

# INPRO Dialogue Forum on Drivers and Impediments for Regional Cooperation on the Way to Sustainable Nuclear Energy Systems



Nuclear Energy Department  
Ministry of Economy



# Content

- Polish Energy sector
- Polish Nuclear Power Program Power System in Poland
- Benefits for the economy
- Public opinion and information campaign



# Power System in Poland

- Installed generation capacity (gross): ~ 35.7 GW
- The maximum demand - more than 25 GW
- Annual production of electricity: more than 150 TWh



# Challenges for the Polish Power Sector



## 1. Security of electricity supply

- Diversification of fuel mix
- Development of interconnections and transmission grid

## 2. Restrictions on SO<sub>2</sub>, NO<sub>x</sub>, CO<sub>2</sub> emissions

## 3. Development of new generation sources

## 4. Increase in electricity generation efficiency





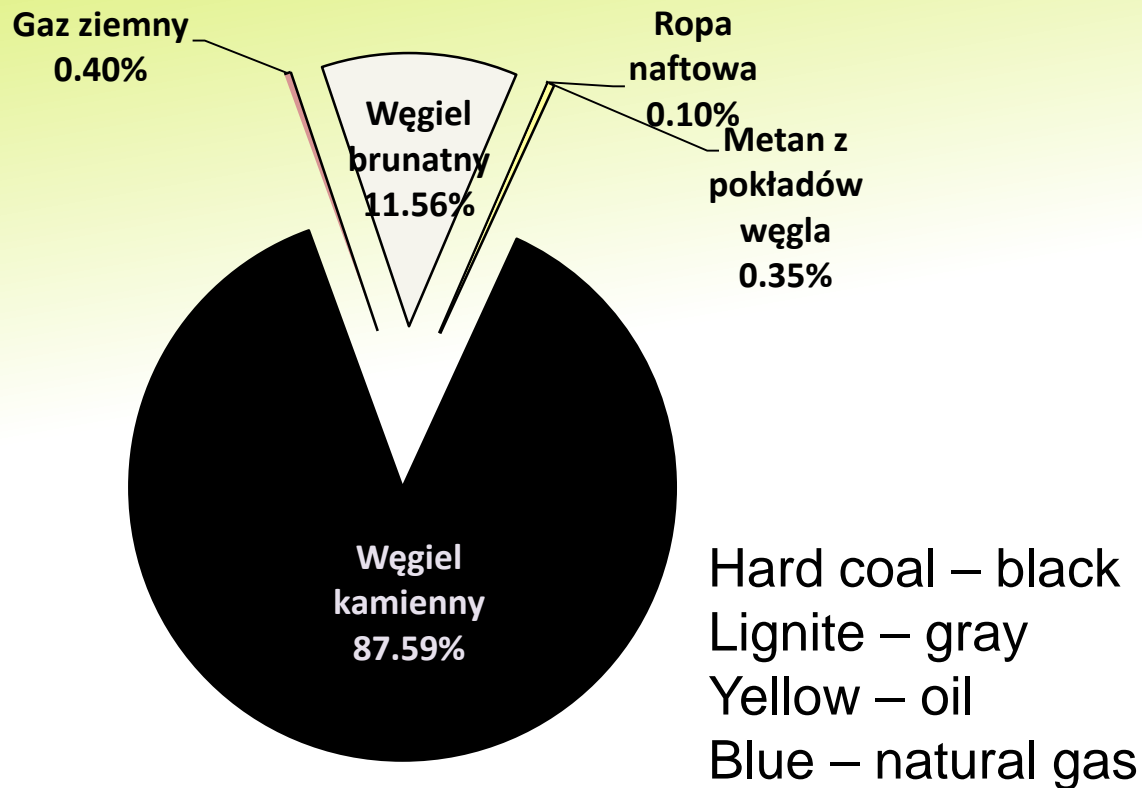
## **EU Climate Energy Package – Additional Challenges**



- 1. New Emission Trade Scheme (ETS) – linear decrease of available CO<sub>2</sub> allowances**
- 2. Full auctioning within ETS for electricity sector since 2020**
- 3. 15% share of RES in final energy consumption in 2020 – target for Poland**
- 4. Implementation of CCS technology – participation in the EU Flagship Programme**



## Domestic energy resources







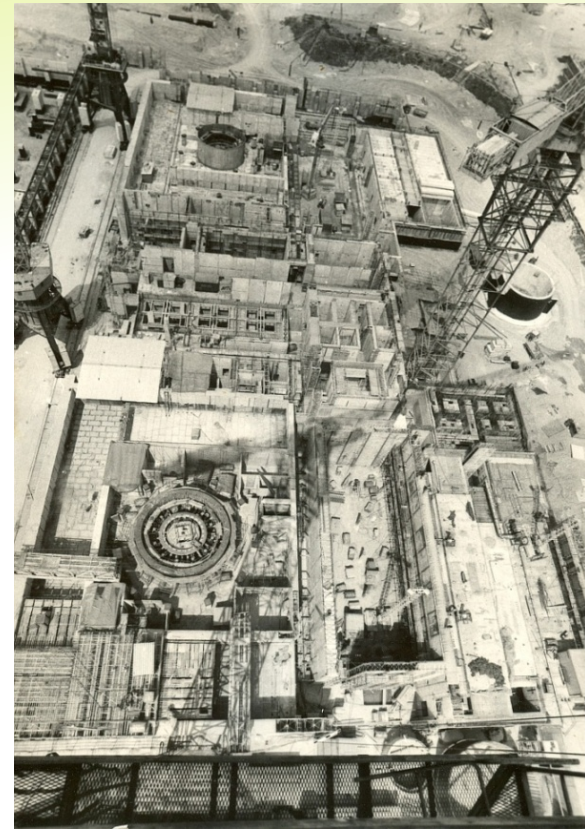
# MINISTRY OF ECONOMY, POLAND

## Introduction –basic information on Country situation



Poland has no NPPs, project of the first NPP, planned at Zarnowiec (two units WWER-440/V213 - construction started in 1985) was abandoned in 1990.

- Mining of uranium ore ended in 1968, and processing was terminated in 1973, being not a source of any new waste at present.
- Domestic nuclear installations other than NPPs (research reactors, spent-fuel, radwaste facilities) in **2 sites** in central Poland (**LILW + SF**)





# MARIA research reactor

- Nominal Power : **30 MW(t)**
- Thermal neutron flux density in the core  **$4 \cdot 10^{14}$  n/cm<sup>2</sup>·s**
- The reactor is operated 4000 hours per year over the 80-person team







## Nuclear Power Plants in Polish power system

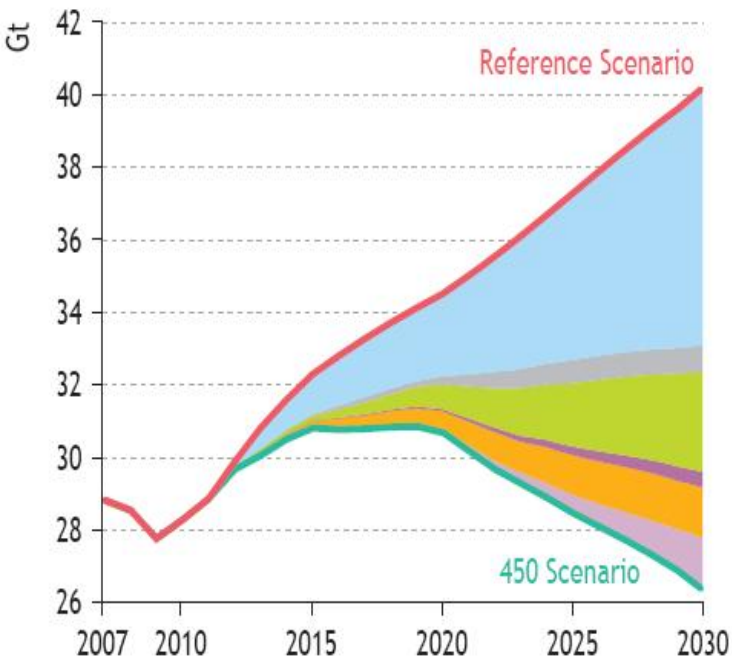
- stable and reliable electricity generation sources with 60-year lifetime
- new capacities to replace old public power plants; limiting import of coal
- predictable and stable in long time period electricity generation costs,
- possibility of fuel storage for many years ahead
- known spent fuel and radioactive waste management technologies;
- possibility of uranium suppliers selection from various regions and stability of fuel supply
- internalization of numerous external costs
- CO<sub>2</sub> and other emission free





# MINISTRY OF ECONOMY, POLAND

## The cost of reducing CO2 emissions in different technologies



	Abatement (Mt CO <sub>2</sub> )		Investment (\$2008 billion)	
	2020	2030	2010- 2020	2021- 2030
Efficiency	2 517	7 880	1 999	5 586
End-use	2 284	7 145	1 933	5 551
Power plants	233	735	66	35
Renewables	680	2 741	527	2 260
Biofuels	57	429	27	378
Nuclear	493	1 380	125	491
CCS	102	1 410	56	646

**bln \$/Mt CO2**  
**0,73**

**0,80**

**0,10**

**0,82**

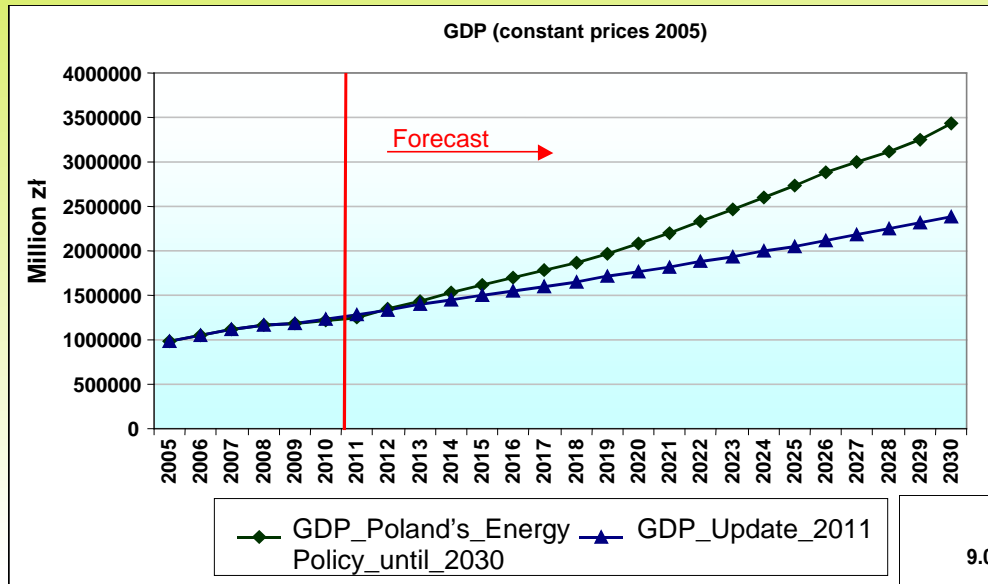
**0,83**

**0,33**

**0,46**

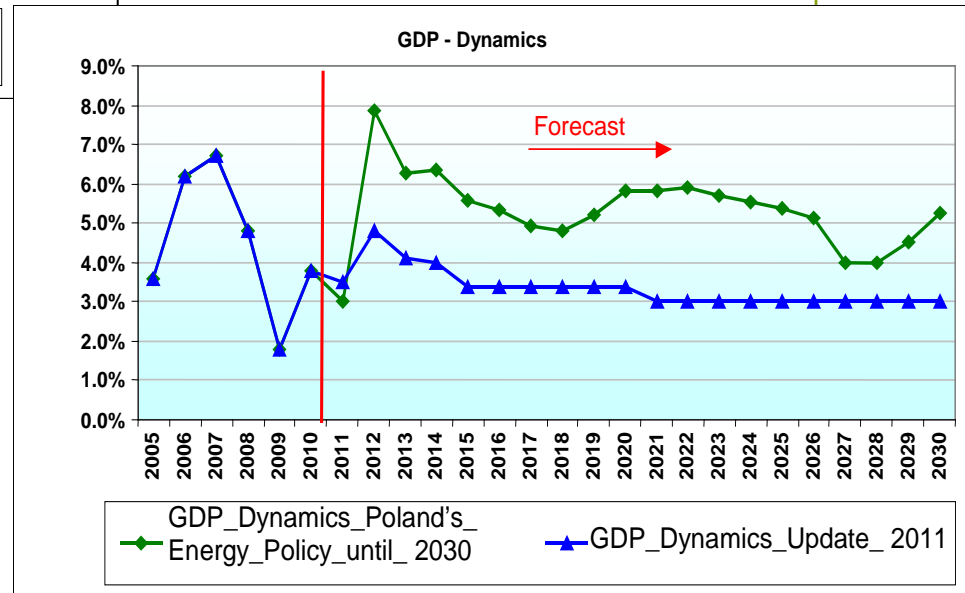


## PROGNOSIS OF GDP for Poland until 2030



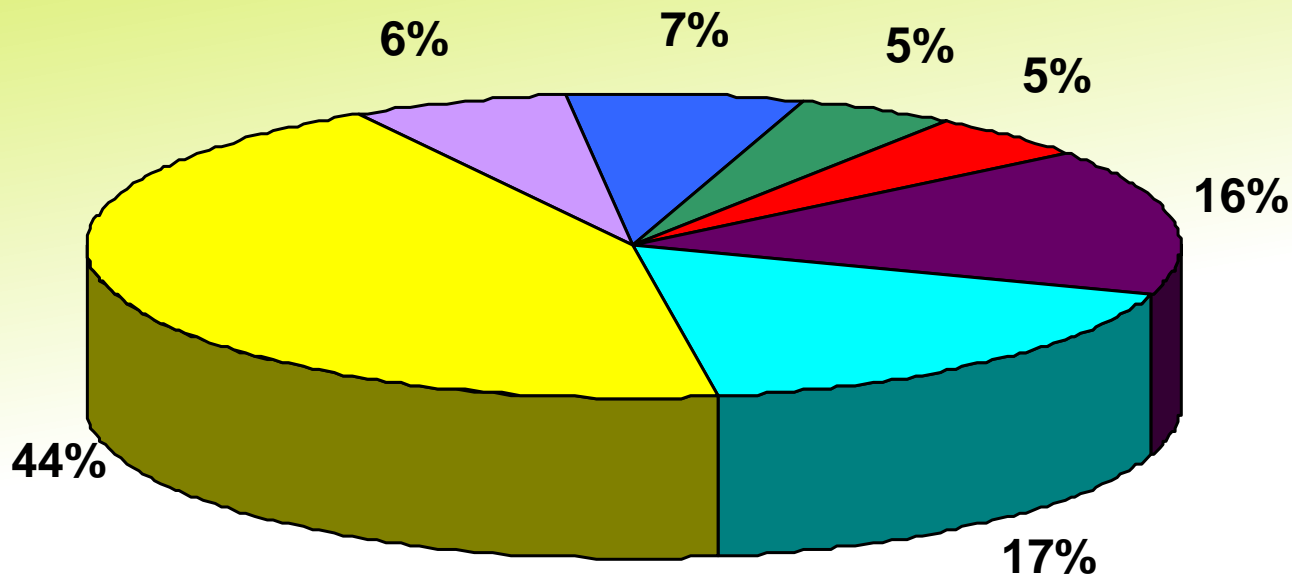
Comparison of GDP forecasts in absolute values

Comparison of GDP increase dynamics





## Age Structure of the Existing Power Plants in Poland



to 5 years

5-10 years

10-15 years

15-20 years

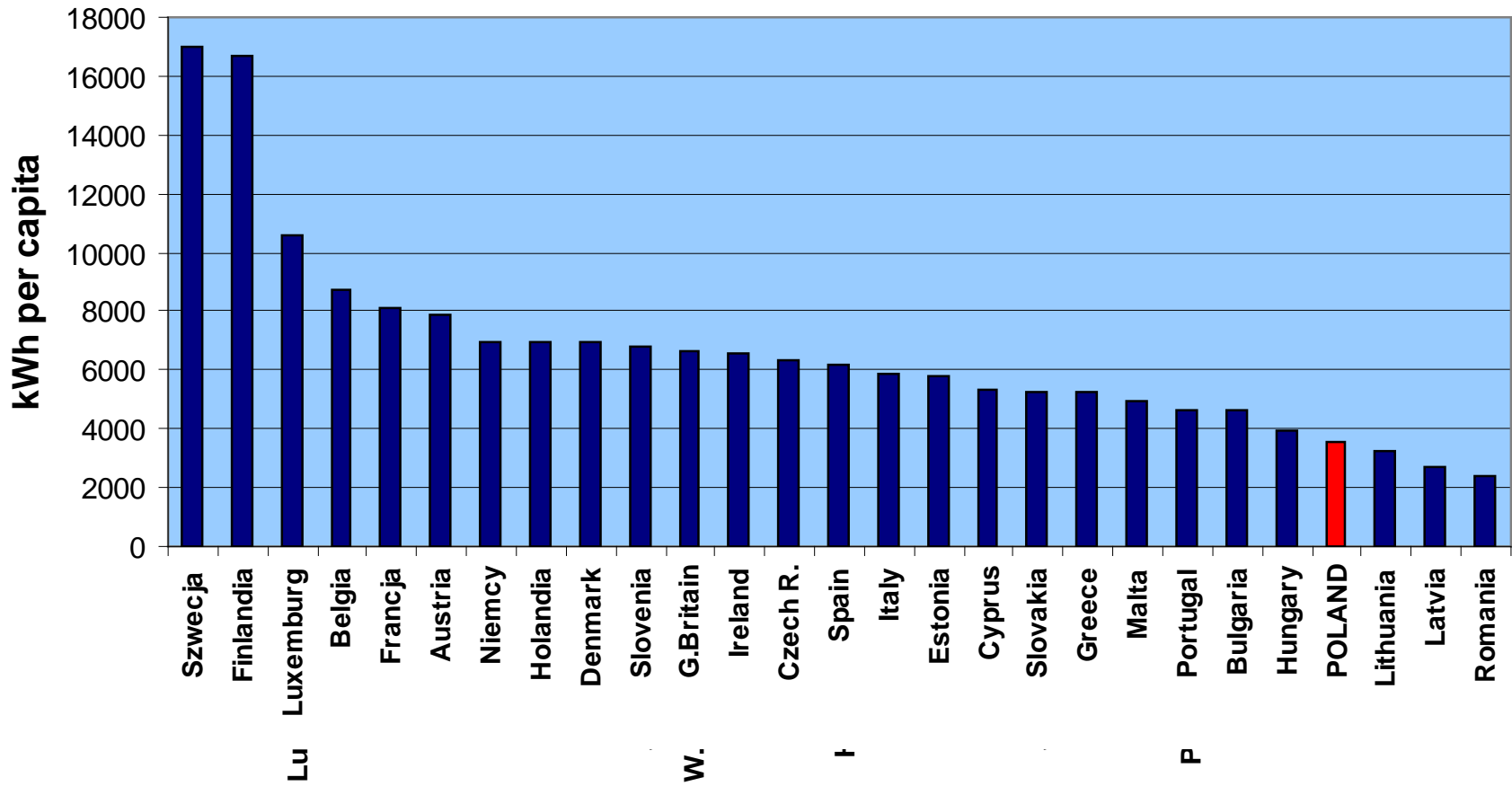
20-25 years

25-30 years

over 30 years



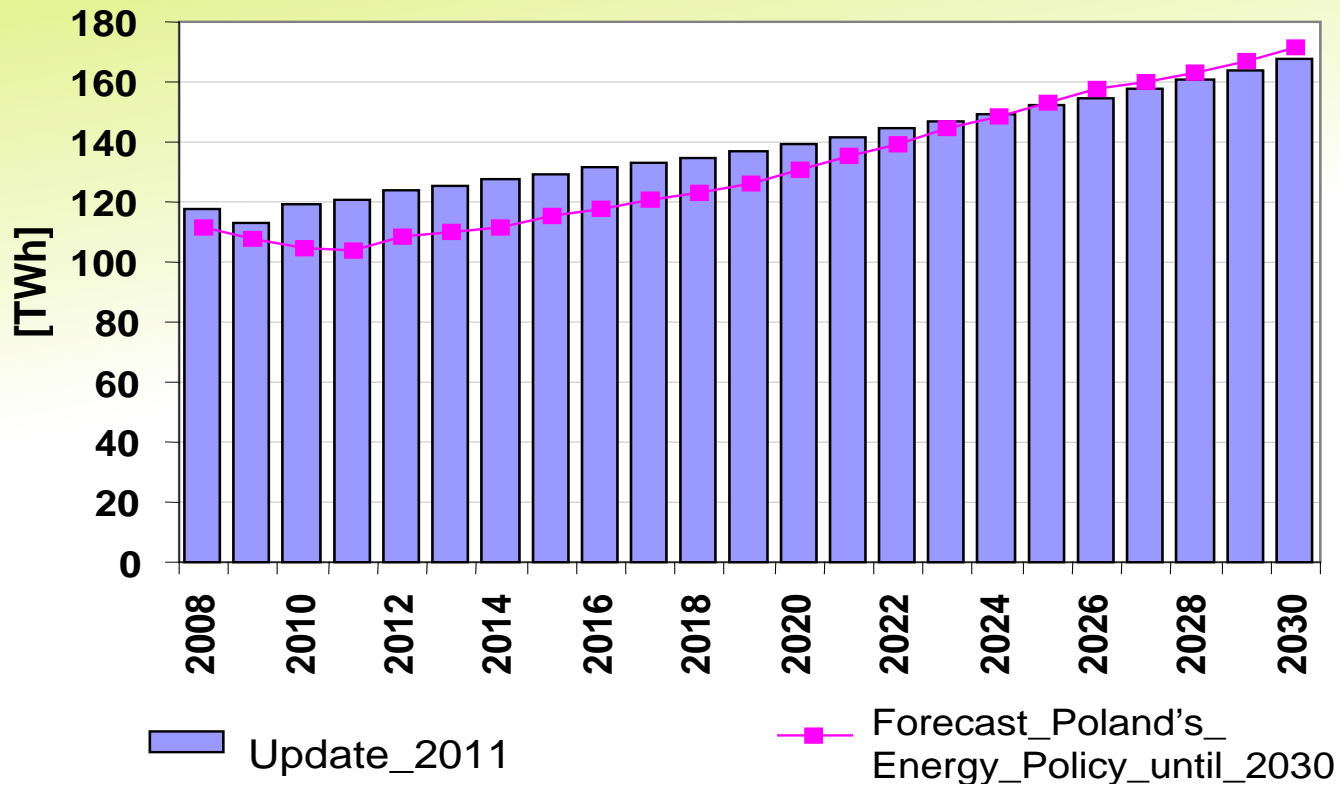
# Using of Electricity





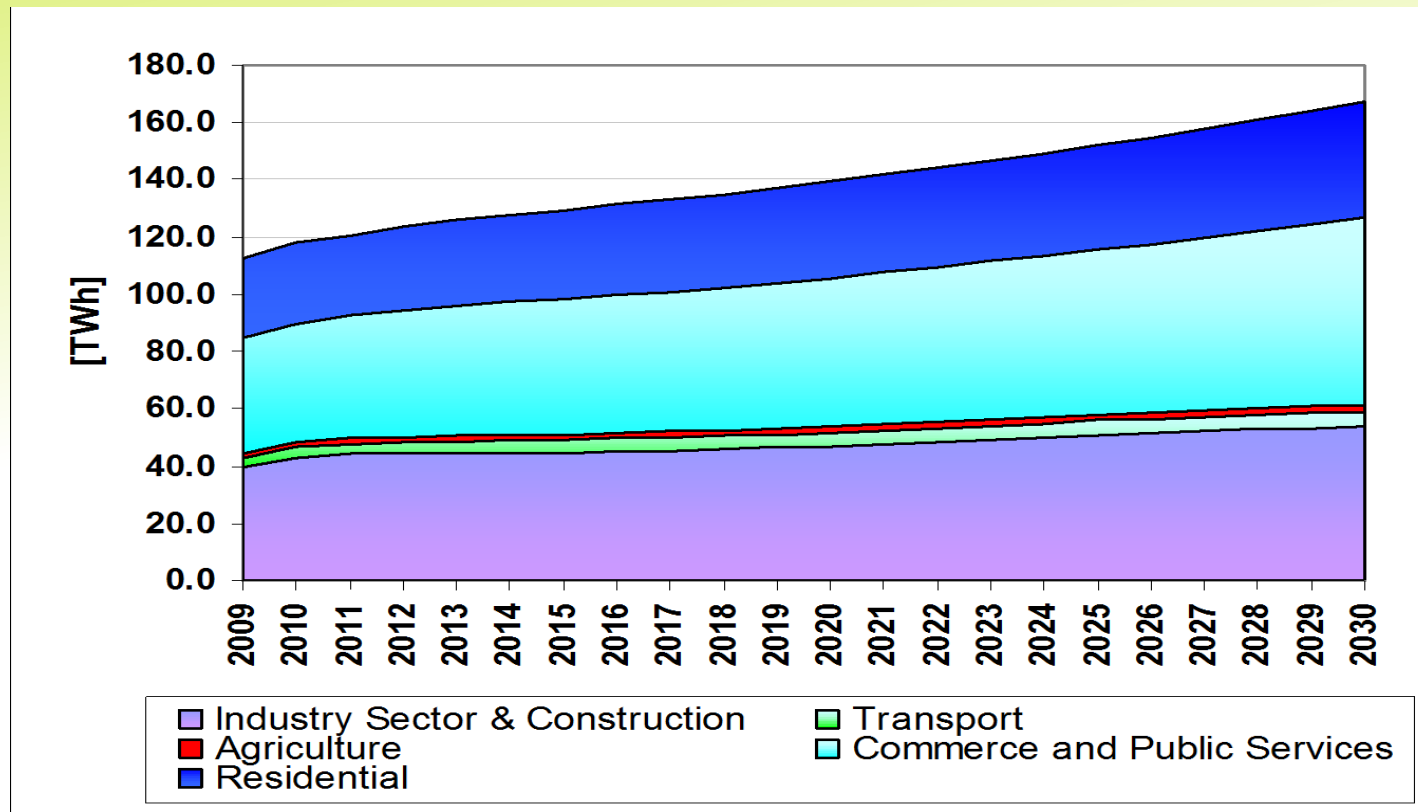


## Update of forecast for electric energy demand until 2030



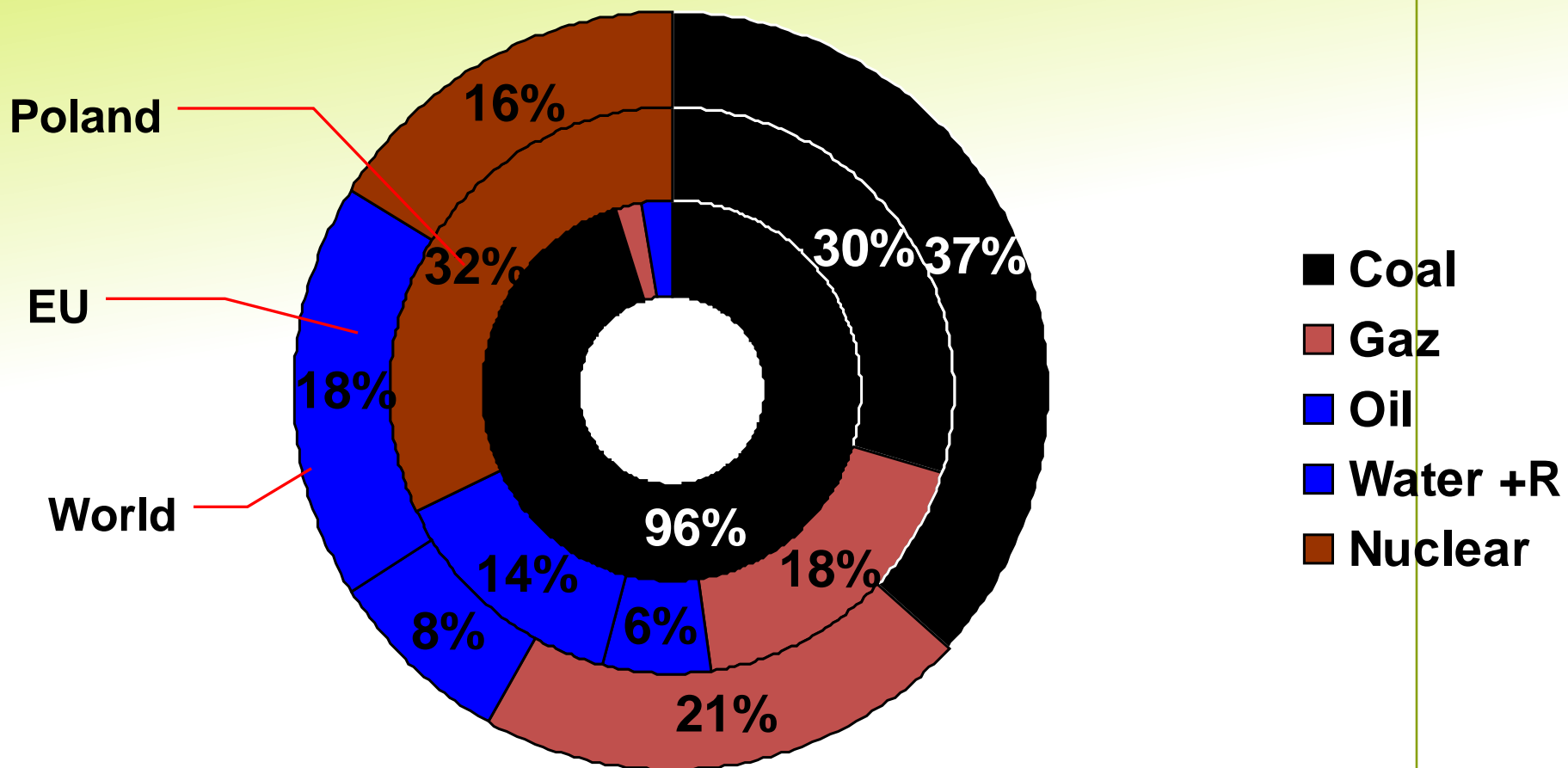


## Prognosis of demand for electric energy for various sectors





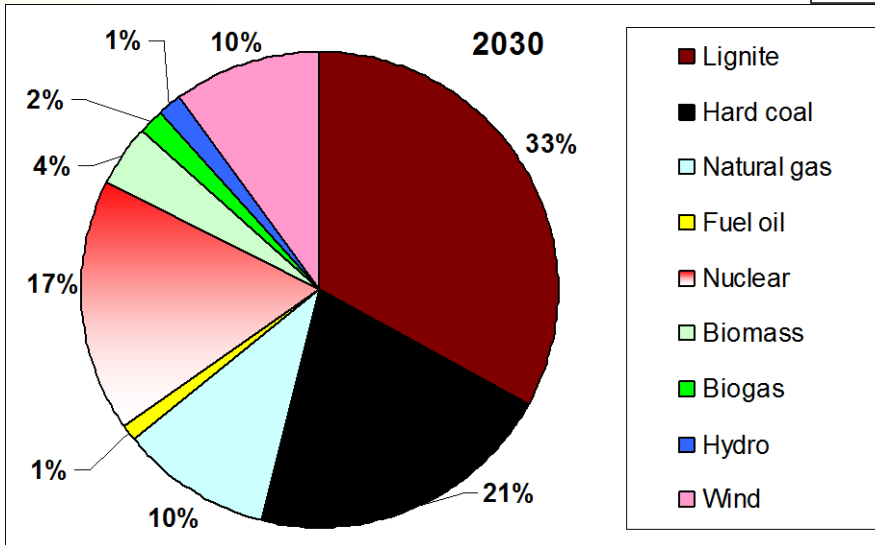
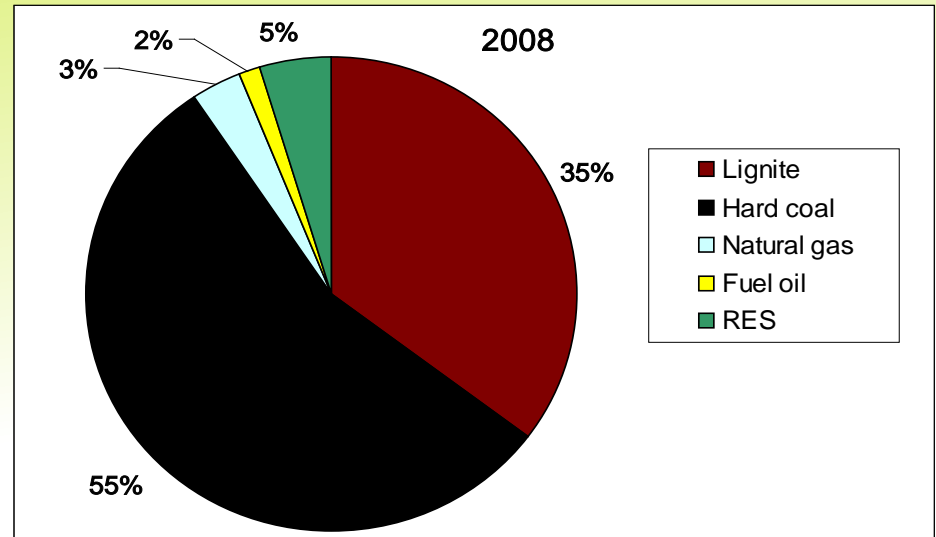
## Fuel Structure of Electricity Generation





# Energy mix of electric energy generation

2008



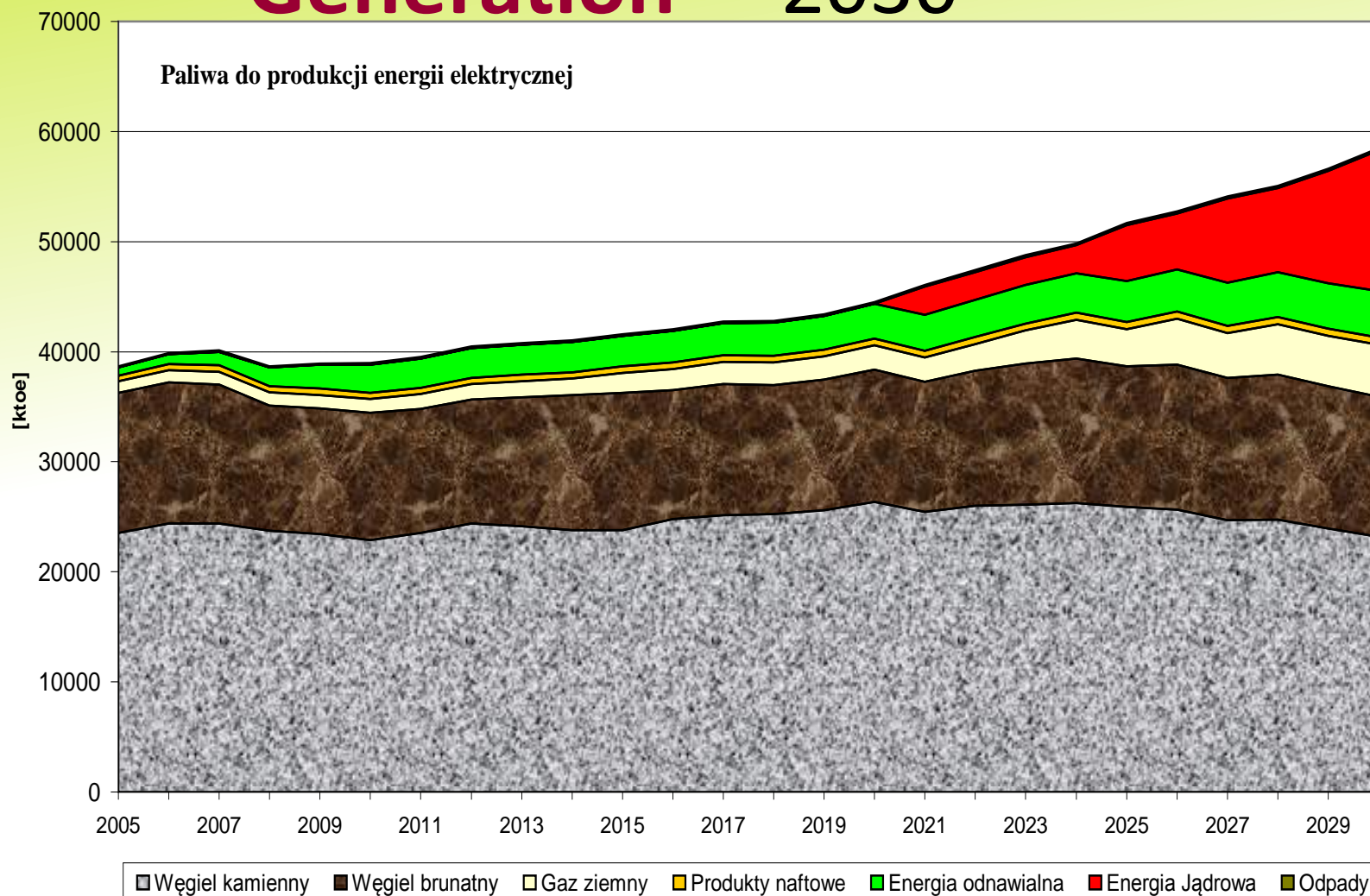
2030



MINISTRY OF ECONOMY, POLAND

# Fuel Structure of Electricity

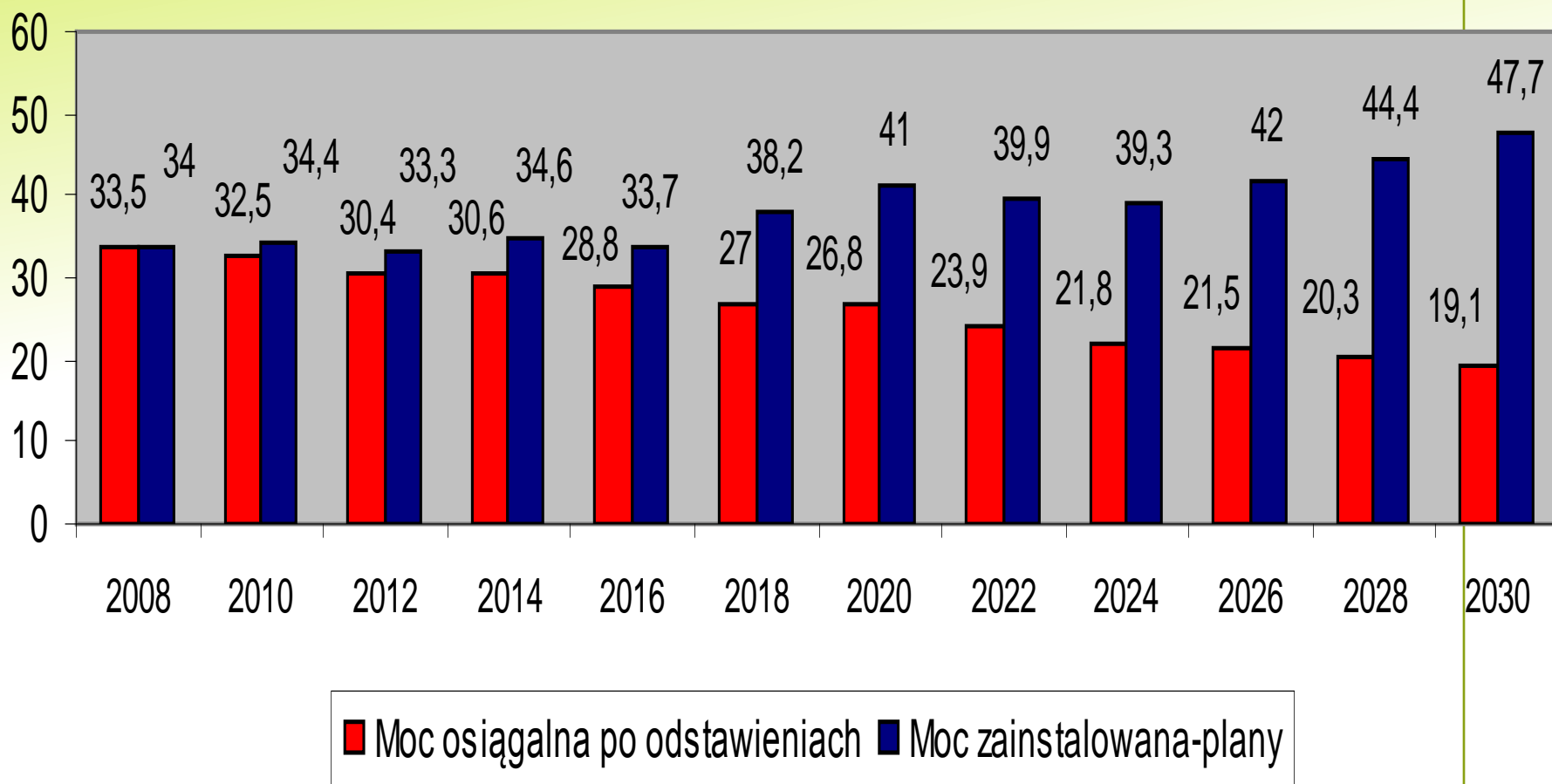
## Generation – 2030





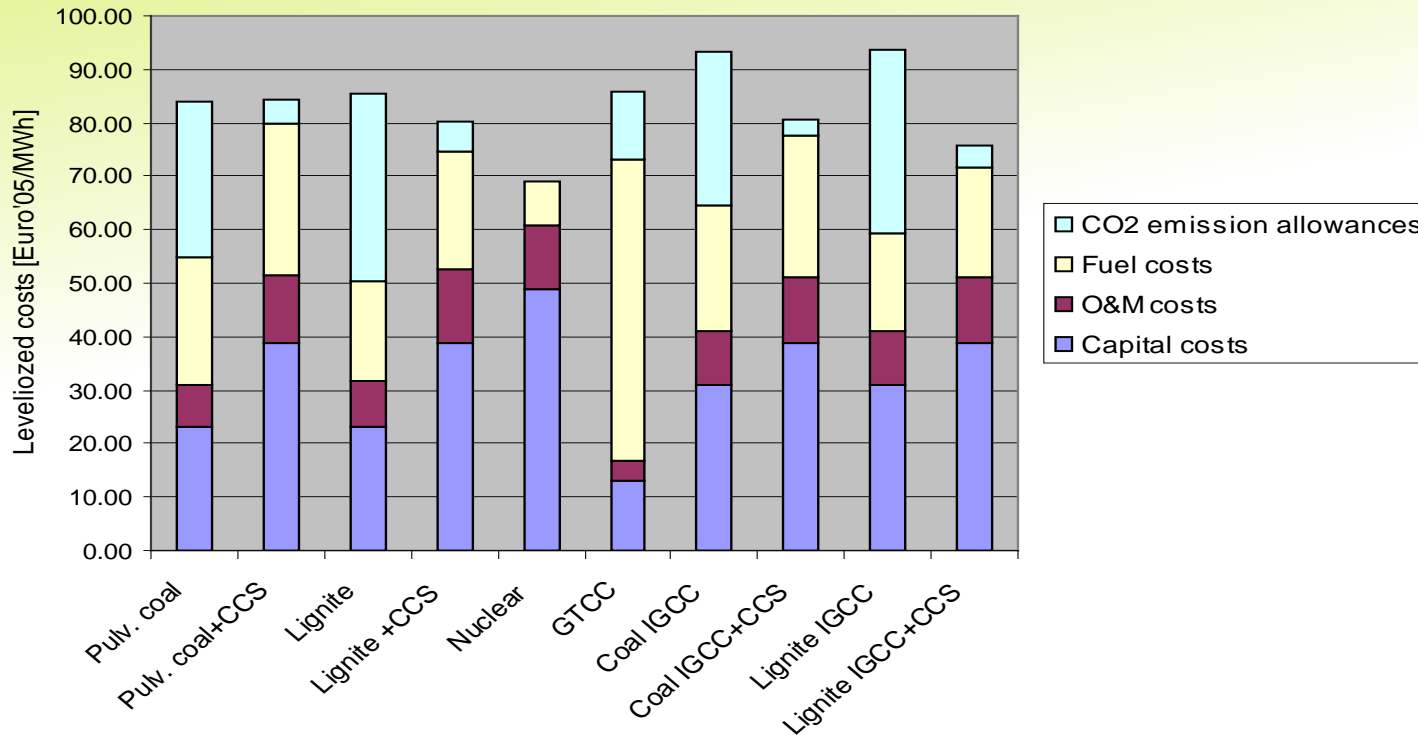


## Power supply available in Poland in the period 2008-2030 [GW]



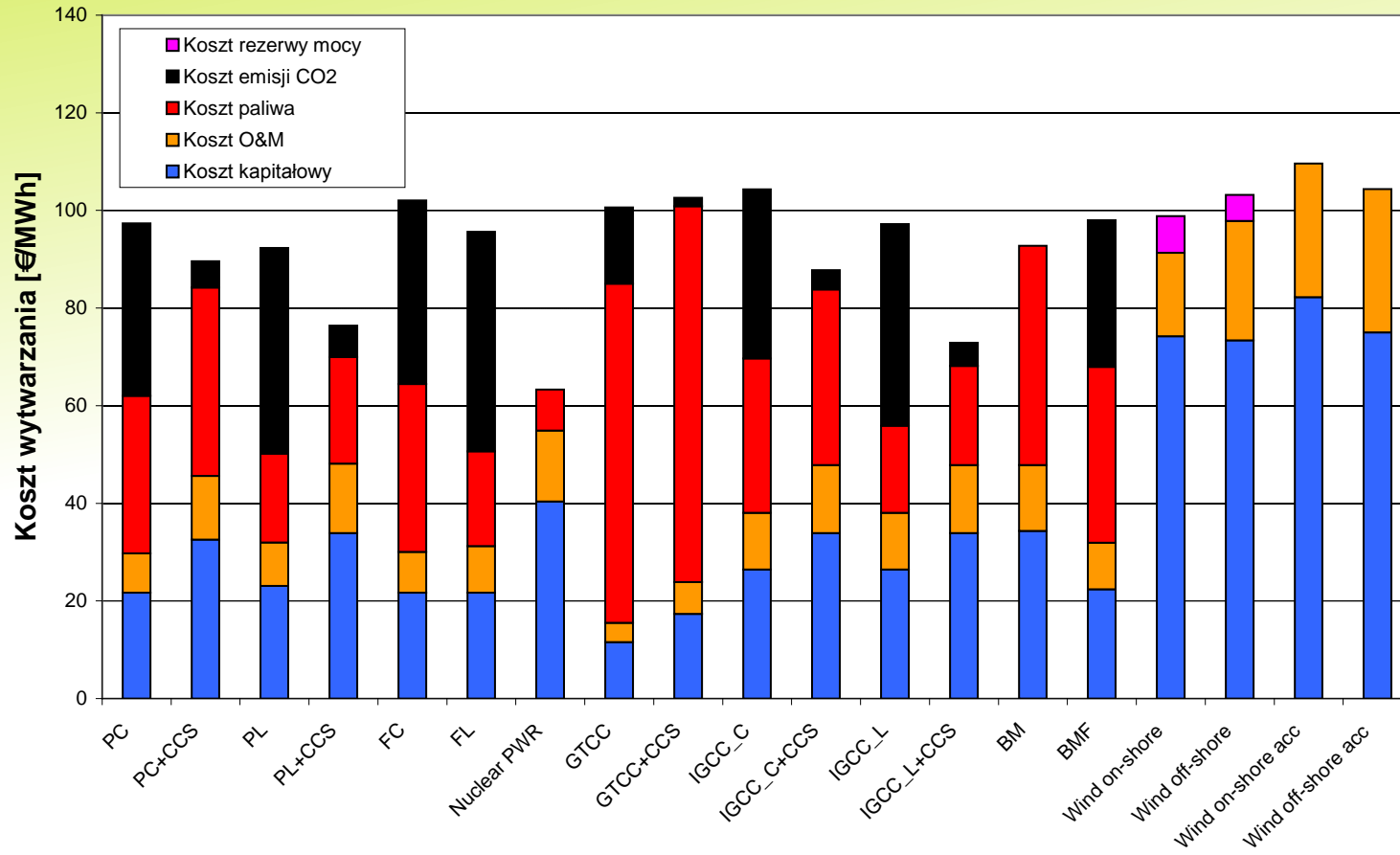


## Comparison of averaged electric energy generation costs for technologies foreseen to implement after 2020





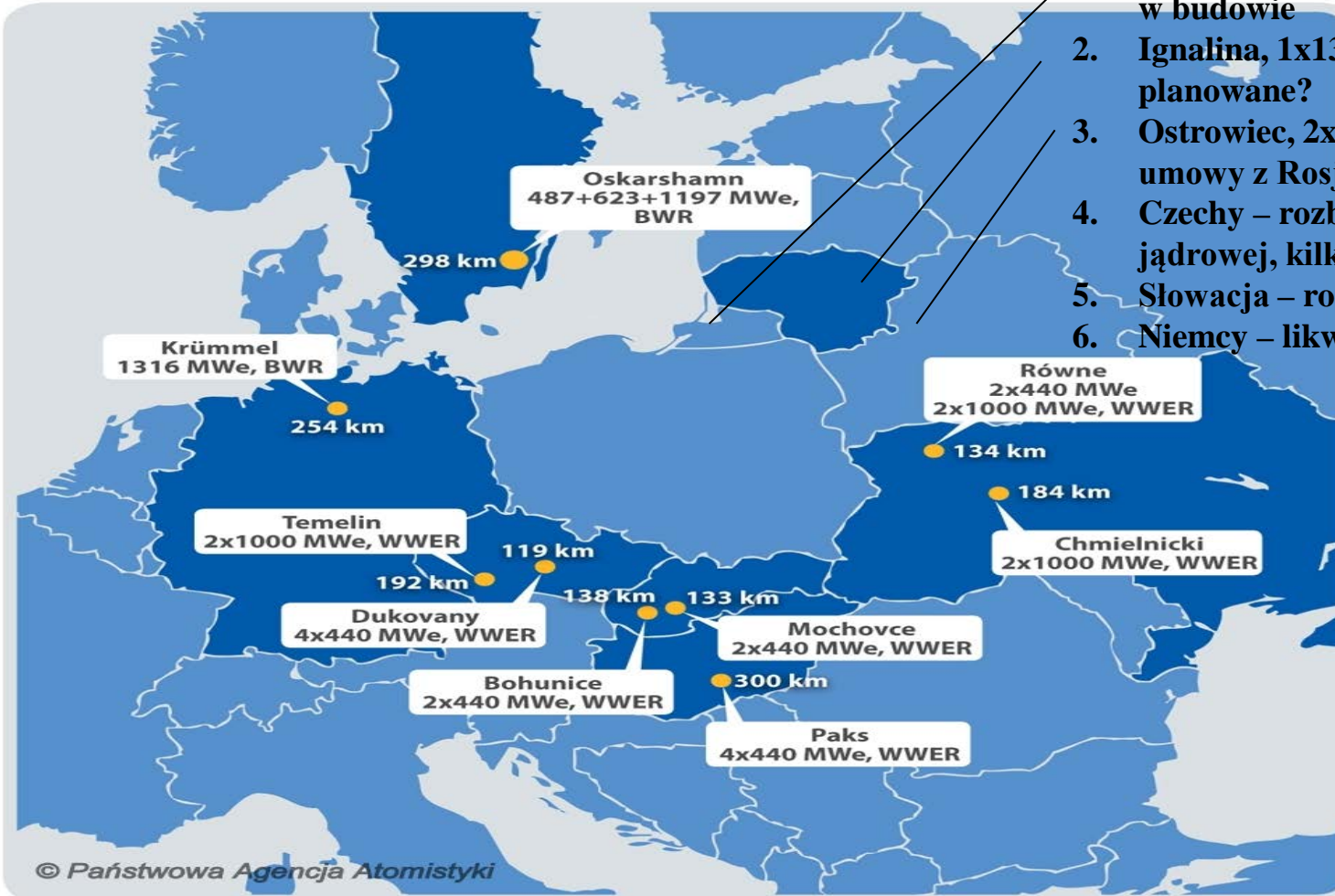
## Comparison of averaged electric energy generation costs for technologies foreseen to implement after 2030





## Nuclear Power Plants around Poland

1. Kaliningrad, 2x1150 MWe, WWER w budowie
2. Ignalina, 1x1300 MWe, RBMK planowane?
3. Ostrowiec, 2x1200 MWe, WWER umowy z Rosją podpisane
4. Czechy – rozbudowa energetyki jądrowej, kilkanaście reaktorów
5. Słowacja – rozbudowa ej
6. Niemcy – likwidacja ej do 2020?





## Nuclear power development in Poland

### 1. Elaboration of the Nuclear Power Program

- Long term vision of the Program; its scope and pace; economic and social impact
- Public debate prior to the formal adoption by the Government

### 2. Building necessary infrastructure:

- legal regulations; model of nuclear power industry
- institutional and organizational structure; building new competences
- effective system of human resources training/education
- R&D resources

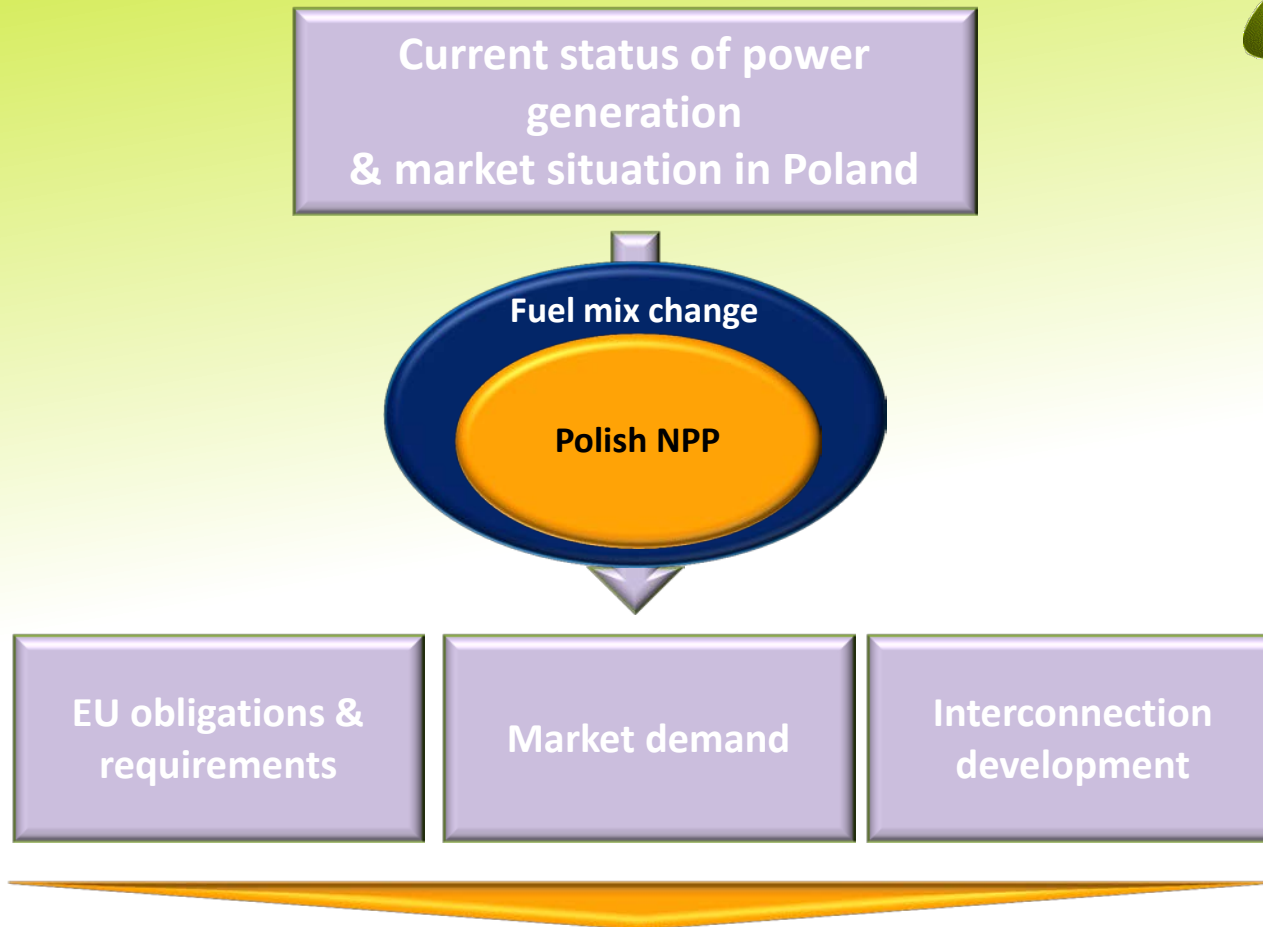
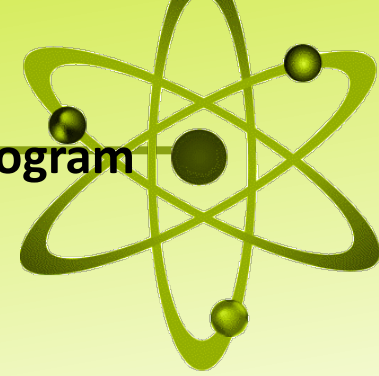
### 3. Preparatory works for the construction of the first NPP – investor responsibilities

- nuclear technology and suppliers selection, concluding contracts
- providing financing for the first NPP
- auxiliary investments planning





## Factors stimulating the Polish Nuclear Power Program



**Polish NPP is at the heart of the Polish Energy Policy, which requires a significant change of power generation fuel mix**



## Legal framework of the Nuclear Power Program

- Resolution no. 4/2009 of the Council of the Ministers of 13 January 2009 on nuclear power development activities
- Ordinance of the Council of Ministers of 12 May 2009 on establishing Government Commissioner for Nuclear Power in Poland
- Resolution of the Council of Ministers of 11 August 2009 on „Framework time schedule for nuclear power activities”
- November 2009 - approval of the *National Energy Policy up to 2030*
- Law of May 13th, 2011 on amendment of Atomic Law and other laws - entered into force on 2011.07.01
- Law of June 29th, 2011 on preparation and realization of Investments in nuclear facilities and accompanying investments - entered into force on 2011.07.01
- Draft strategy: Polish Nuclear Power Program - will be approved in the second half of 2012 by the Council of Ministers.



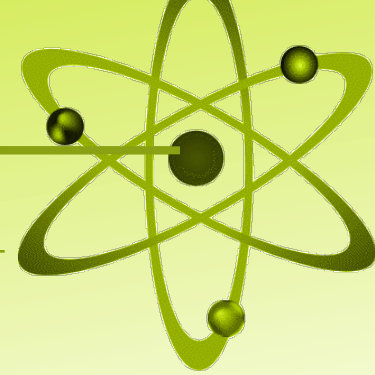
**Poland's "Energy Policy until 2030" – priorities**  
(**approx. 10 November, 2009 by the Council of Ministers**)

- Energy efficiency improvement
- Increasing security of fuel and energy supplies
- Diversification of power generation sources through implementation of nuclear power
- Increasing use of renewable energy sources, including bio fuels
- Development of competitive fuel and energy markets
- Limitation of energy sector's impact on environment



## Reduction of GHGs emissions vs energy security

- Essential is reduction of emissions without jeopardising energy security
- Poland's energy balance is particularly dominated by coal (92% of electricity and 77% of heat based on coal)
  - This is why our approach to reduction of CO<sub>2</sub> emissions must be specific
- Poland is going to optimise the use of own resources (mainly coal) in order to ensure the energy security



## Polish Nuclear Power Program

PNPP's timeframe includes following stages:

Stage I - until 30.06.2013:

- passing and entering into force of regulations necessary for the development and functioning of the nuclear power - until 30.06.2011
- elaboration and adoption by the Council of Ministers of the PNPP[1] – the second half of 2012.

Stage II - 1.07.2013 - 31.12.2014:

- site selection and signing of the contract for the construction of the first unit of the first nuclear power plant;

Stage III - 1.01.2015 - 31.12.2017:

- elaboration of the technical engineering documentation and obtaining the licences required by the law;

Stage IV - 1.01.2018 - 31.12.2022:

- licence to construct and construction of the first unit of the first NPP;

Stage V - 1.01.2023 - 31.12.2025:

- completion of the first NPP and starting the construction of the next NPP (to be operational in 2029).

**[1] as multiannual program according to the provisions of the law on rules of implementation of the development policy.**





# Polish Nuclear Power Program

## Content:

- Time schedule of the Polish Nuclear Power Program - PNPP
- Nuclear Power in the context of the long term energy policy
- Analysis of costs and economic justification of the nuclear power
- Work organization of the PNPP implementation
- Securing conditions of the safe use of the nuclear power
- Implementation cost and financing sources of the PNPP
- Choice of the NPP's site and technical surroundings
- Preparation and necessary changes of the national grid
- Environment protection in the PNPP
- Supply of specialized human resources
- Technical and R&D support for Polish nuclear power
- Safety of supply of nuclear fuel
- Economy and management of radioactive materials at various stages of the cycle
- Participation of local industry in PNPP - localization
- Public consultations and information process of the society on preparation and implementation of the PNPP



## Polish Nuclear Power Program

Information on the stage of preparation of the PNPP adopted by the Council of Ministers on January 27th, 2011,

- ESPOO and ARHUS Conventions procedures being realized
- final adoption until end of 2012
- We are preparing bilateral meetings

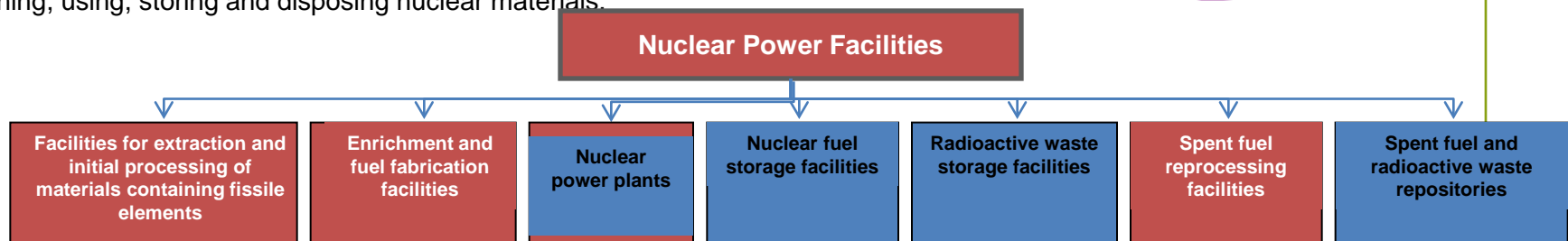
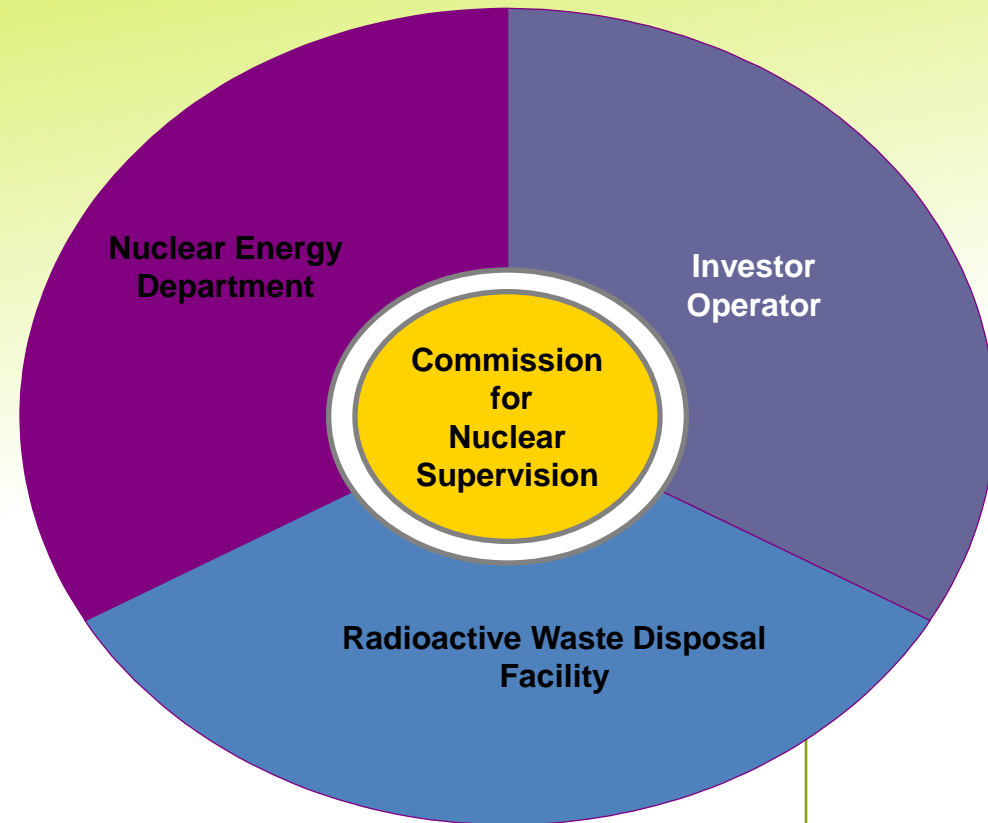


- In line with Energy Policy and regularly updated.
- Pursued in co-operation with the leading investor of the first NPP

## Main principles of Polish nuclear power sector

### Tasks for the State:

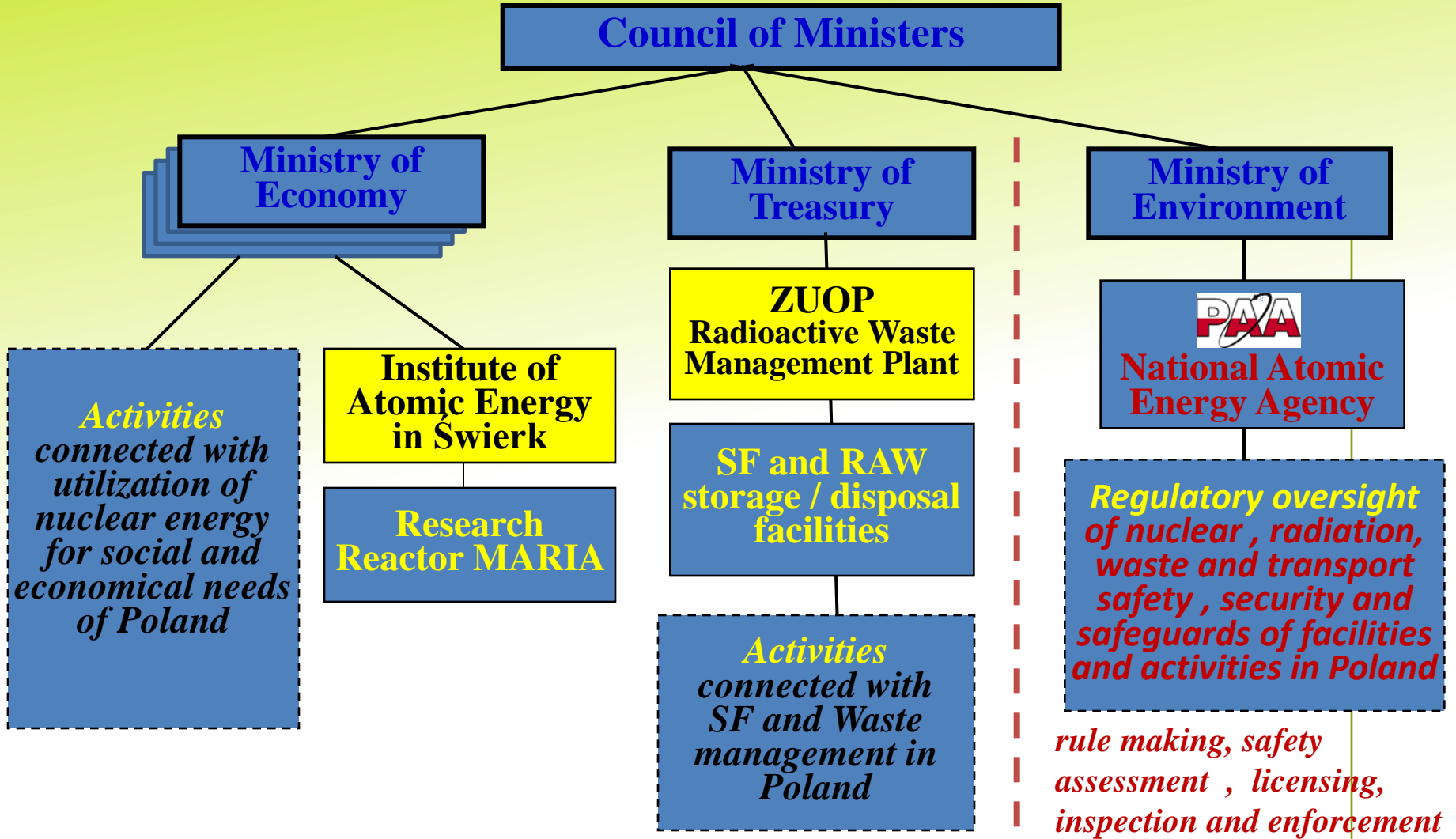
- To create conditions for development of nuclear power
- To develop, updating, implementing, enforcing and following procedures regarding: nuclear and radiation safety and security; non-proliferation and physical protection of nuclear materials and radiation protection.
- To establish regulations for processes such as: preparation for construction, erection, operation and decommissioning of nuclear facilities.
- To intensify activities in order to **gain and maintain social confidence** for development of nuclear power in Poland.
- To observe Poland's obligations resulting from **international agreements** signed by Poland.
- To ensure **nuclear and radiation safety and security** at all levels of: equipment design and manufacturing; erection, operation and decommissioning of nuclear facilities as well as obtaining, using, storing and disposing nuclear materials.





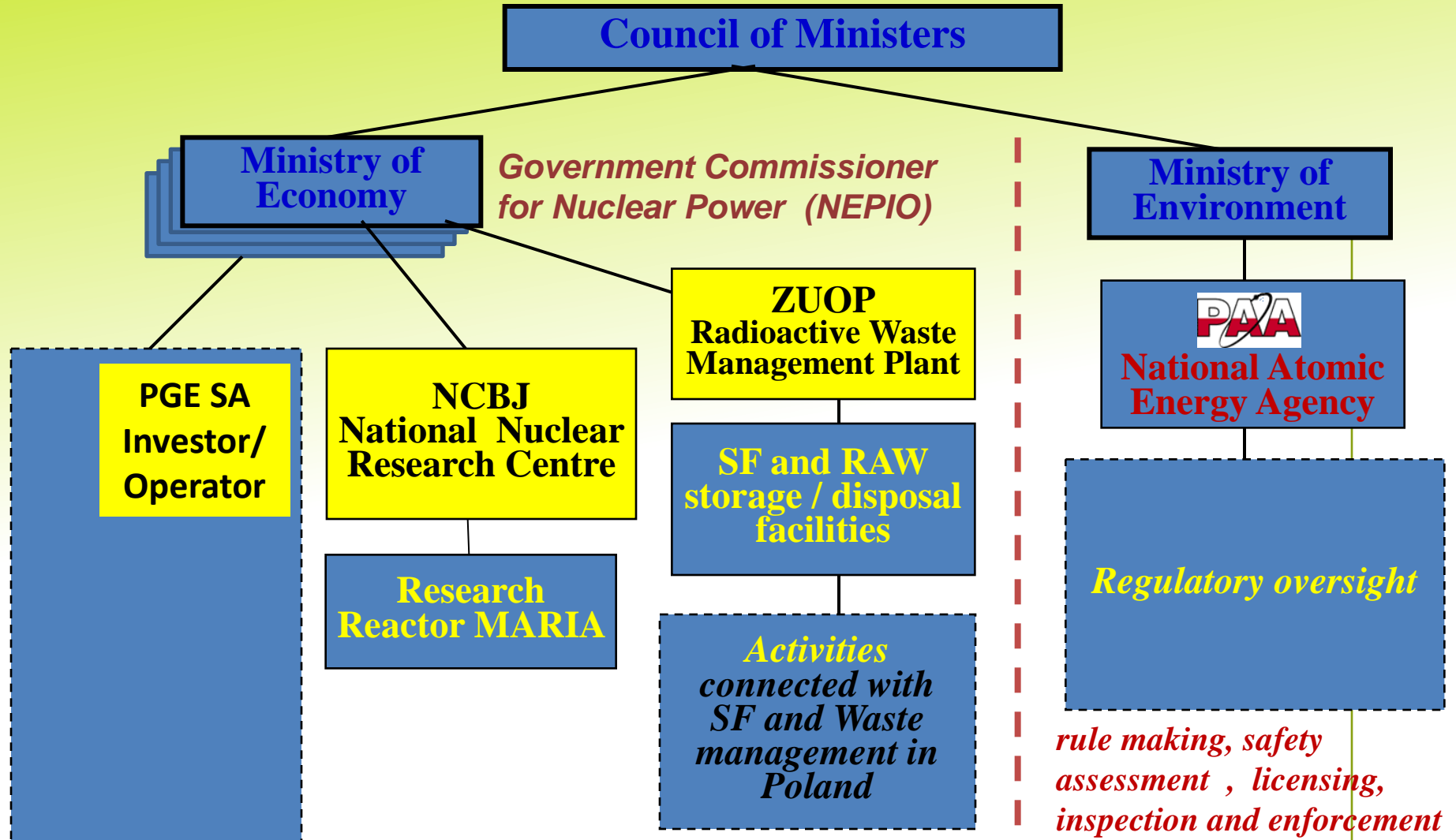


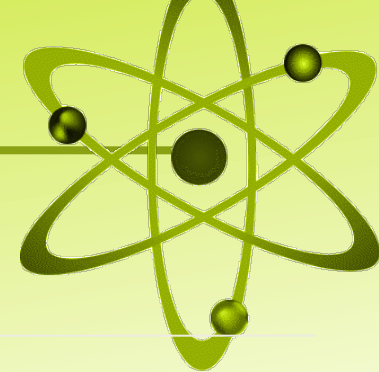
# Structure of governmental responsibilities



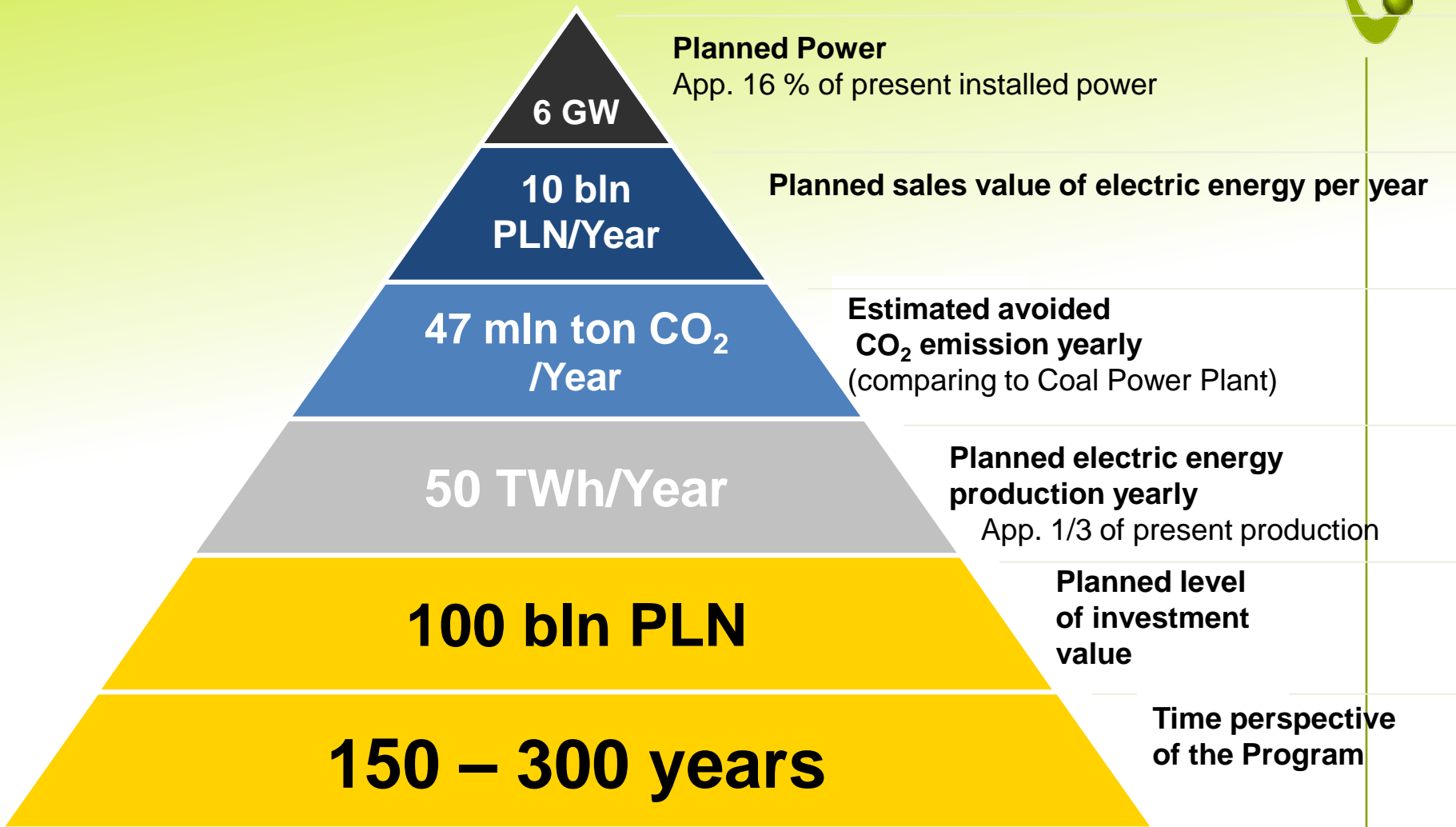


# Polish Nuclear Power Program implications



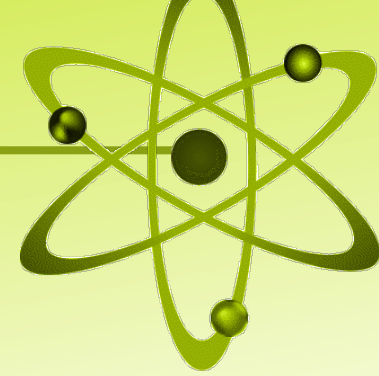


# Scale Pyramid of Polish Nuclear Power

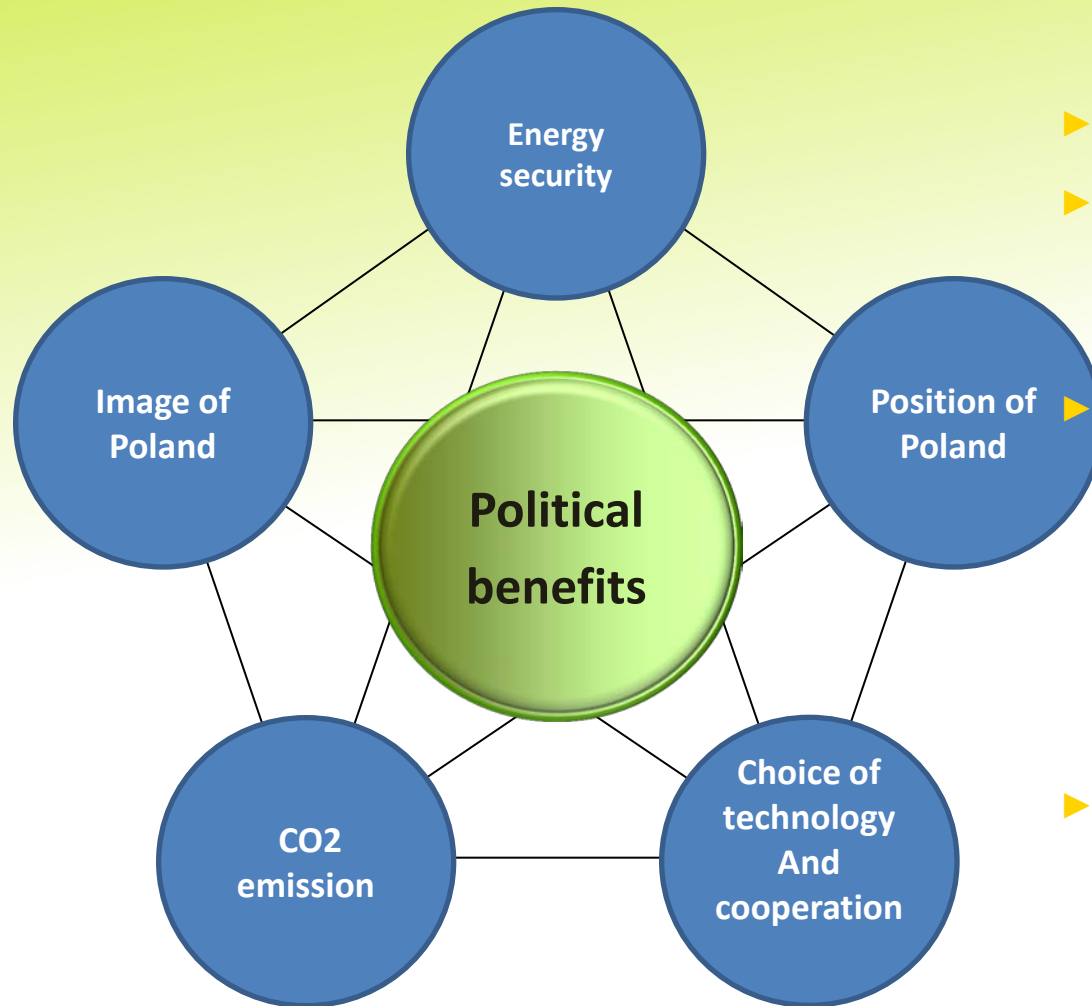


Source: „Identification of profits from realization of nuclear power development program in Poland”, Ernst & Young 2011.

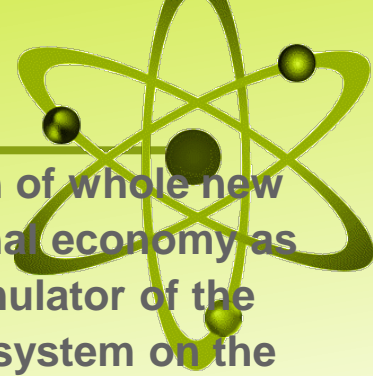




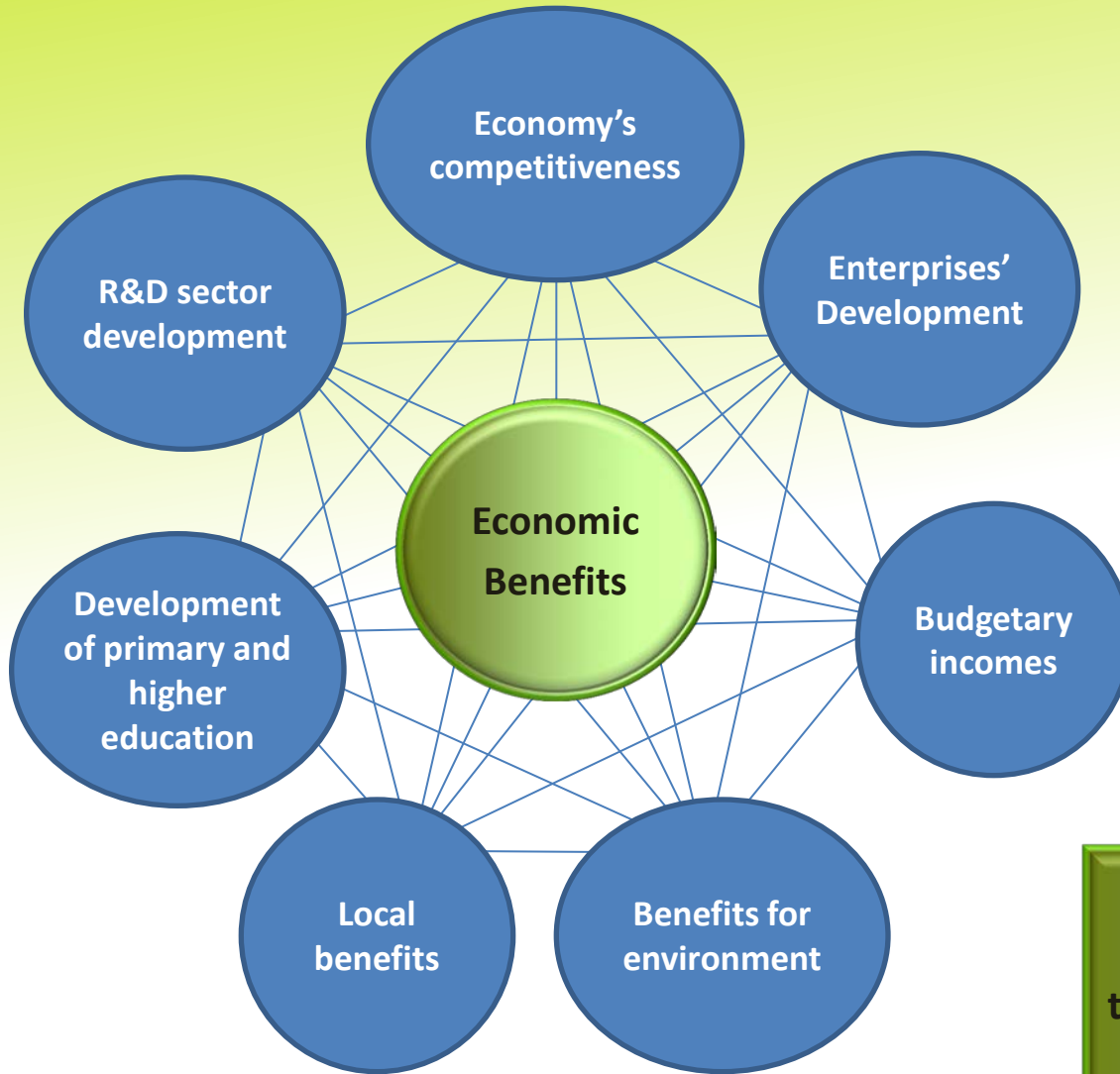
## Political benefits



- ▶ **Energy security** improvement.
- ▶ **Creation of Poland's image** internationally as modern, dynamically developing country
- ▶ **Building Poland's position** on the international arena through utilization of the strategic partnership in the nuclear power area with countries delivering the nuclear technology.
- ▶ **Making more flexible** Poland's position on the international arena regarding climate protection and CO<sub>2</sub> emission reduction.



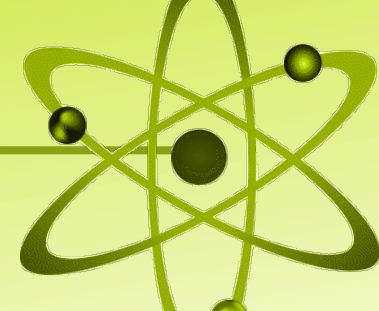
## Economic benefits



- ▶ Complex creation of whole new branche of national economy as development stimulator of the whole economic system on the national as well as local level.
- ▶ Broad and manifold impact spectrum of the nuclear program on the economy will include various areas of economic life even without the proper State's organs support.



**State's support will have the key importance for optimization of long term as well as short term benefits from implementation of nuclear power in Poland.**

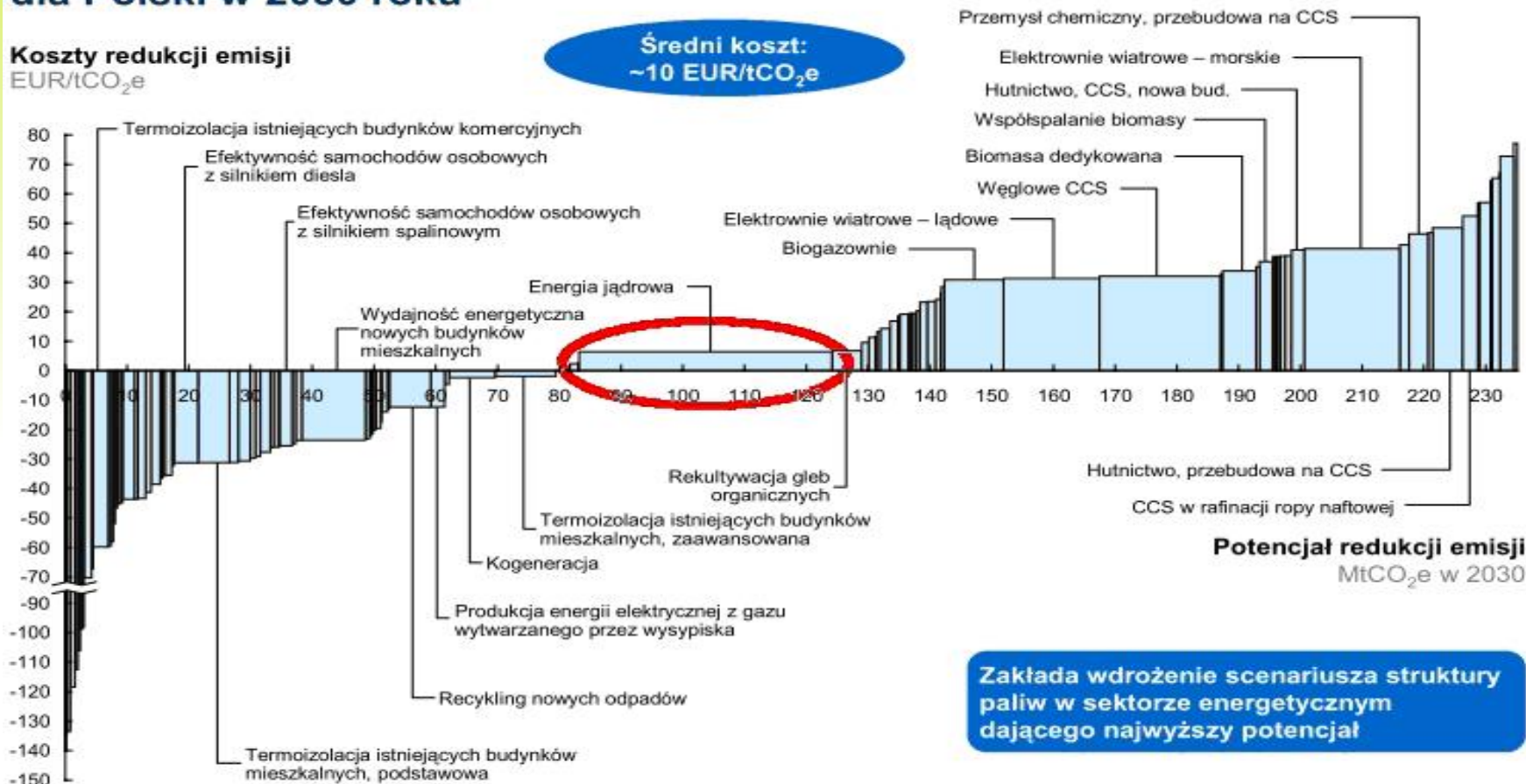


## Nuclear power is the cheapest way of reducing CO2 emissions (McKinsey)

### Krzywa kosztów redukcji emisji gazów cieplarnianych dla Polski w 2030 roku<sup>1</sup>

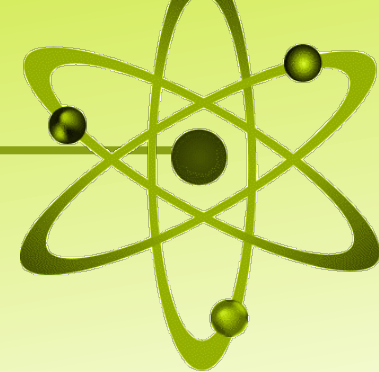
Koszty redukcji emisji  
EUR/tCO<sub>2</sub>e

Średni koszt:  
~10 EUR/tCO<sub>2</sub>e



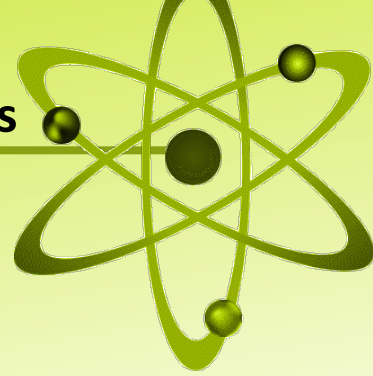
Zakłada wdrożenie scenariusza struktury paliw w sektorze energetycznym dającego najwyższy potencjał

<sup>1</sup> Wymieniono nazwy tylko metod redukcji emisji o największym potencjale



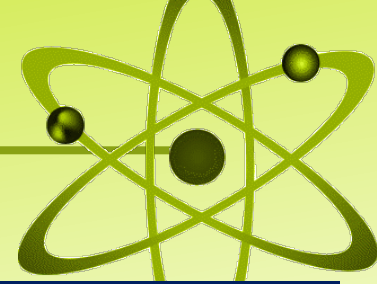
# LEADING INVESTOR

- **PGE SA (Polish Energy Group), biggest power producer & supplier in Poland:**
  - 12,4 GW installed capacity
  - 45,1 million tones annual lignite production
  - 56.0 TWh net power production
  - 268 100 km distribution lines
  - 5 mln customers
  - 46 thousand employees



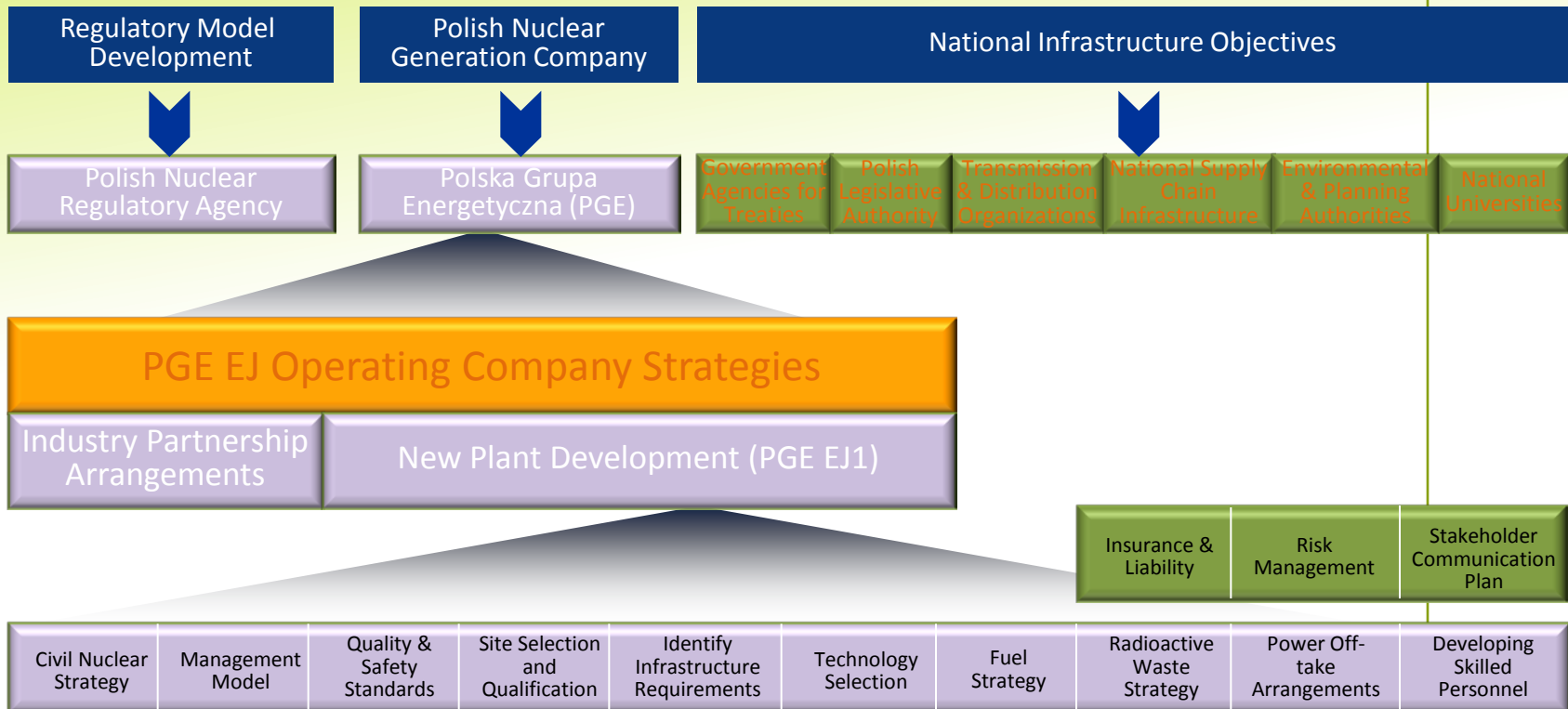
- ❑ **Continued growth in electricity gross demand:**
  - Historically 1,4% annually (2005 – 2010) despite the economic downturn
  - 1,4% in line with the recent forecasts (2010 – 2030)
- ❑ **Technical feasibility to build the NPP:**
  - Gen III / III+ technology available from a number of Vendors
  - A number of potential NPP locations (sea and in-land)
  - Feasibility to connect to the HV grid confirmed with the PSE Operator
- ❑ **Positive business case above PGE investment thresholds**
- ❑ **Positive influence of the NPP on PGE's and country's competitiveness confirmed through other in-house and external studies**

- **First NPP plant (site) ca. 3000 MWe (2-3 units depending on the technology)**
- **First NPP unit operational by the end of 2022**
- **Other units to reach ca. 6000 MWe in line with the Polish Energy Policy by 2030**

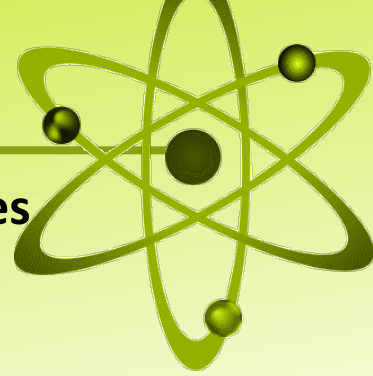


### National Nuclear Power Program Vision & Mission

### Guiding Principles and Stakeholder Obligations





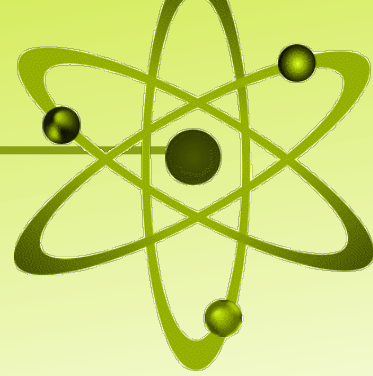


## Plant Vendor Procurement Process Principles

- Open** competition
- Transparent** procurement process compliant with EU and Polish Procurement Laws
- Level playing field focused on **best value** for PGE
- International **acceptance** of process and outcomes
- Process conducted in **deliberate**, yet timely manner
- Technically **rigorous**
- Seeking **innovation** for delivery of Program
- Collaborative** approach on ECA financing issues

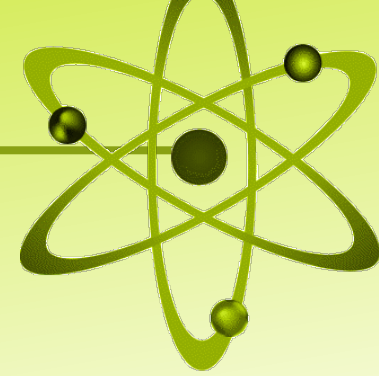
**Effective and Long Term Partnership**





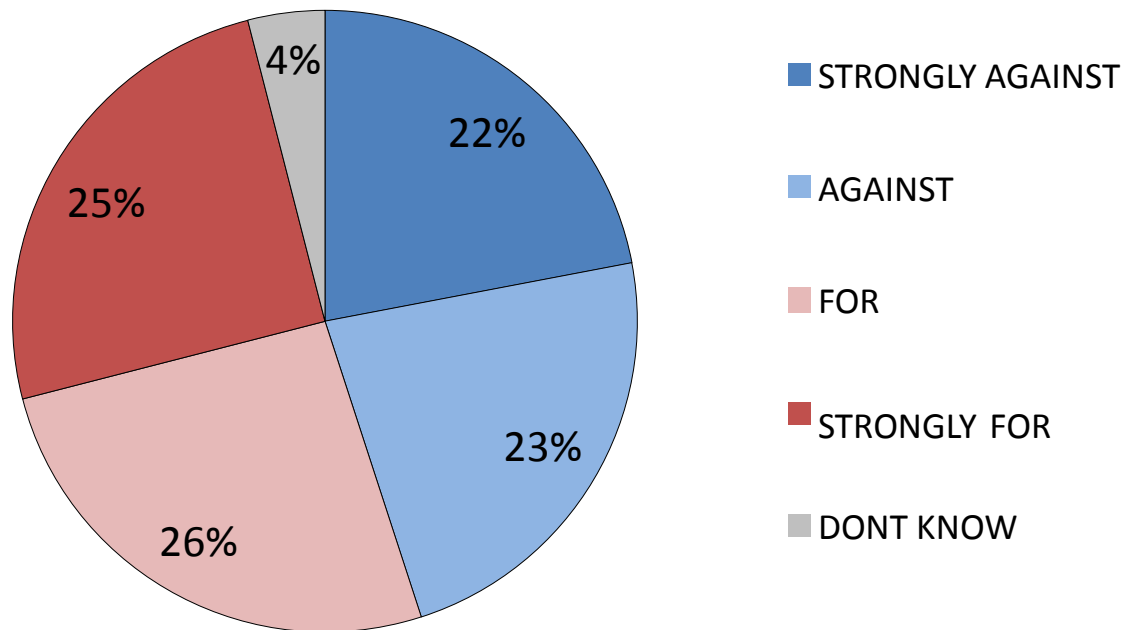
## R&D

- 4 nuclear research institutes in Poland
- In 2011 – creation of National Nuclear Laboratory -TS
- From this year – special research programmes



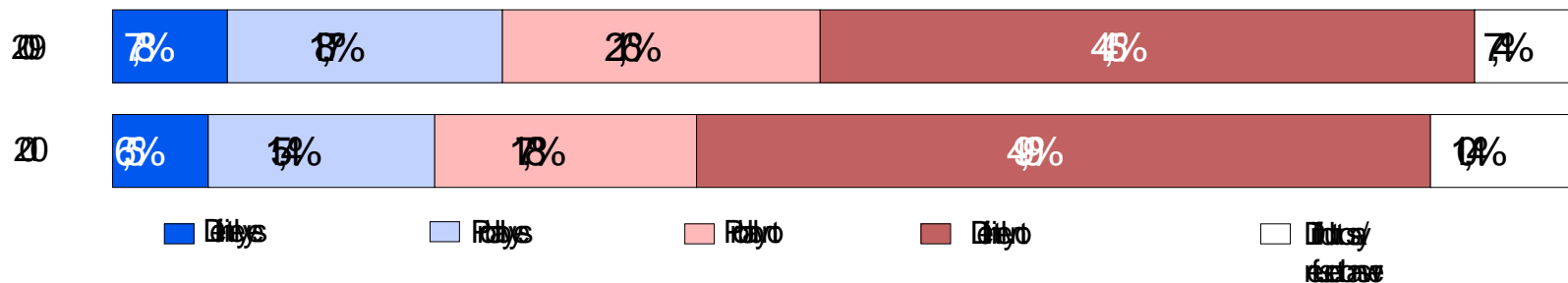
## Public opinion - construction of the first NPP in Poland

- 51% of Poles are in favor of building a nuclear power plant in Poland, 45% are against



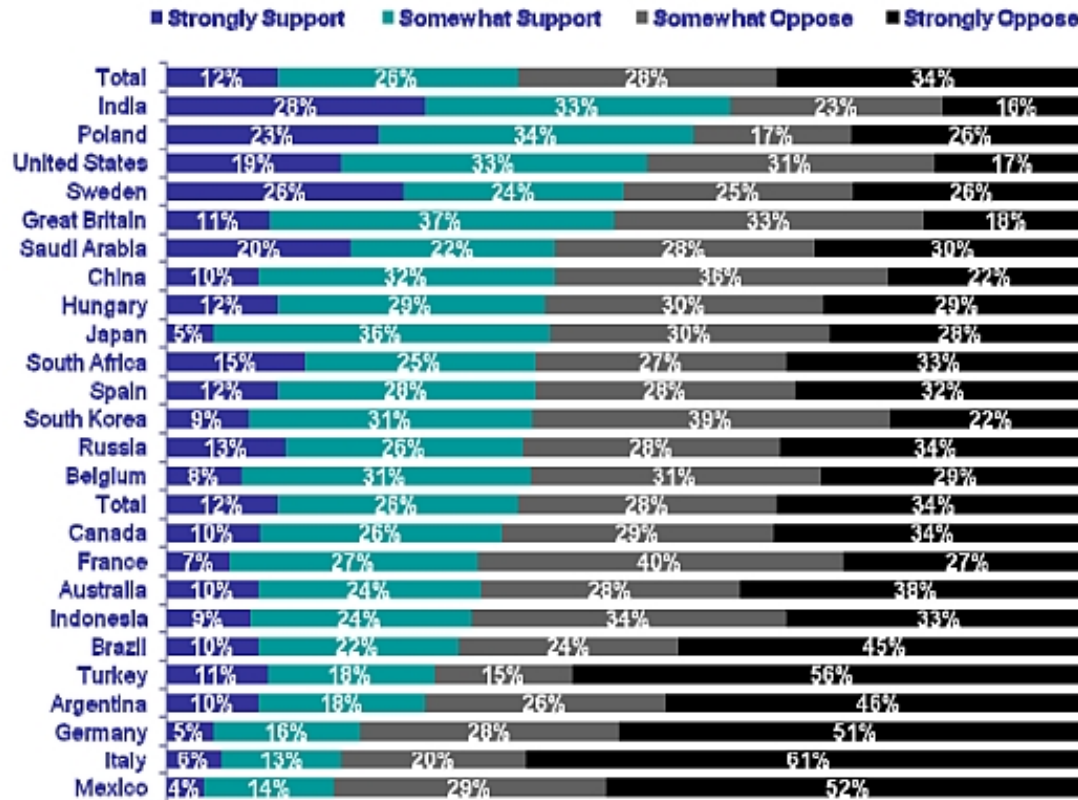


The operation of a nuclear power plant involves the question of disposal of radioactive waste. Assuming that the nuclear plant would be built in Poland, if you accept the location, modern, safe, straightforward, disposal of radioactive waste near their place of residence or not?

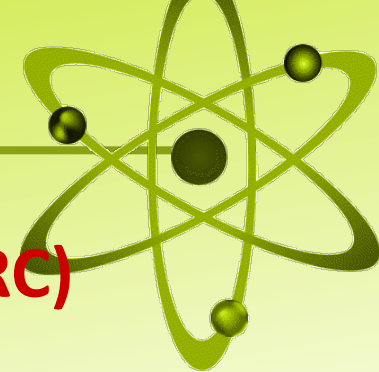




## Majorities in India, Poland and US Support Nuclear Power...

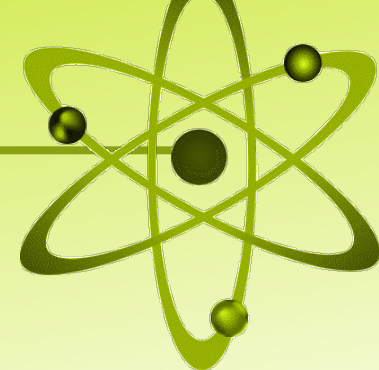


Please indicate whether you strongly support, somewhat support, somewhat oppose, or strongly oppose each way of producing electricity. Base: All Respondents n = 18787

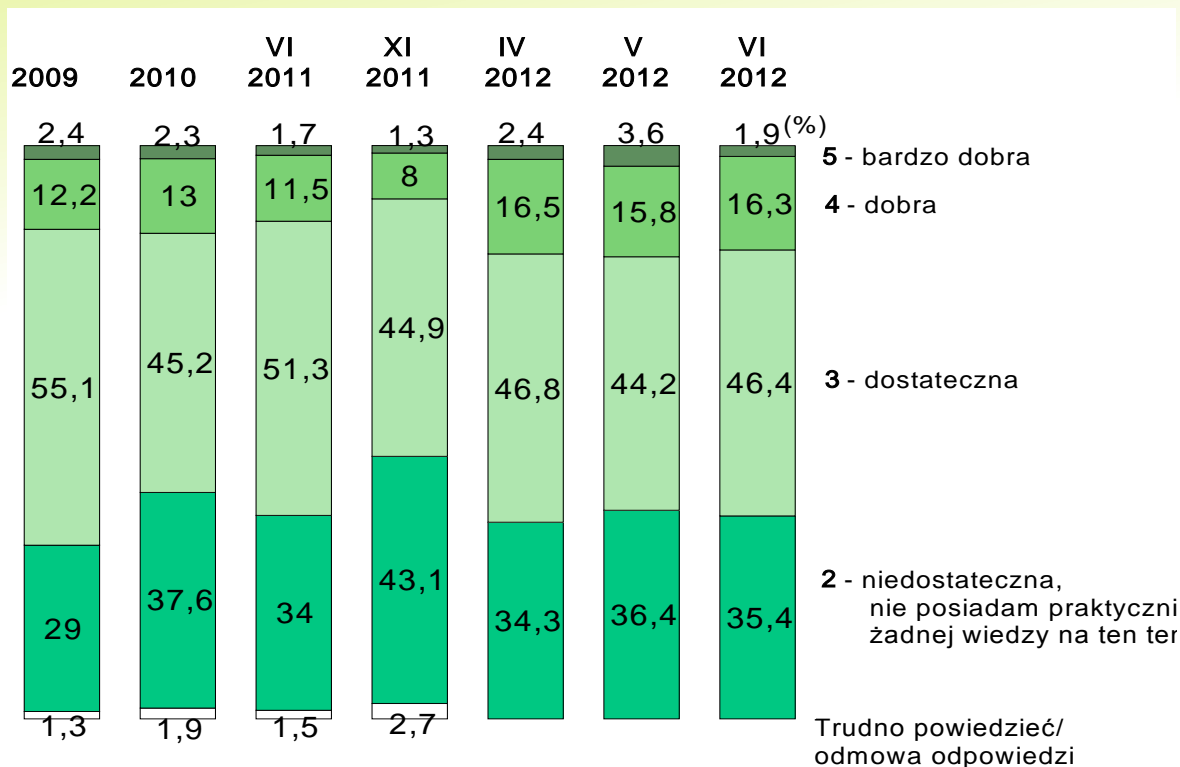


## Public opinion pool ( Millward Brown SMG/KRC) February/March 2012

- 51% of Poles are in favor of building a nuclear power plant in Poland, but 63% would not like to have it near their homes
- Construction of a nuclear power plant is an important issue for 67% of them and 94% expect an information campaign on nuclear power
- Nearly 60% of Poles declare their knowledge of the nuclear power as insufficient
  - They would like to learn more about: safety, environmental impact, energy supply/demand in Poland, costs and benefits for Poland of the development of nuclear power



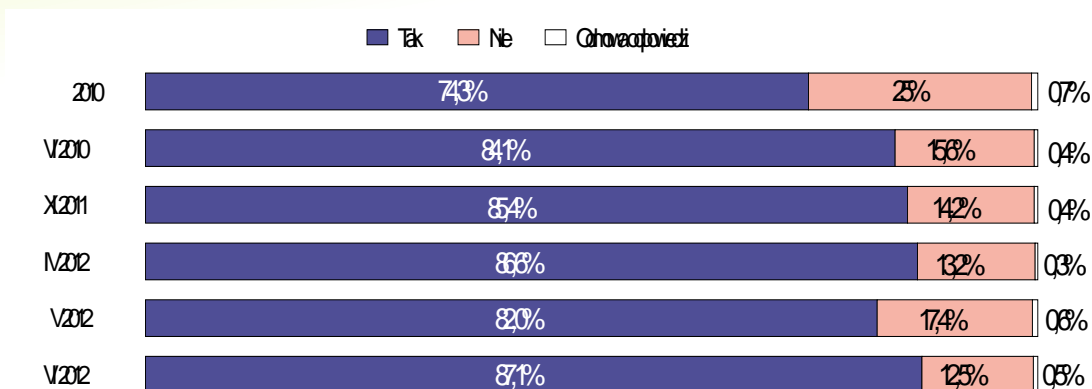
# Self-evaluation of the knowledge about nuclear energy (from 2 - non-existent to 5 - very good) CBOS – June 2012





# Knowledge of the government's plan to build NPP CBOS – June 2012

blue – know, red – don't know, white – no response







## What are the challenges faced by the government on building a nuclear power programme?

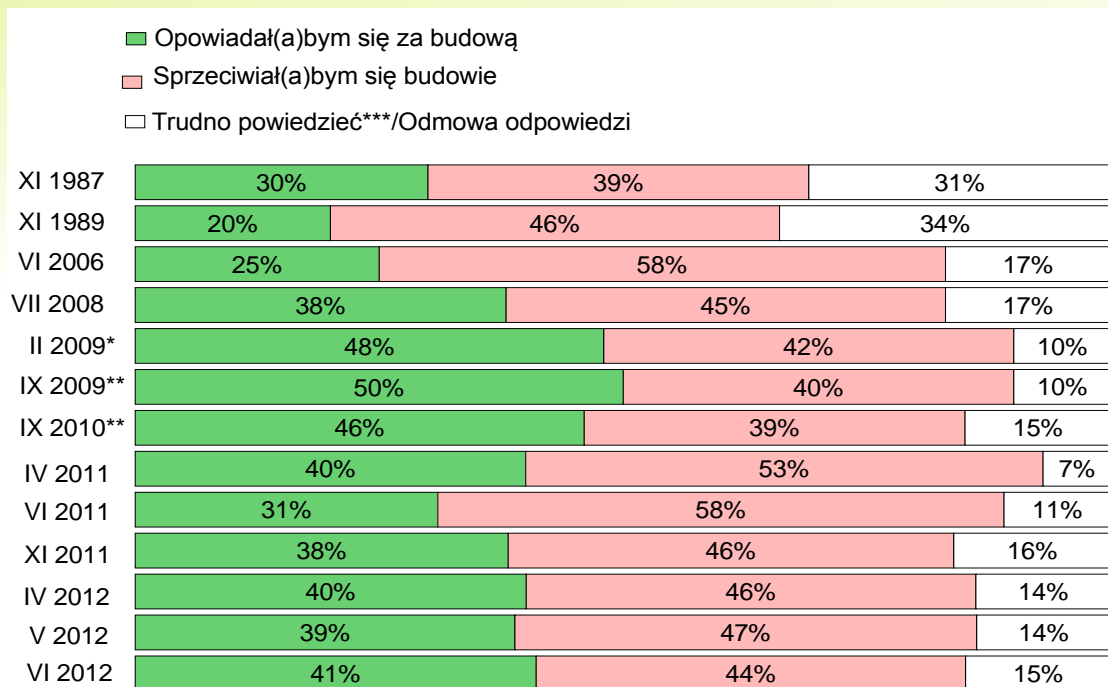
- Raising public awareness of nuclear energy
  - More than 80% of Poles declare their knowledge of the nuclear power as not good
- Raising public confidence in nuclear power
  - 51% of Poles are in favour of building a nuclear power plant in Poland, but 63% would not like to have in their neighbourhood



# Opinion pool - construction of the first NPP in Poland

## CBOS – June 2012

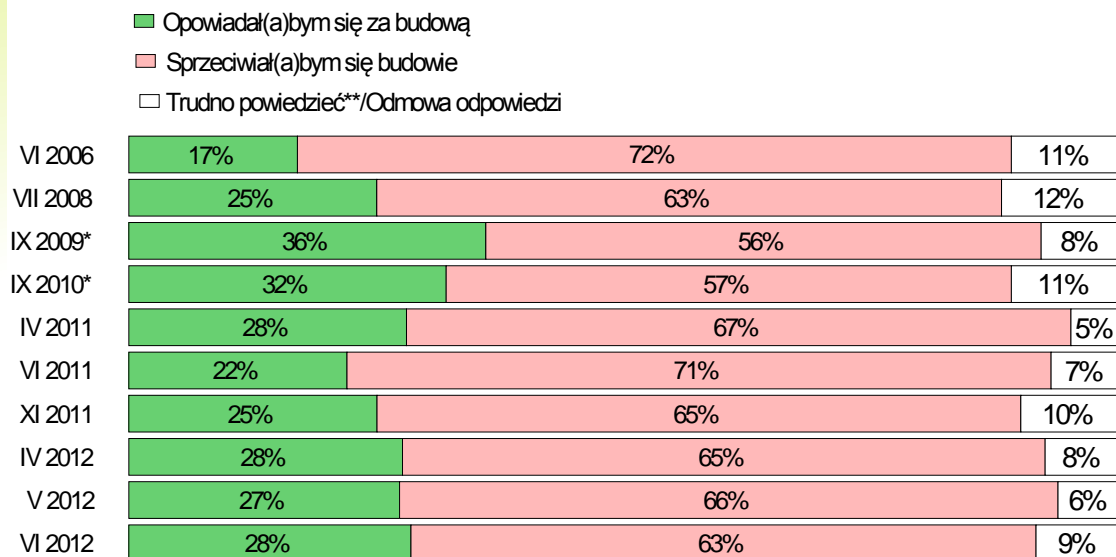
green – for, red – against, white – hard to say





## Opinion pool - construction of the first NPP in Poland in my neighbourhood CBOS – June 2012

green – for, red – against, white – hard to say





## **How to build a national consensus on nuclear power: who is in charge of that, what are the processes and the stakeholder involvement policies, what are the difficulties faced to in those policies?**

Different levels of engagements:

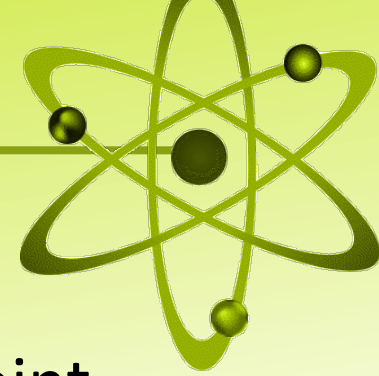
- Government Commissioner for Nuclear Power in Poland meetings with regional-level administration
- Ministry of Economy launched in March 2012 an information campaign on nuclear energy
- Investor PGE S.A. runs an information campaign about NPP
- National Atomic Agency informs about nuclear safety and radiological protection



## Stakeholder involvement

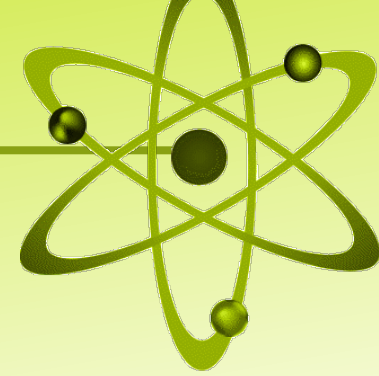
Draft Polish Nuclear Power Programme and Environmental Impact Assessment were widely consulted with the public:

- In September 2010 draft Programme was distributed to over 100 institutions, associations and eco foundations (including those opposing to nuclear power).
- In December 2010, Ministry of Economy launched a public consultation of the draft programme and its Environmental Impact Assessment -according to *The Act of 3 October 2008 on sharing information about the environment and its protection, public participation in environmental protection and environmental impact assessment* – both documents were published at the Ministry of Economy's website. In response Ministry received comments from app. 300 different institutions and organizations.



## International cooperation

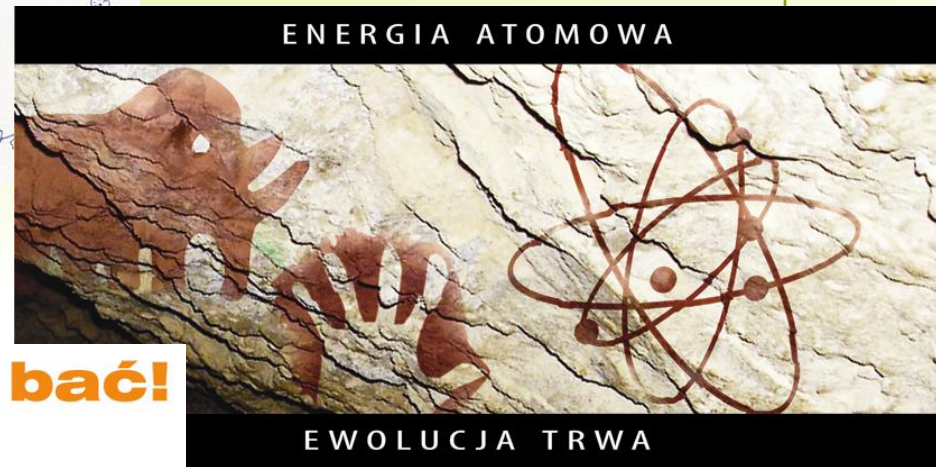
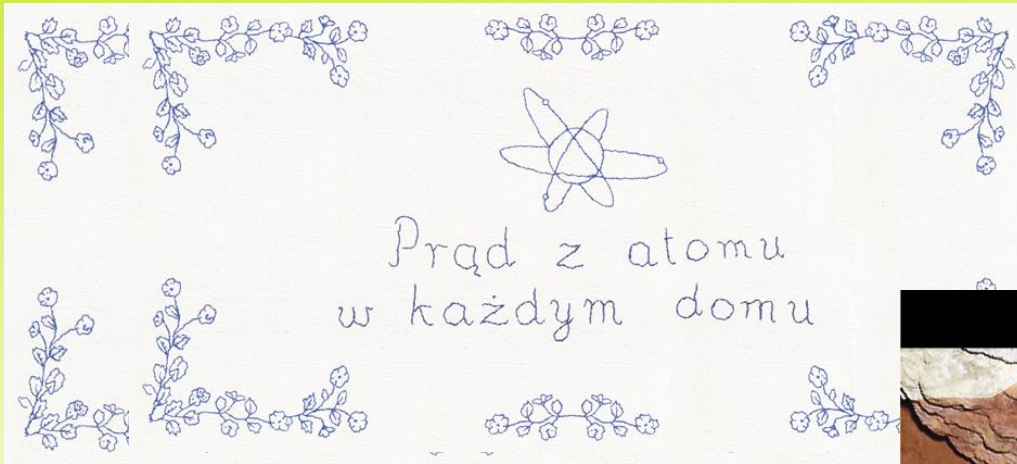
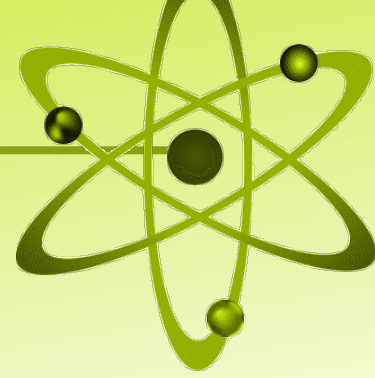
- bilateral (Japan - MoC, Korea - MoC, USA – Joint Declaration, US NRC – cooperation agreement with NAEA),
- multilateral (EU, Euratom, IAEA, OECD/NEA, IFNEC – Steering Committee meeting in Warsaw, September 2011, ENSREG, INPRO, WANO, GTRI – agreements with USA, Russia and 5 transports of SNF from research reactors EWA and MARIA, SNETP – conference in Warsaw, December 2011,
- INIR mission to Poland 2012,



# Fuel cycle

- After research We consider open fuel cycle,
- We will look carefully about other solutions ( closed, mox, others) – changing opinion is possible
- - We have uranium resources – We estimate them -We now not thinking about mining





**nie ma się czego bać!**



**Zbudujemy nowoczesną, bezpieczną elektrownię atomową!**

**Thank you for your attention**