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Market Potentials
A case study of Poland as a Central European market

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Plan of Presentation:

- Why Poland can be the potential market for CCS technologies?
- The goals of Energy Policy of Poland until 2030
- Measures for reach emission standards and CO2 emission reduction in energy sector
- Examples of undertaken activities in the field of CCS technology testing
- Conclusions

Poland (2010)

area: 312.679 km²
population : 38.500 mln
GDP: 354 616 mln EURO at current prices

electricity production: 157 TWh
of which 89% is based on hard coal and lignite
CO_2 emission from energy sector: 173 mln tonnes

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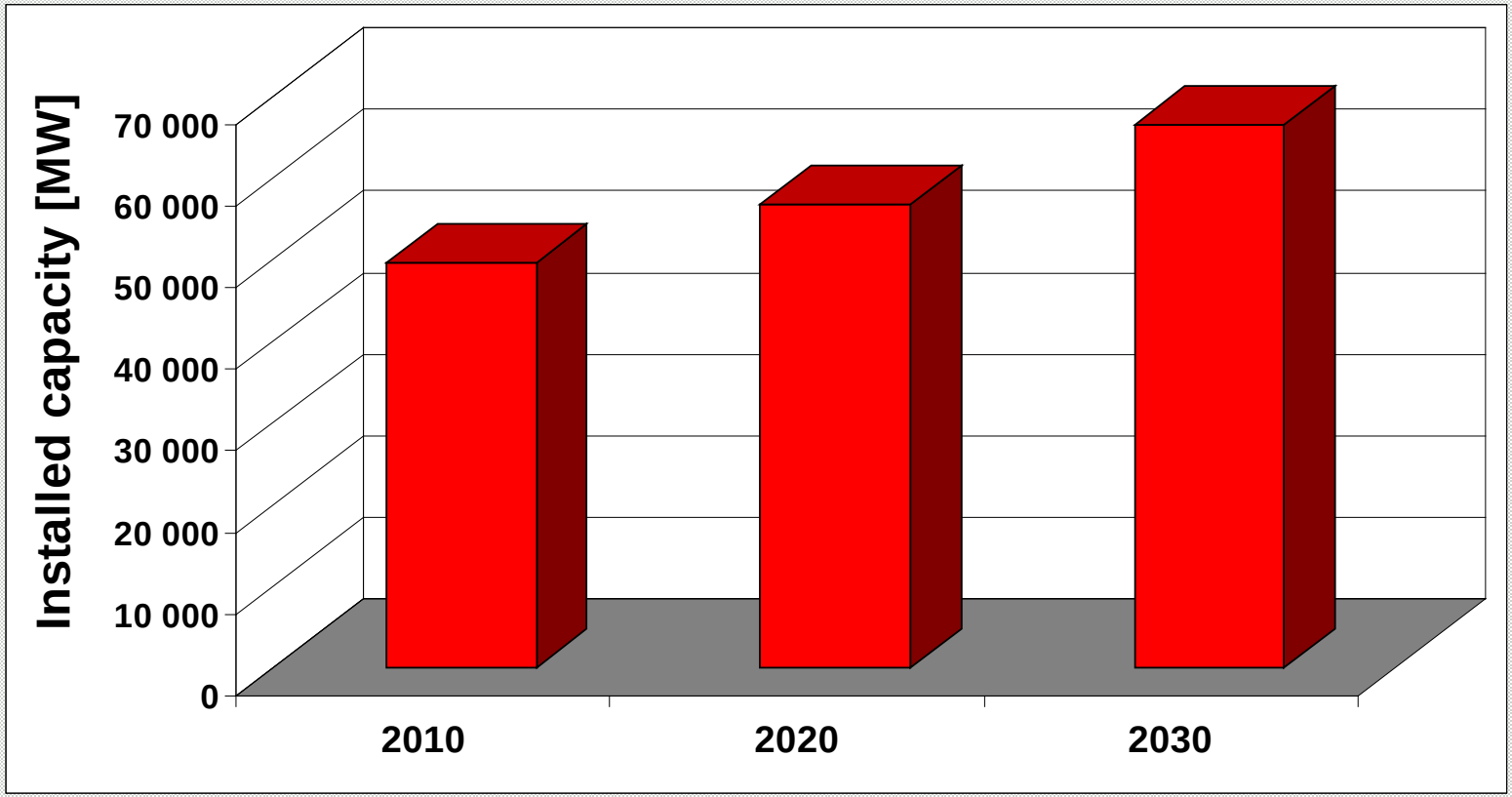
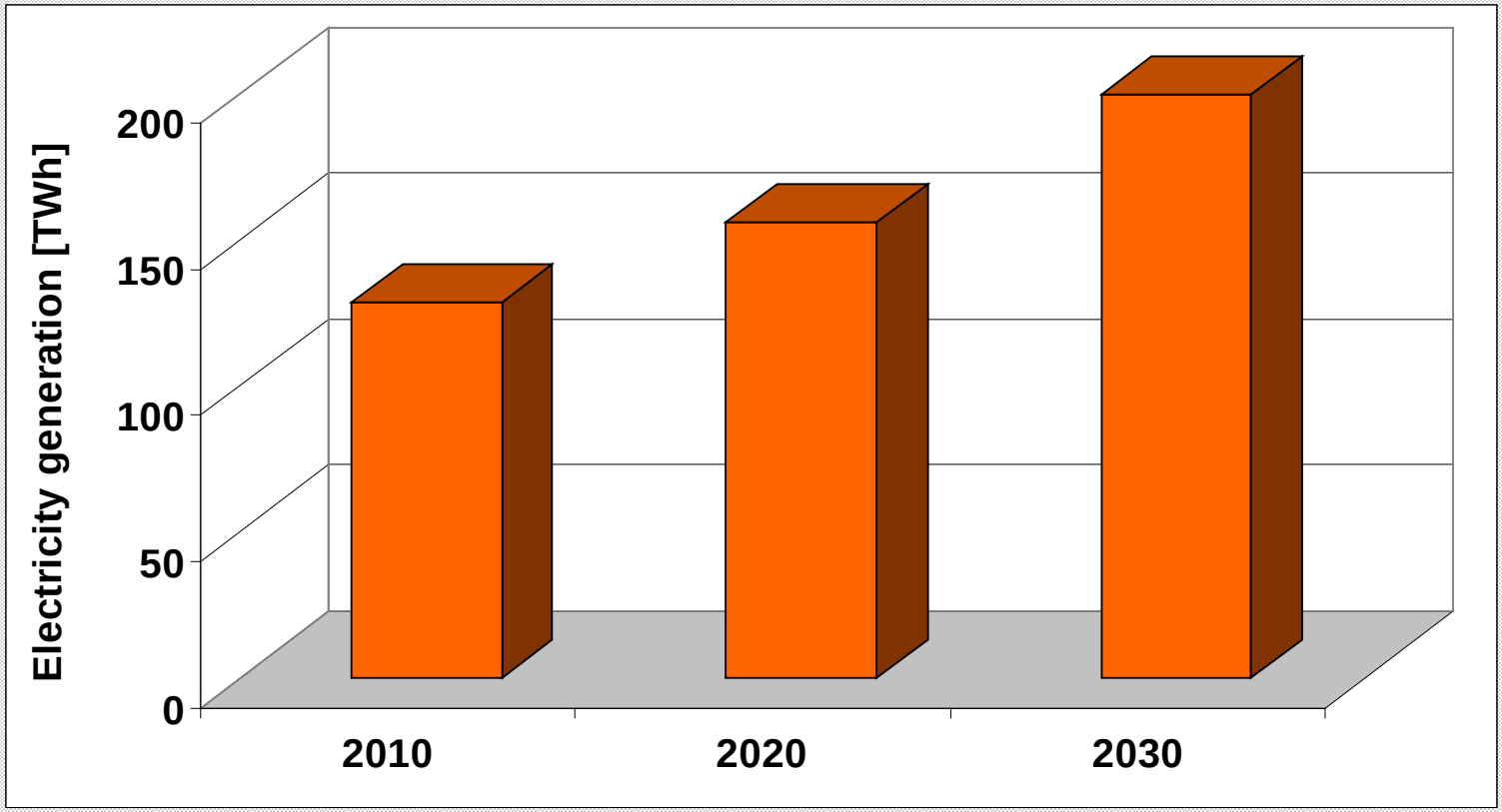


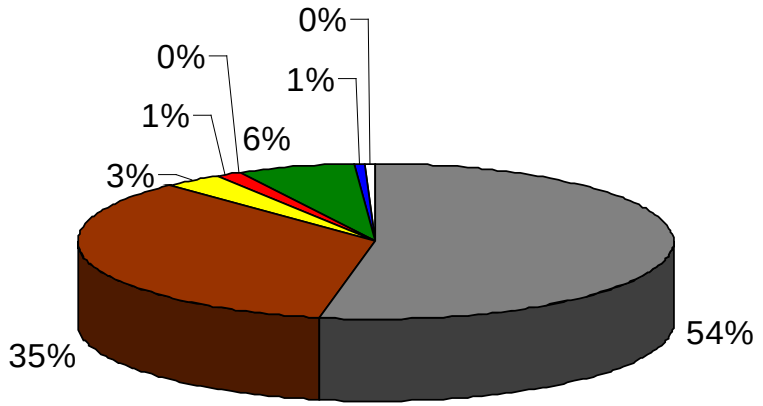
Capacity of gross electricity installed in 2010 and projection to 2030 (PP + CHP + industrial CHP) [MW]

based on: Energy Policy of Poland until 2030, Document adopted by the Council of Ministers



Generation of net electricity in 2010 and projection to 2030, [TWh]

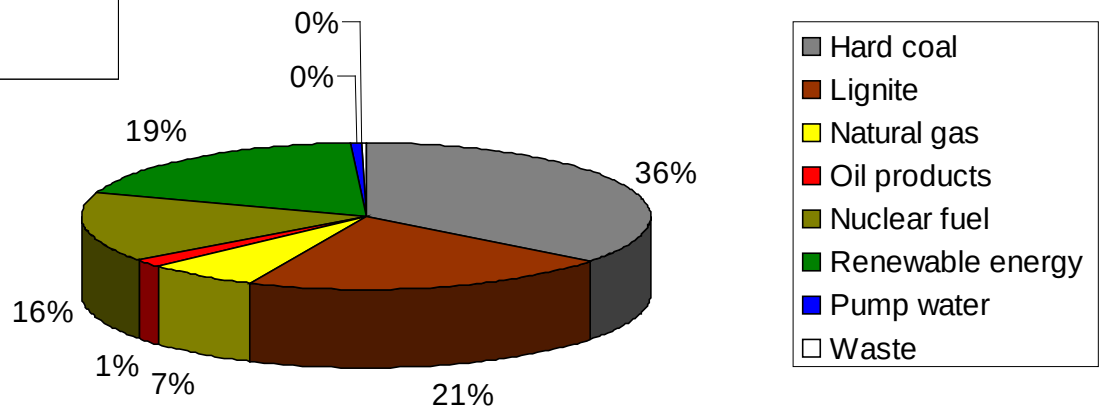
based on: Energy Policy of Poland until 2030, Document adopted by the Council of Ministers



2010

Decrease of percentage share of solid fuels for electricity generation between 2010 – 2030 **~ 32%**

Increase the share of natural gas for electricity generation by **130% between 2010 – 2030**



2030

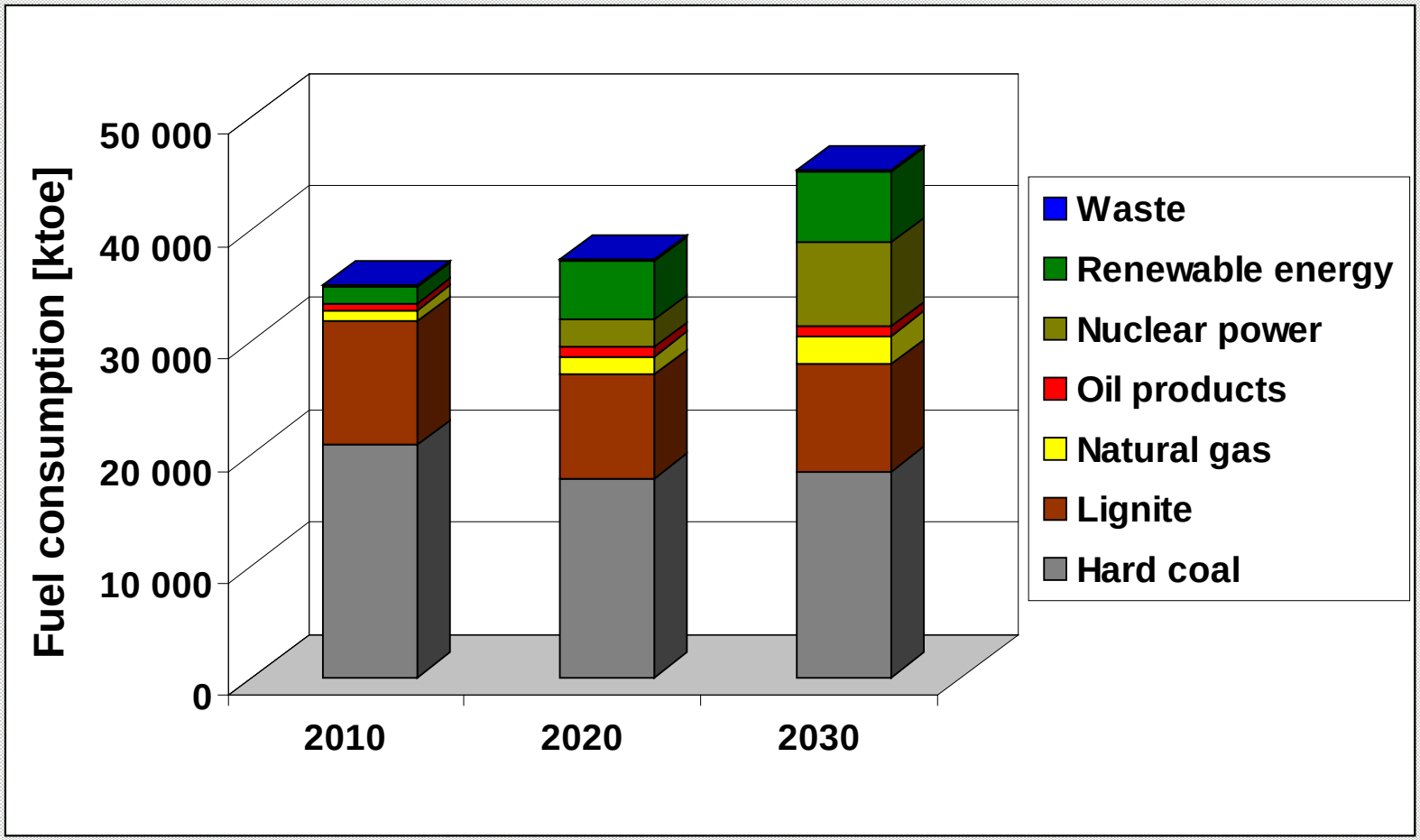
In the year 2030

19% share of renewable sources in energy generation,

16% share of nuclear fuel

Projected changes in the percentage share of fuels used for electricity generation between 2010 - 2030

based on: Energy Policy of Poland until 2030, Document adopted by the Council of Ministers



Projected changes in fuels consumption for electricity generation between 2010 – 2030 (including CHP), [ktoe]

based on: Energy Policy of Poland until 2030, Document adopted by the Council of Ministers

The main Energy Policy objectives in the area of environment

- **<u>Reducing CO2 emission by 2020, while maintaining a high level of energy security,</u>**
- Reducing emission of SO2, NOx, and dust to the level set forth in the current and drafted EU regulations,
- Reducing the negative impact of the power sector on the condition of surface water and groundwater,
- Minimising waste dumping by using them in the economy to the greatest possible extent
- **<u>Changing the structure of energy generation towards low-emission technologies</u>**

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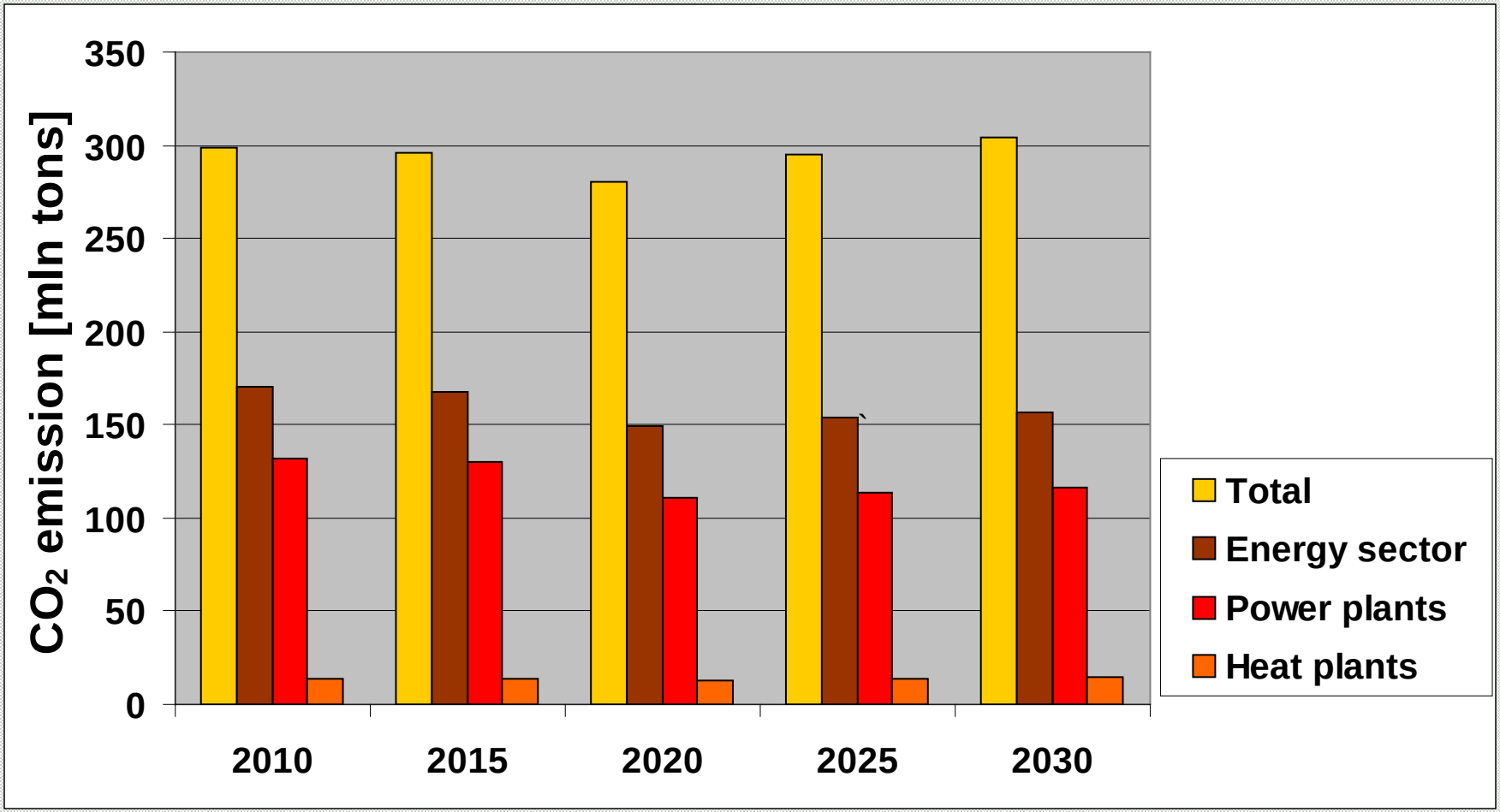
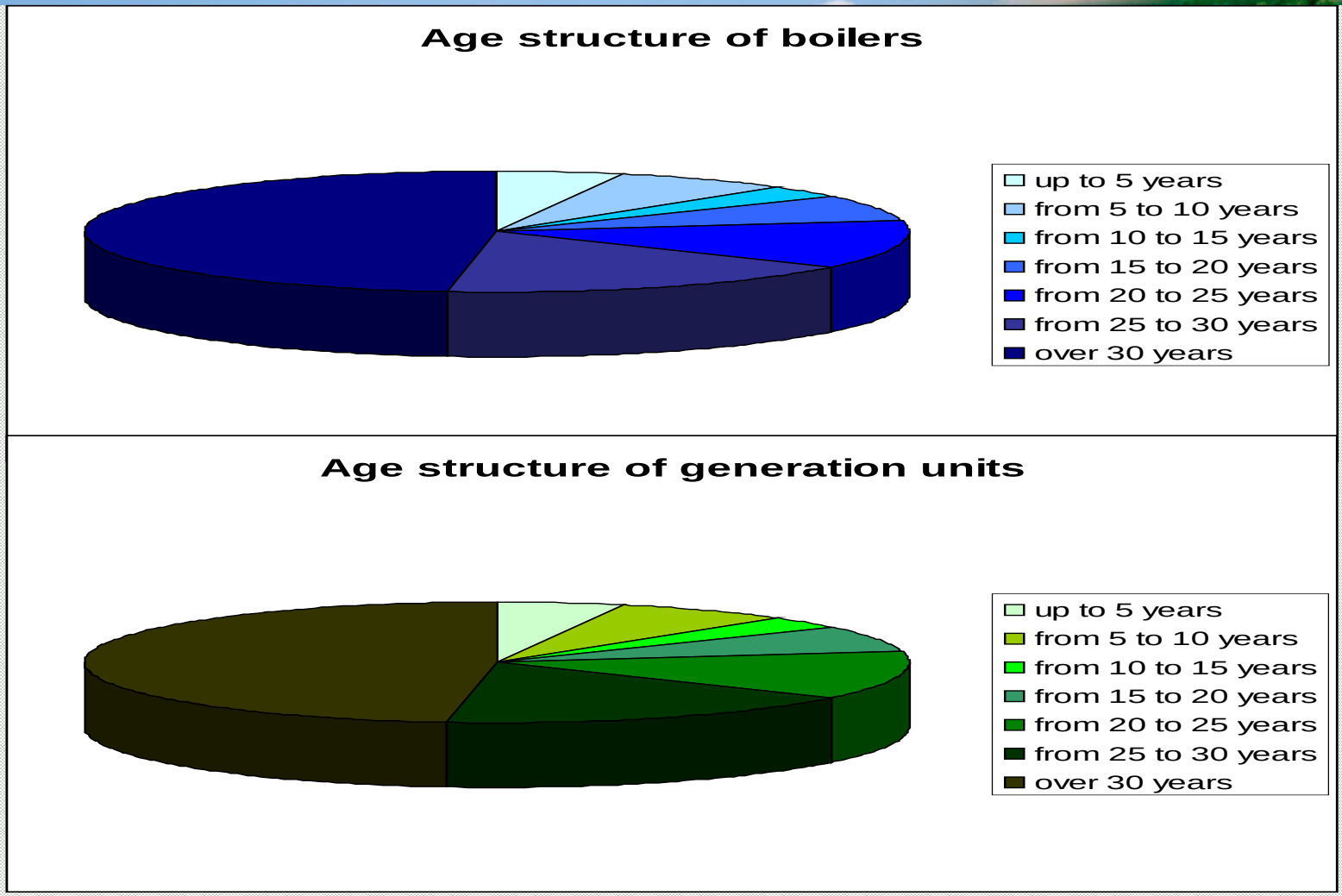


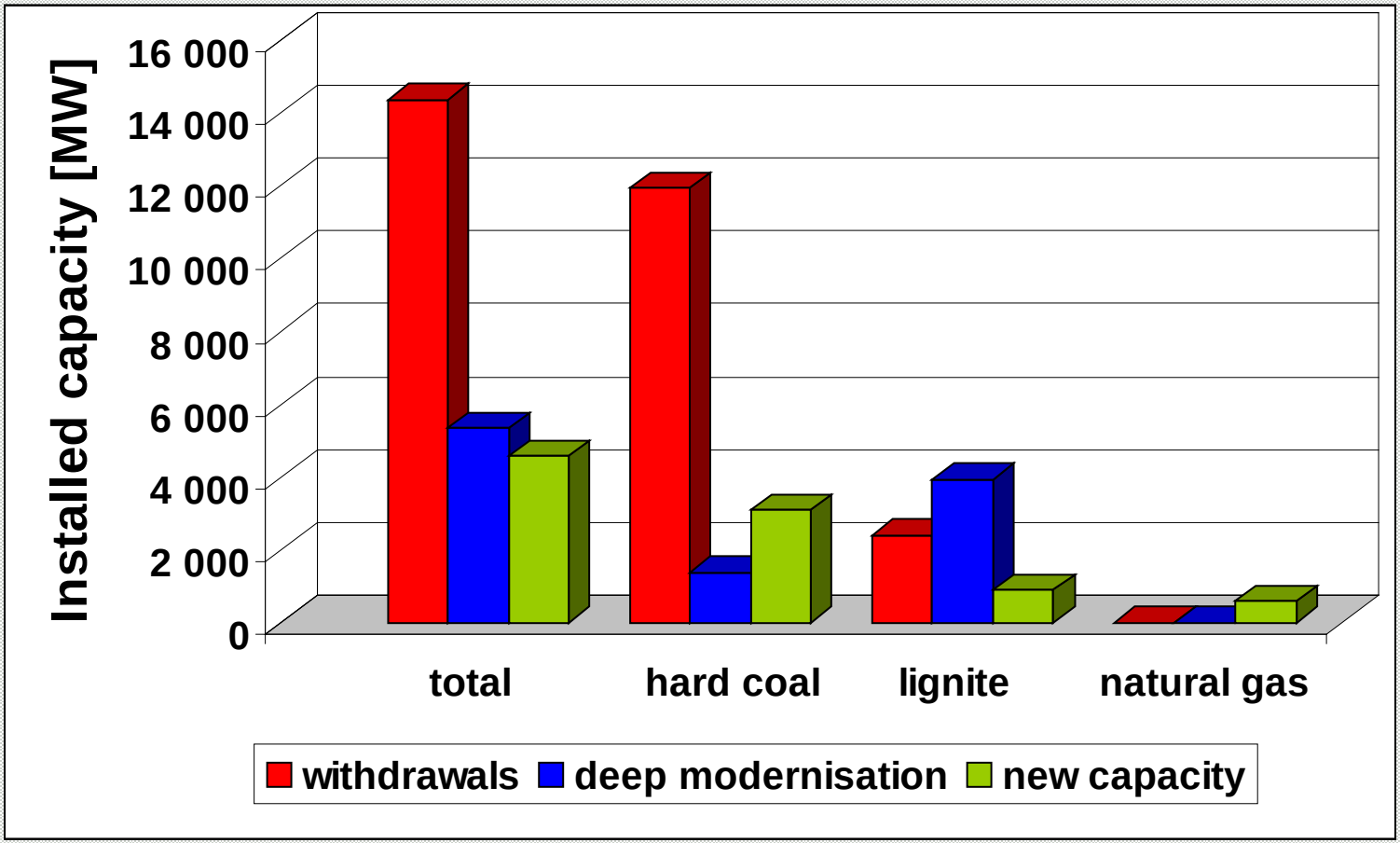
Projected changes in CO2 emission in Poland between 2010 – 2030, [mln tonns]

based on: Energy Policy of Poland until 2030, Document adopted by the Council of Ministers



Age structure of boilers and energy generation units, state for the year 2010

source: Energy Regulatory Office



Planned and forecast withdrawals, deep modernisation and gains/recoveries of gross generation capacity in power plants in the years 2010 – 2030, [MW]

based on: Energy Policy of Poland until 2030, Document adopted by the Council of Ministers

Measures aimed at mitigating the environmental impact of power industry (1)

- Establishing a system to manage national emission caps of greenhouse gases and other substances
- Introduction of acceptable product emission rates for electricity and heat generation as a tool which allows reducing SO2 and NOx emission levels and reaching the emissions from NEC Directive
- Meeting the commitments for the power and heat sectors stemming from the new ETS Directive (Directive 2009/29/EC)
- Using the income from auctions of CO2 emission allowances to support measures aimed at reducing greenhouse gas emission volumes

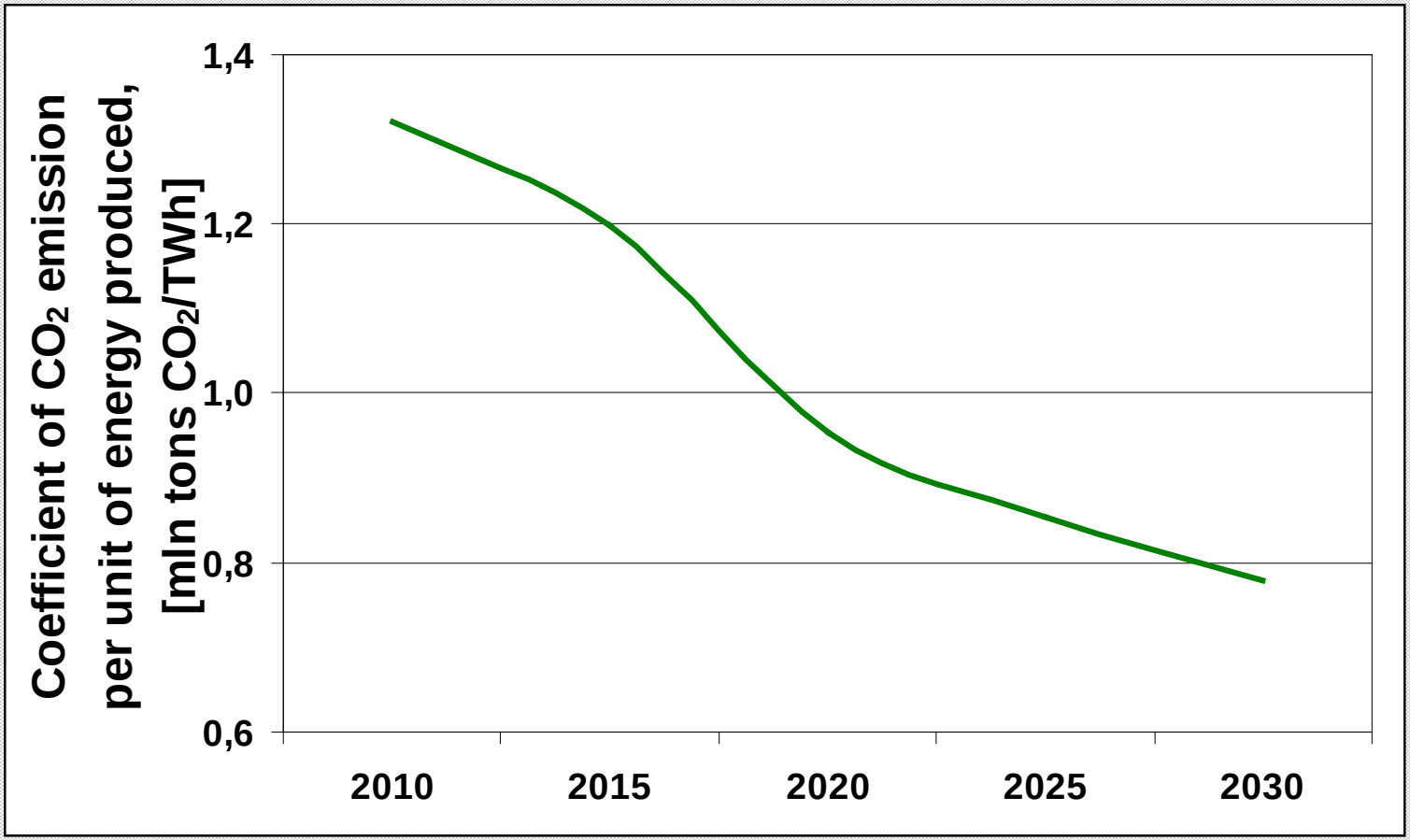
Measures aimed at mitigating the environmental impact of power industry (2)

- Introducing standards for building new power plants under the system of preparation for carbon capture and setting national capacity for geological CO2 storage, including in empty crude oil and natural gas deposits at the bottom of the Baltic Sea
- Active participation in implementing the initiative of the EC to build large-scale demonstration facilities for carbon capture and storage (CCS) technologies
- Intensifying research and development on the CCS technology and on new technologies which allow using captured CO2 as a raw material by other industry branches

Measures aimed at mitigating the environmental impact of power industry (3)

- Applying CCS technologies to support crude oil and natural gas extraction
- Industrial use of waste coal
- Increasing the use of incineration by-products
- Using high-efficiency closed cooling cycles in power plants and in heat and power stations
- Diagnosing the possibility of unintended production of POPs (dioxins and furans) by the power sector
- Supporting measures in respect of environmental protection with the use of, inter alia, European funds.

Anticipated effects of measures aimed at mitigating the environmental impact of power industry in the field of CO2 (1)



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Anticipated effects of measures aimed at mitigating the environmental impact of power industry In the field of CO2 (2)

The “Energy Policy of Poland until 2030” takes into account the measures allowing Poland to meet the obligations stemming from the regulations of the European Union currently in force.

Measures aimed at implementing the draft legal acts comprising the energy and climate package adopted by the European Parliament were particularly taken into account.

Anticipated effects of measures aimed at mitigating the environmental impact of power industry In the field of CO2 (3)

Introducing standards for building coal-fired power plants within the system of preparation for CO2 capture resulting from the new EU regulations will allow quickly introduce those technologies when they are ready for commercial use.

It is anticipated that at least two CCS demonstration facilities will be located in Poland.

Specific aspects of CCS implementation in Poland

Positives

- CO2 emission reduction
- modernisation of energy sector
- leadership in the development of CCS
- Internal diversification of energy sector
- Increased EU financial support
- CCS technology forming an integral part of the IGCC technology, allows not only to separate CO2 to be sequestered in the pre-processing system, but also to produce pure hydrogen - the cleanest fuel
- Increasing oil and gas production whilst disposing significant amount of CO2

Specific aspects of CCS implementation in Poland

Negatives

- implementation of CCS technology is associated with enormous costs regarding both development and implementation as well as operation and maintenance, which ultimately must translate into greatly increased prices of electricity
- additional amount of energy needed to operate the process of capture, transport and storage of CO2 requires greater consumption of coal (about 10%)
- revision of current legislature is required to provide a legal basis for CCS operations

Current state (1)

- national program “Identifying geological formations and structures for safe CO2 storage with monitoring program” is currently underway
- Poland has good conditions for underground CO2 storage (90 billion tons *[US trillion]*)
- Polish CCS Strategy “How to efficiently implement CCS in Poland?” was developed in 2011 within the framework of the project “Carbon Capture and Storage as a preferred technology for mainstreaming the clean use of coal in Poland”. The project has been supported by the Global CCS Institute.

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Current state (2)

one large-scale demonstration CCS installation is under construction **in Belchatow**. CCP of size equivalent to >250 MW and the CO2 capture efficiency of >85% utilizing the Advanced Amine Process (AAP) will be integrated with the 858 MW unit operated since September 2011 in power plant based on lignite. Actually the generation unit obtained the Capture Ready status. CO2 will be transport by a pipeline to the storage site. CO2 Storage will include the injection of pressurized CO2 into the ground (deep saline aquifers) for permanent storage.

Current state (3)

Second project is realised in **Lagisza Power Plant**; its goal is CO2 sequestration by preasure swing adsoption on the energy generation unit of 460 MW

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Current state (4)

Mobile CCS unit for CO2 capture from exhausted gases , based on adsoption in liquid amine sorbents, developed by Institute for Chemical Processing of Coal in Zabrze will be tested **this year** in **Laziska Power Plant**

and **in 2014** in **Jaworzno III Power Plant**

Conclusions:

- Poland is the potential market for CCS technologies because :
  - according to EU and national emission standards for power plants, most of the energy production units must be withdrawal up to 2030,
  - many of energy generation units need deep modernisation in the same period of time,
  - new low emission technologies are welcome in energy sector to fulfill Polish international obligations on the emission reduction including CO2
  - in the Energy Policy of Poland up to 2030 implementation of CCS is one of the measures for improve the environmental standards

Thank you for the attention