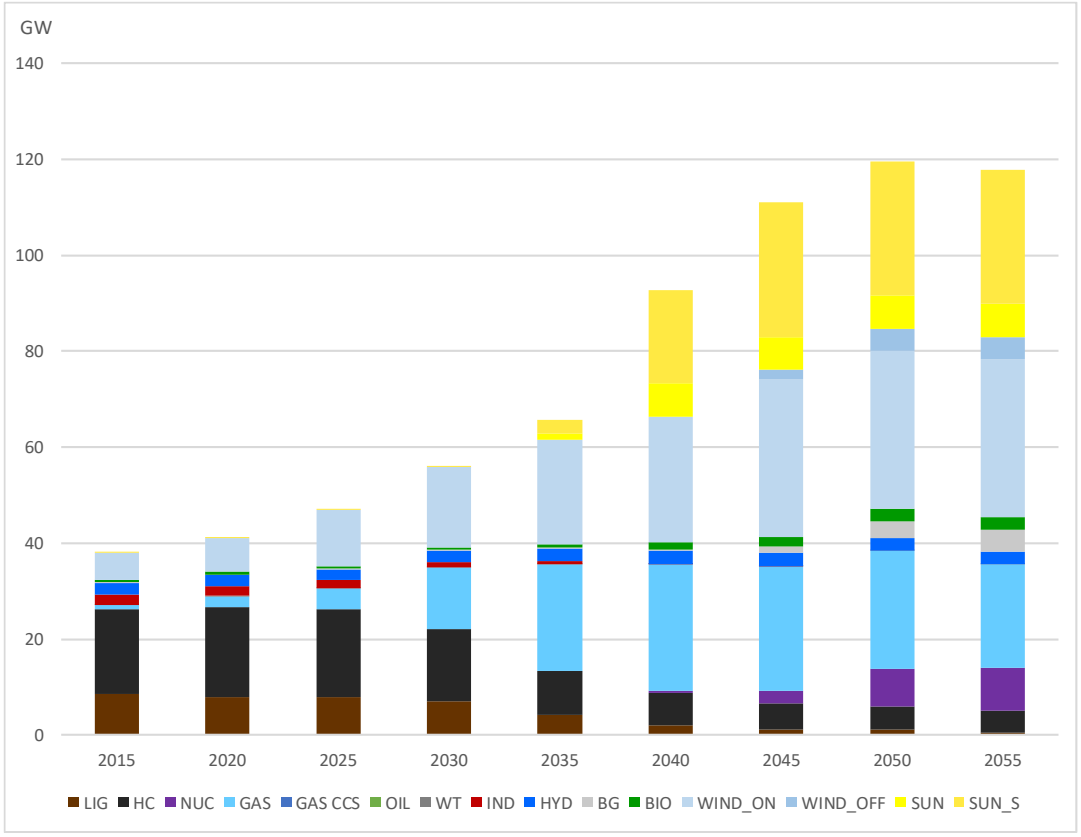
DEEP NN



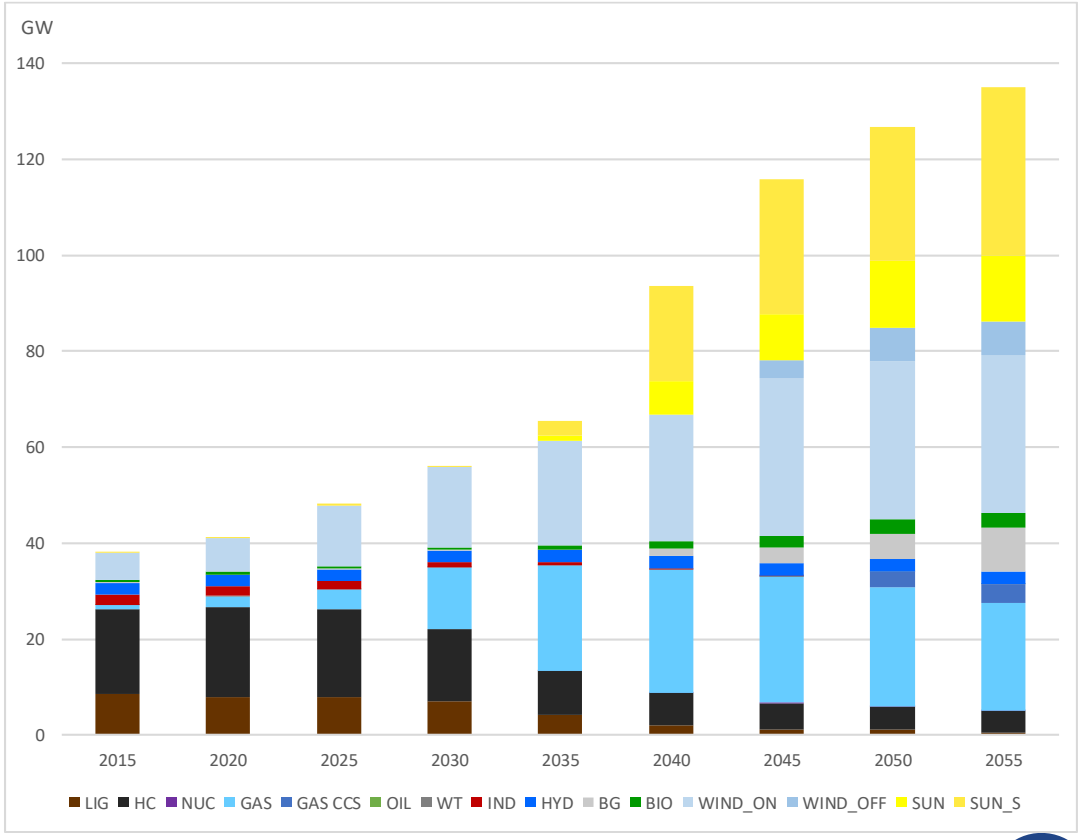
LOW EMISSION ENERGY SECTOR IN EU

- Installed capacity of a power system - **Poland**

DEEP

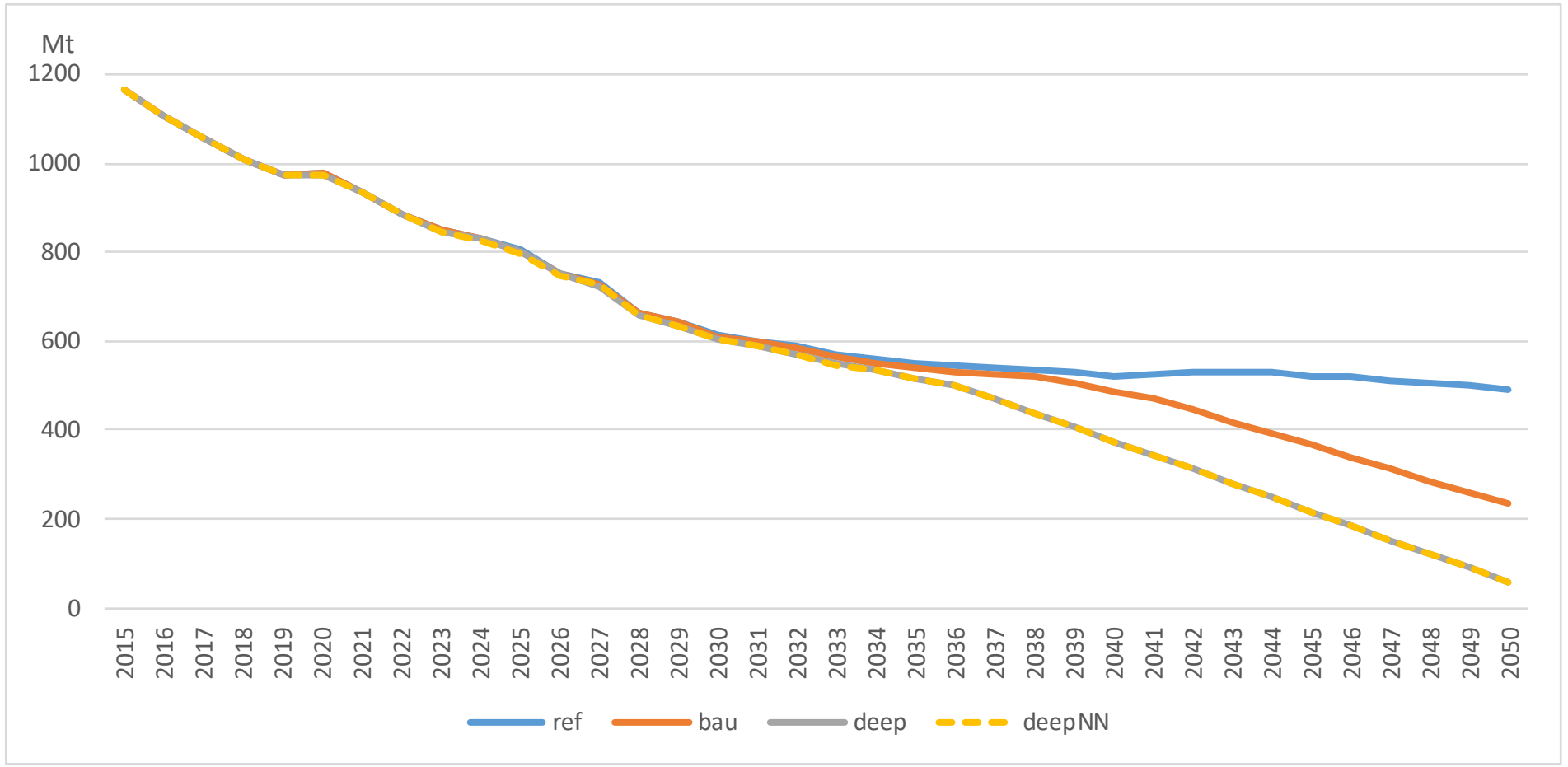


DEEP NN



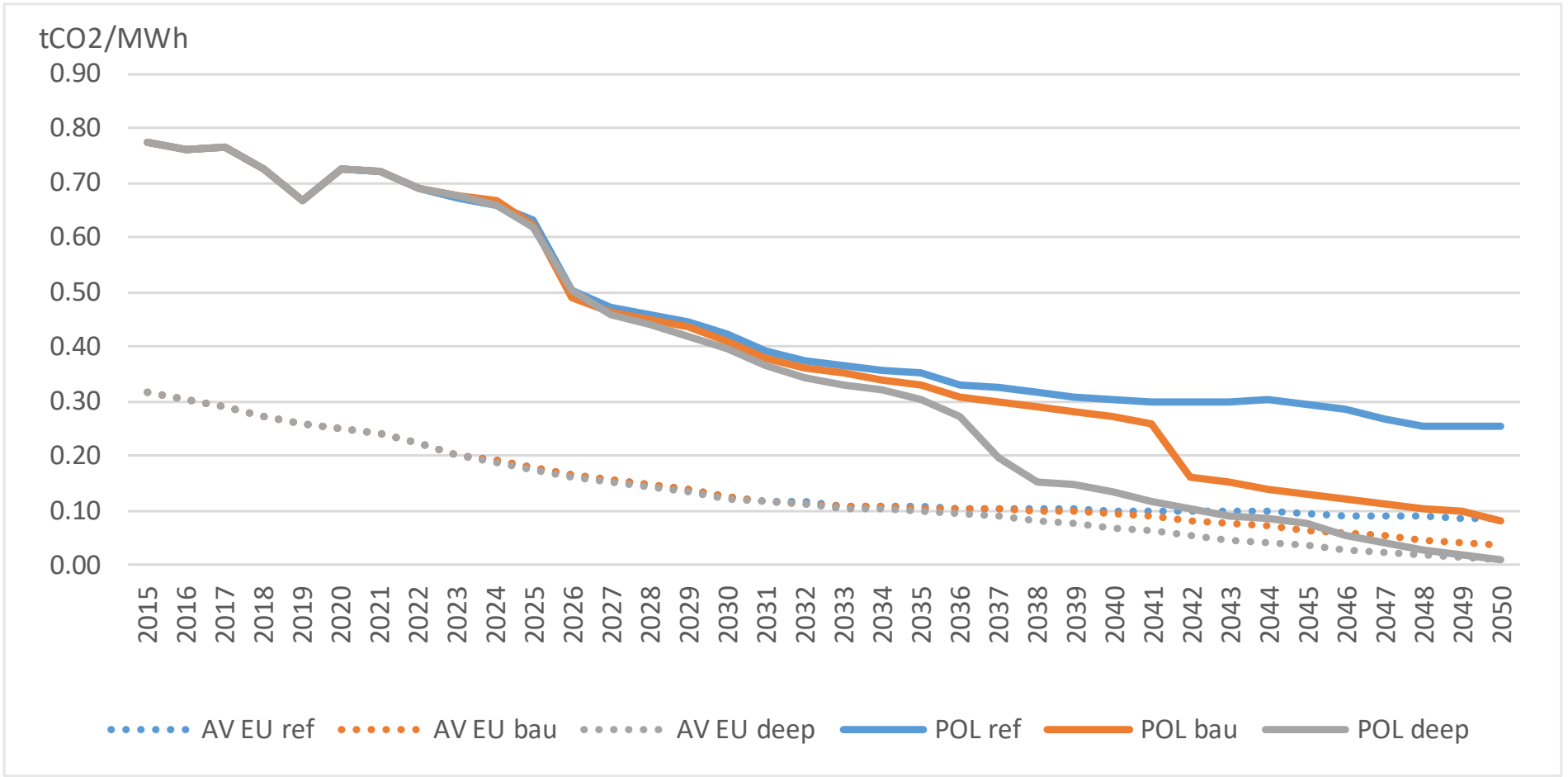
LOW EMISSION ENERGY SECTOR IN EU

- CO_2 emission in energy sector – **EU28 + Switzerland and Norway**



LOW EMISSION ENERGY SECTOR IN EU

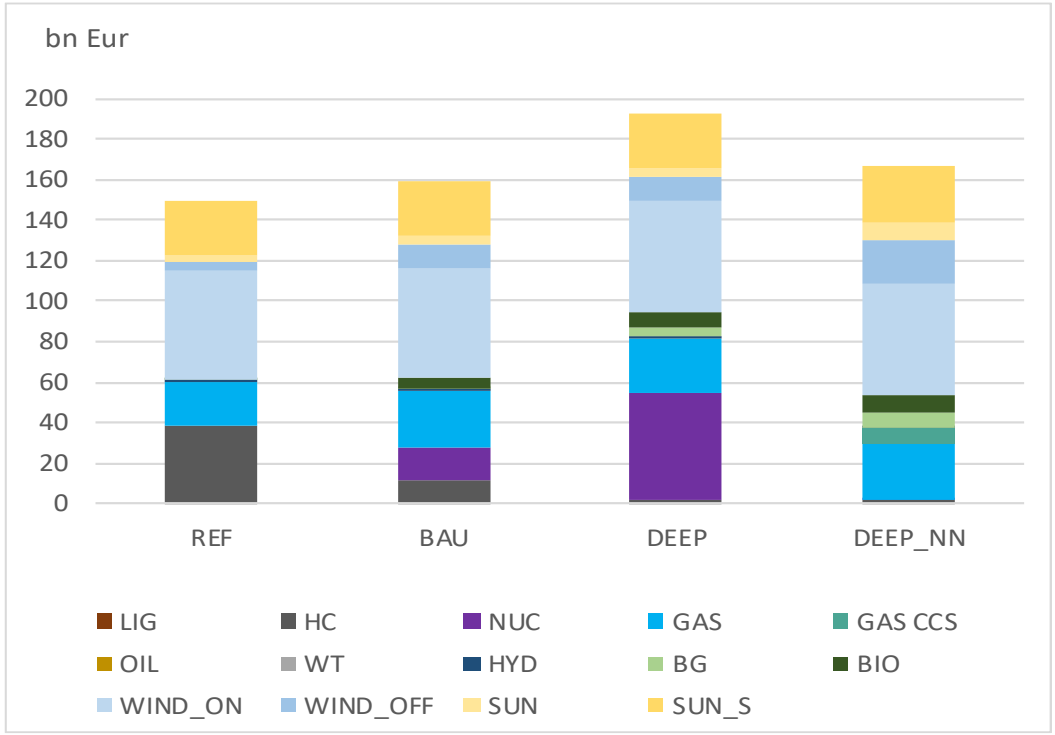
- CO_2 average emission intensity in energy sector **EU vs Poland**



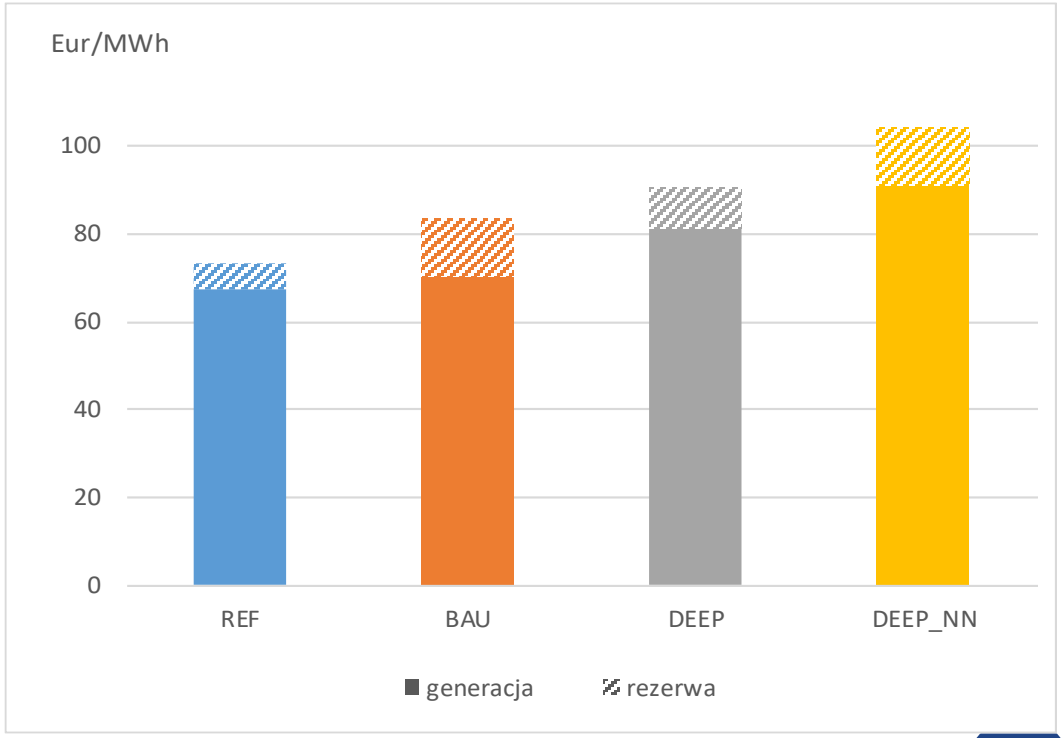
LOW EMISSION ENERGY SECTOR IN EU

- Investments in energy sector (2021-2055 period) and generation cost in Poland

TECHNOLOGICAL STRUCTURE OF INVESTMENTS (2021-2055)

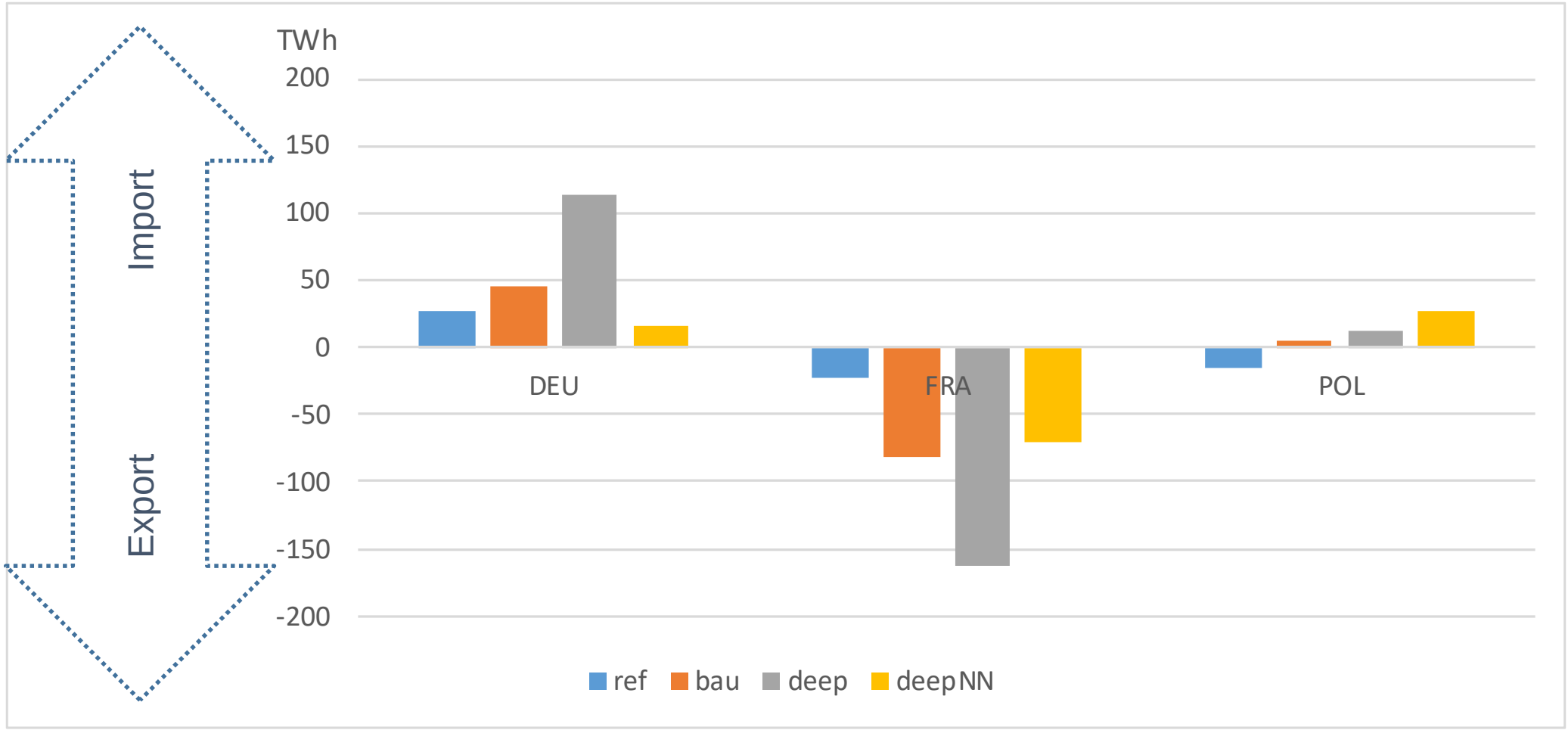


AVERAGE GENERATION COST IN 2048-2052 IN POLAND



LOW EMISSION ENERGY SECTOR IN EU

- Balance of cross-border exchange in the years 2048-2052 for selected countries



CONCLUSIONS

- Significantly reduced coal contribution over the next ten-year perspective in all scenarios. Share of renewables and natural gas (at least temporarily) is growing.
- Coal phase-out domestic policies have significant impact on emission reduction (by 50%) till 2030.
- Emission reduction by 95% in 2050 seems technically feasible but results in a significant increase in energy generation cost and marginal cost of emission reduction.
- Without new nuclear investments in Europe accomplishment of reduction target is still achievable but at significantly higher cost of energy supply (the gap is filled by renewable sources and gas turbines with CCS).
- Cross-border energy transmission capabilities will be an important factor in achieving reduction targets due to uneven distribution of nuclear power and different RES potentials in particular countries.
- Part of a district heat could be replaced by individual heating systems in deep emission reduction scenarios :
  - heat pumps and electric heaters – emission is “transferred” from heat to electricity but remains controlled by the EU-ETS and in line with overall emission reduction targets;
  - gas-fired boilers – emission escapes from the EU ETS since small individual home heating devices are not covered by the system (overall emission may rise).

Thank you!

LIFE Climate CAKE PL Team

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