

ENERGY IN POLAND

State and the future

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Nuclear Governance in a changing world. Spring school Kiev, Ukraine 21-27 April 2012

Poland (2011)

- Population 38 501 000
- Area 312 679 km²
- Agricultural land 51%
- 1% of global CO₂ em.
= 9t CO₂ / person



**Production of energy is based on fossil
fuels (>90%)**

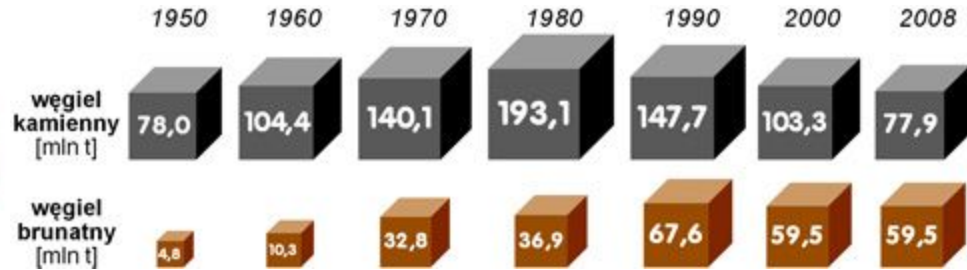
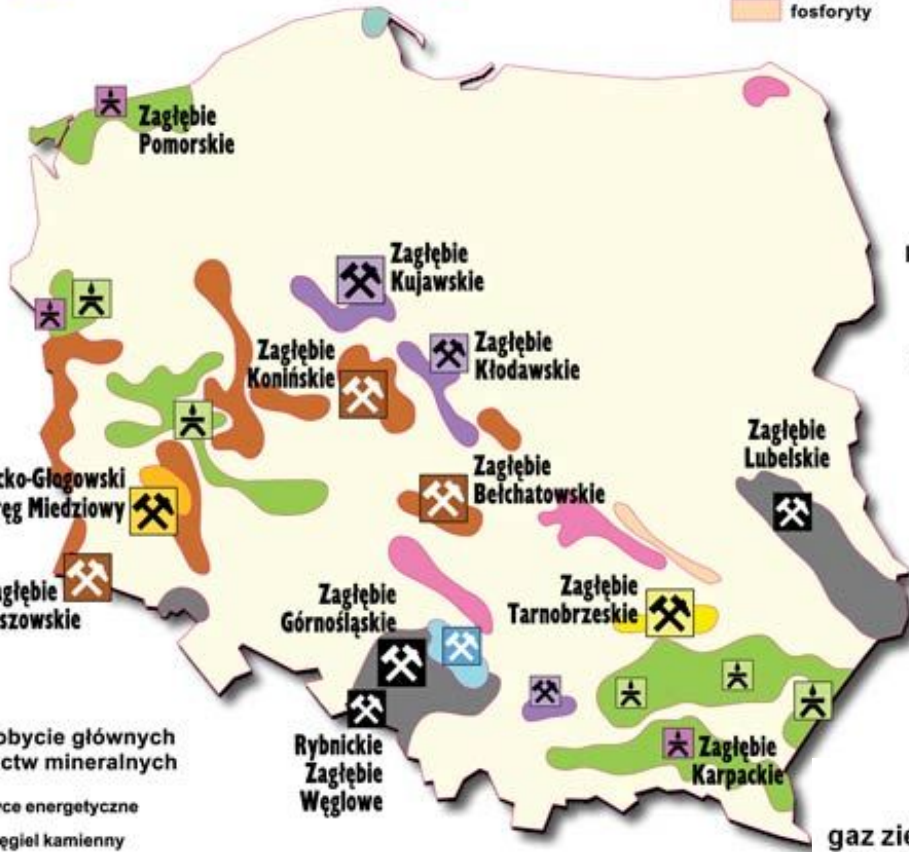






Black coal, brown coal and natural gas

Złóża głównych bogactw mineralnych



Wydobycie głównych bogactw mineralnych



Natural gas

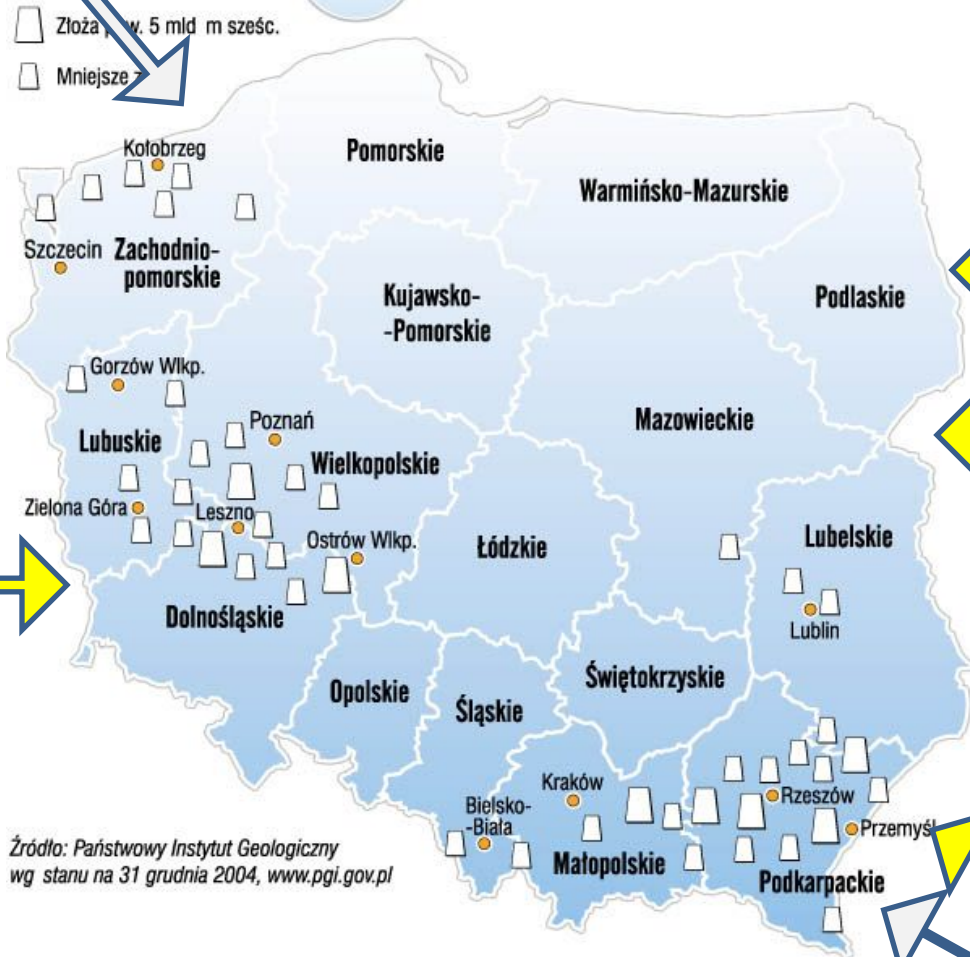
Denmark
Norway

**Polskie złoża
gazu ziemnego**

- Złoża powyżej 5 mld m sześci.
- Mniejsze



imported
possibilities



Russia

Russia

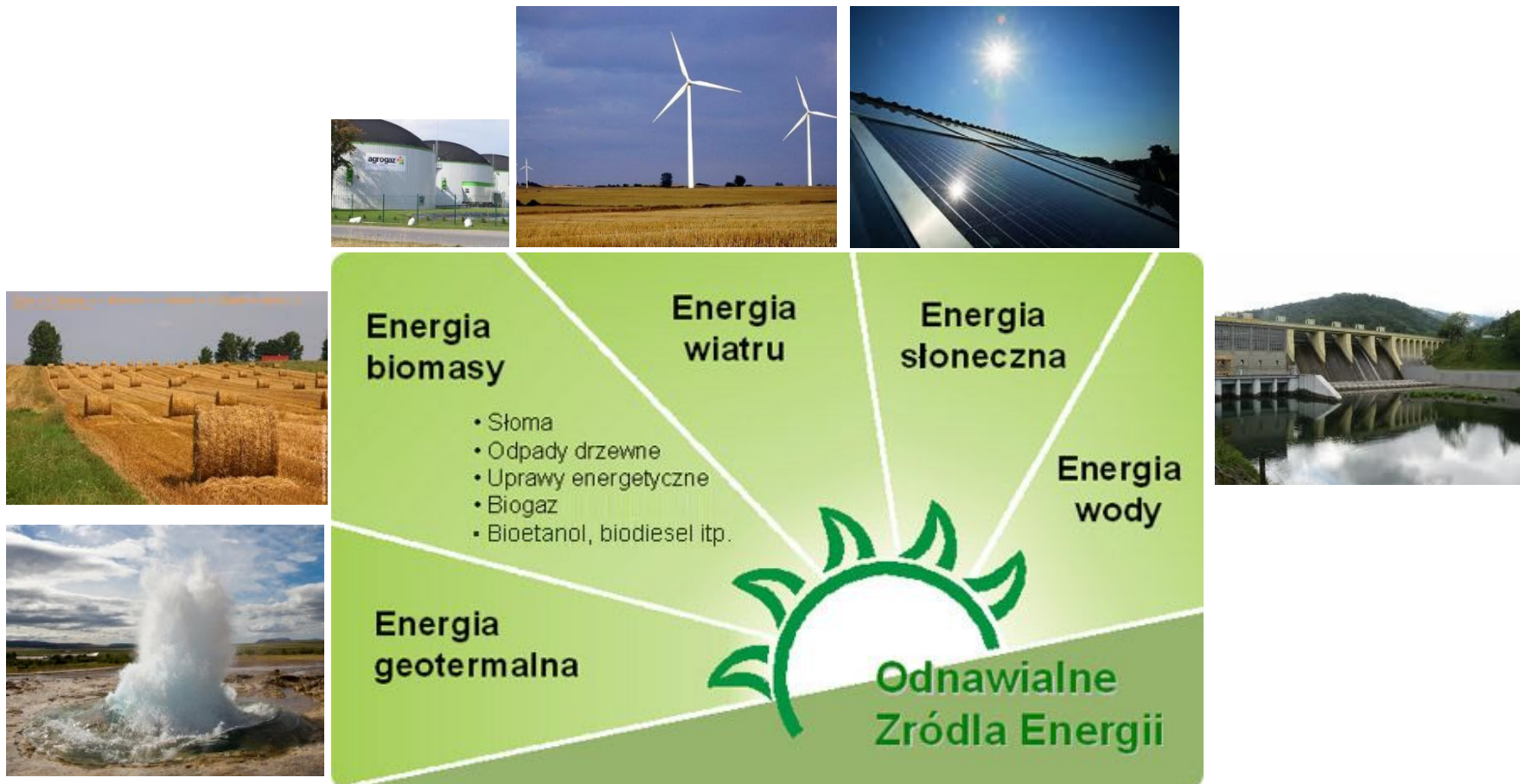
Germany
Norway

Russia

Asia

Źródło: Państwowy Instytut Geologiczny
wg stanu na 31 grudnia 2004, www.pgi.gov.pl

Renewable Energy Sources



Biomass – short story...

- 2001 – 1st RES strategy in Poland: „the highest potential in biomass from SRP and agricultural waste”



Biomass – short story...

- 2004 – **biomass co-combustion** is accepted (the reason is EU requirement of 15% RES in 2020)
- 2006 – „green certificate” market (a great chance for big power generation companies to earn a lot of money...)



+



=



Biomass – short story...



- 2007 – 35% of „green energy” in Poland from biomass co-combustion;
- in 2010 – 50% ...

Biomass – short story...

- 2012 – 80% of co-combusted biomass come from forest



Biomass – short story...

- **Unsustainable timber market (energetic sector wins with paper and furniture industry), increasing of „low emission”**

4,5 mln of households use coal for heating



Biomass – short story...

- 2010 – 4,5 mln m³ from National Forests
- 2014 – we will need from 7 to 10 mln ton of biomass
- 2020 – we will need 17 mln ton of biomass for co-combustion



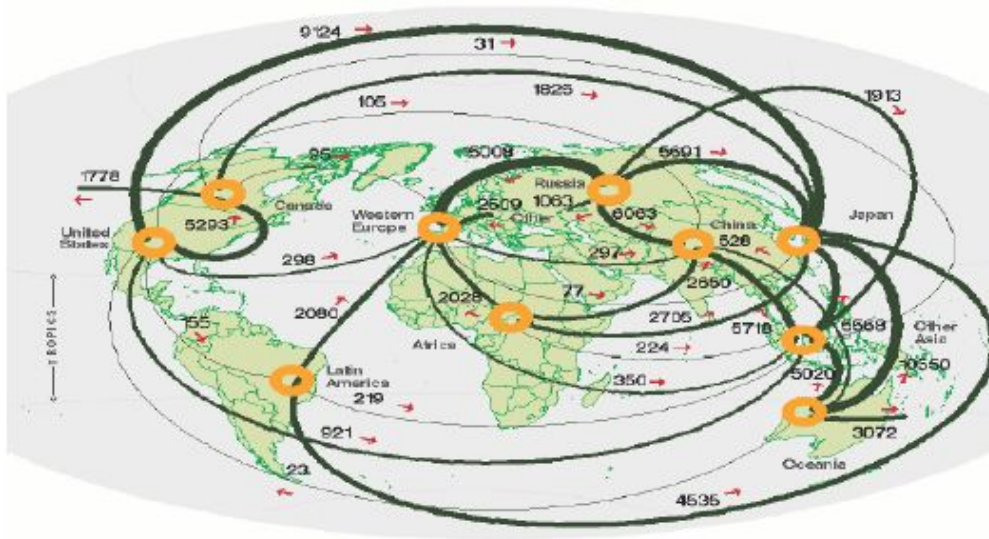
We don't have enough timber resources...



Biomass – short story...

- We have to import biomass...

Figure 5 Main net flows ('000 m³) of wood raw materials in 2000 [14]



Import of timber:
2004 – 50 000 ton
2011 – 600 000 ton

Import of agricultural
biomass:
2005 – 200 000 ton
2011 – 700 000 ton

Import from 50 countries around the world eg. Russia, Balarus, Ukraine, RPA, Indonesia, Malesia, Argentina...

High CO₂ and water footprint of imported biomass; deforestation 😞

Solution?: The EU's "Illegal Timber Law" (ITL) from 2013?

Biomass – short story...

Promotion of biomass co-combustion in big power plants:

- ⇒ lost of sustainability**
- ⇒ dependency on import of fuel**
- ⇒ braking of RES development**



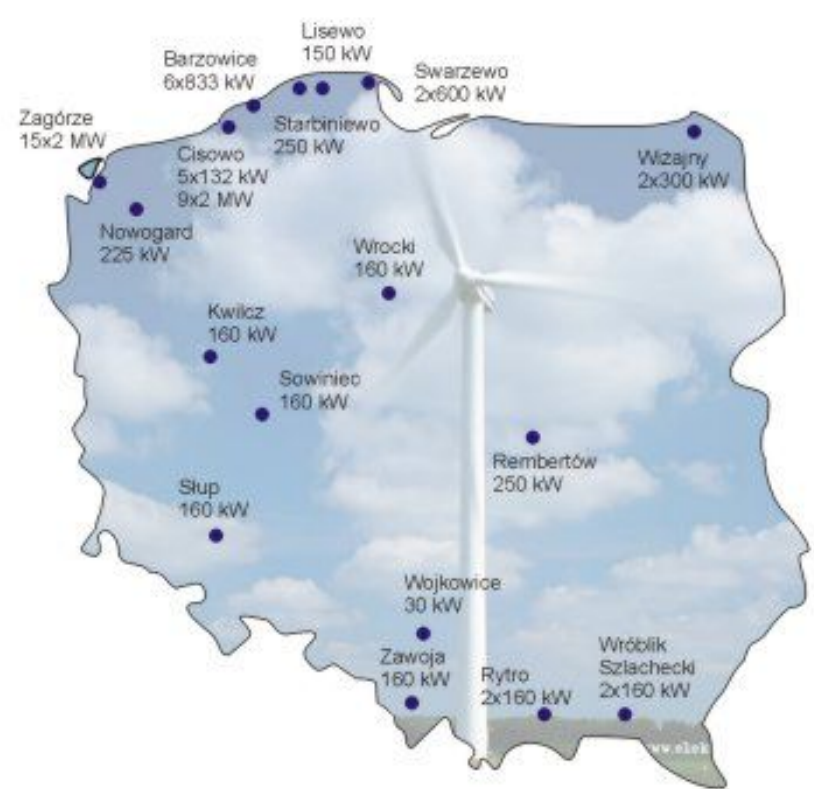
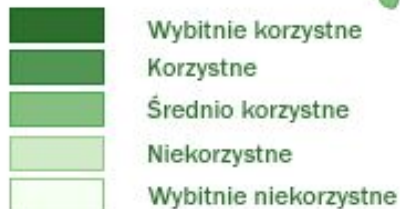
Hydroenergy



Potential of hydroenergy is assessed for 13,7 TWh per year

Actual use is only 12%

Wind energy



Moc farm wiatrowych w Polsce [MW]

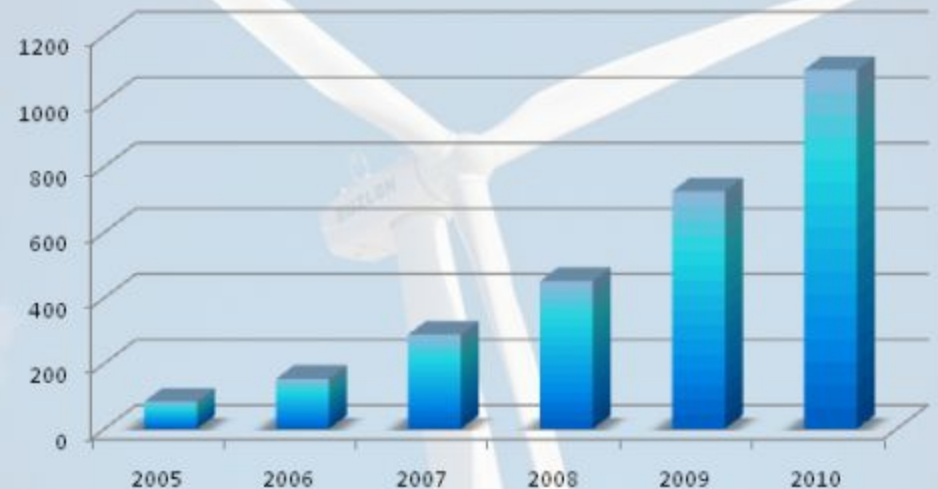
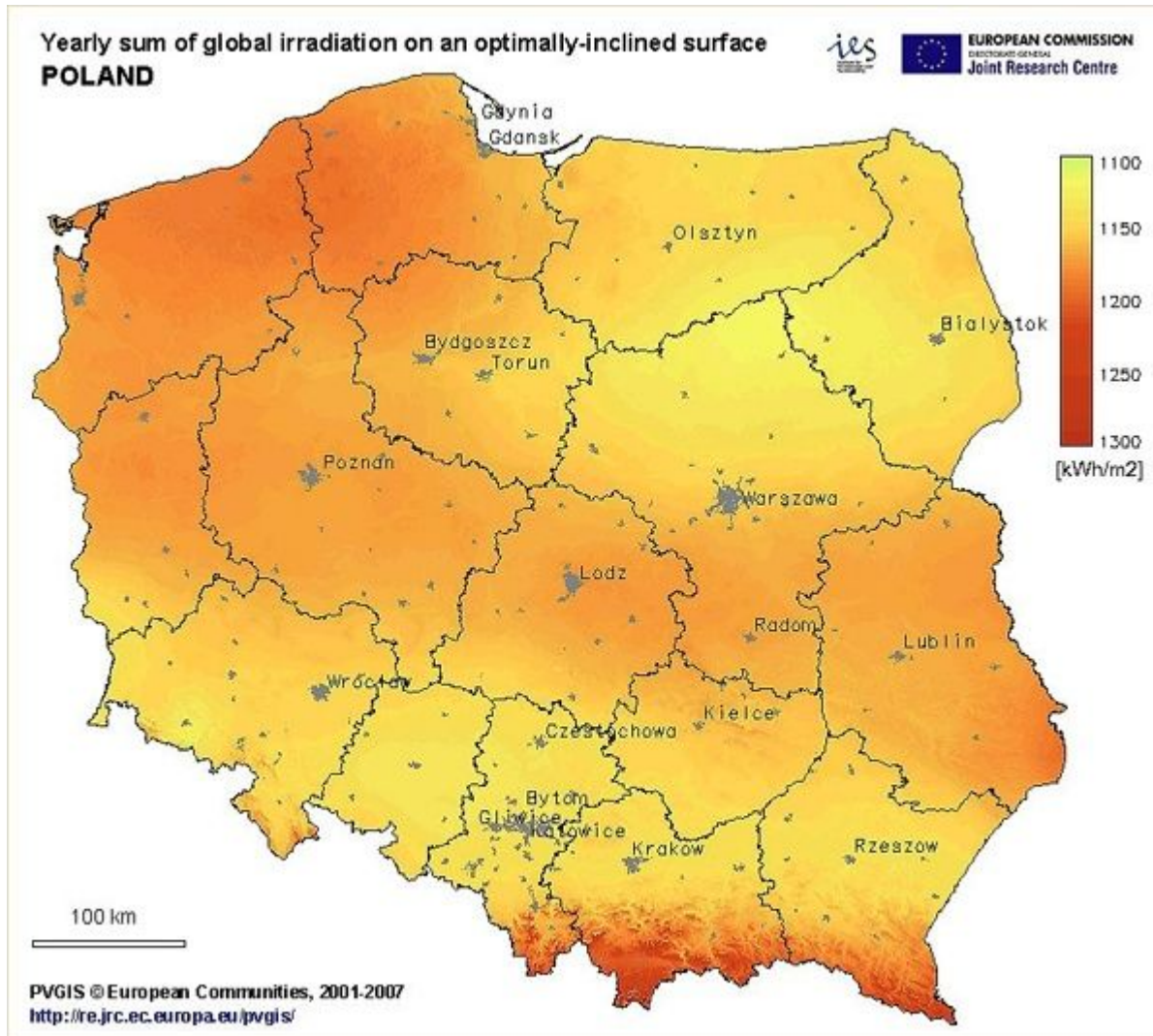
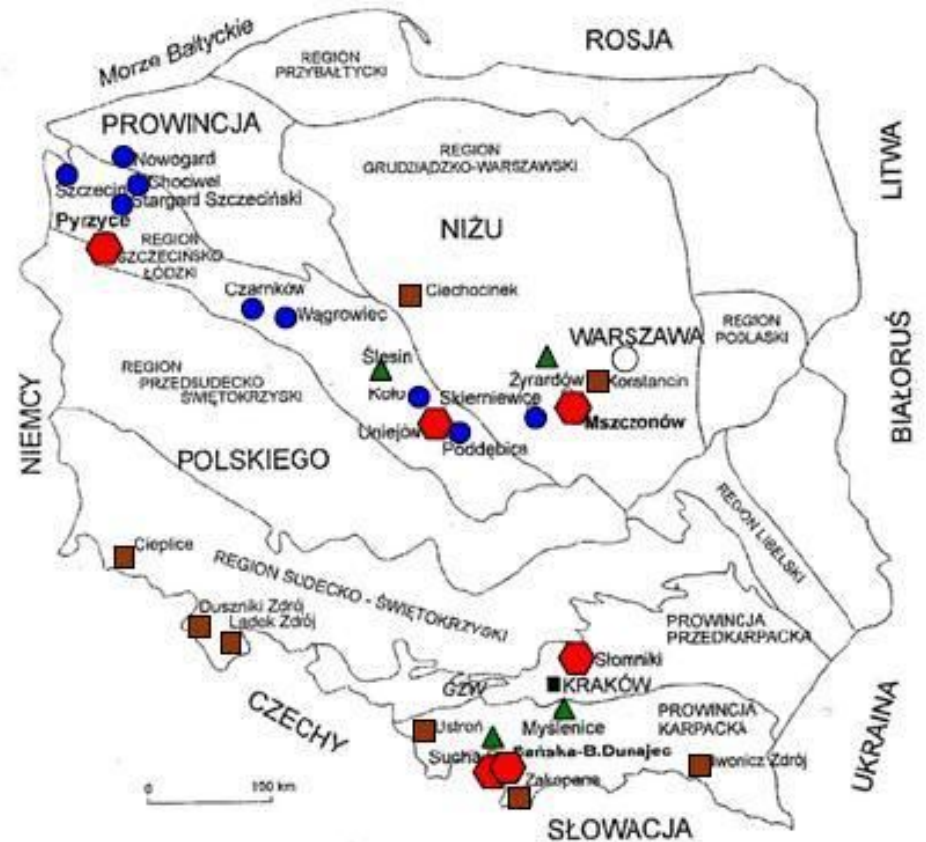
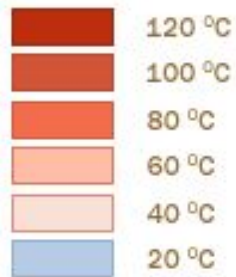
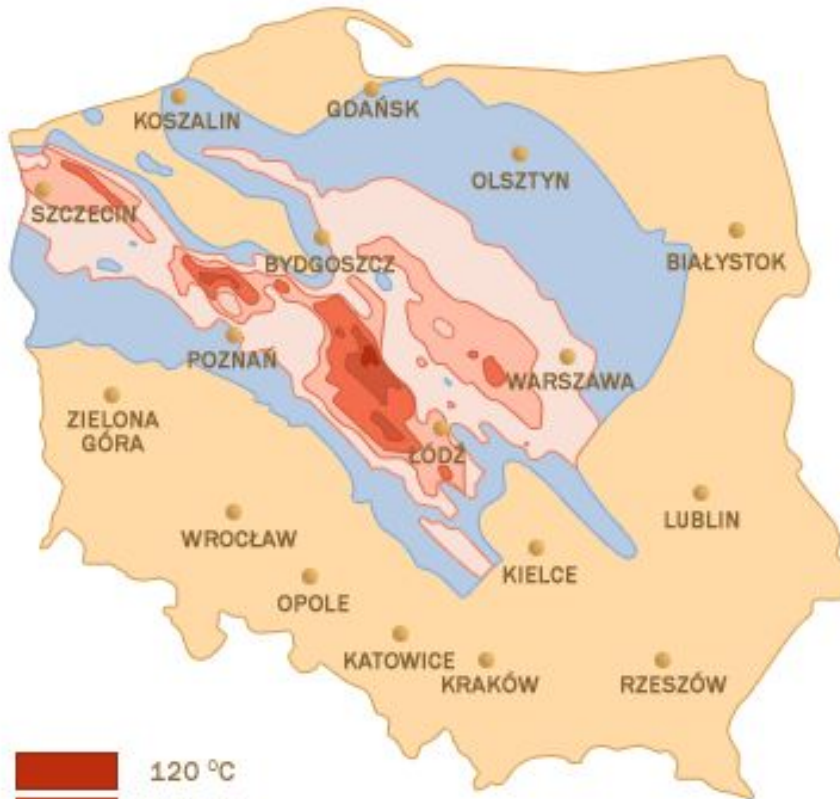


Foto: Kenneth Hynek, flickr cc-by-2.0

Solar energy



Geothermal energy



http://www.mojeopinie.pl/potencjal_oze_w_polsce_geotermia,3,1281866696

<http://www.builddesk.pl/edukacja/zrodla-energi/energia+geotermalna>

Renewable Energy Sources

- According to different assessments RES potential is not enough to cover energy needs.
- RES can not be an alternative for nuclear energy
- They will play an important role in diversification of energy sources



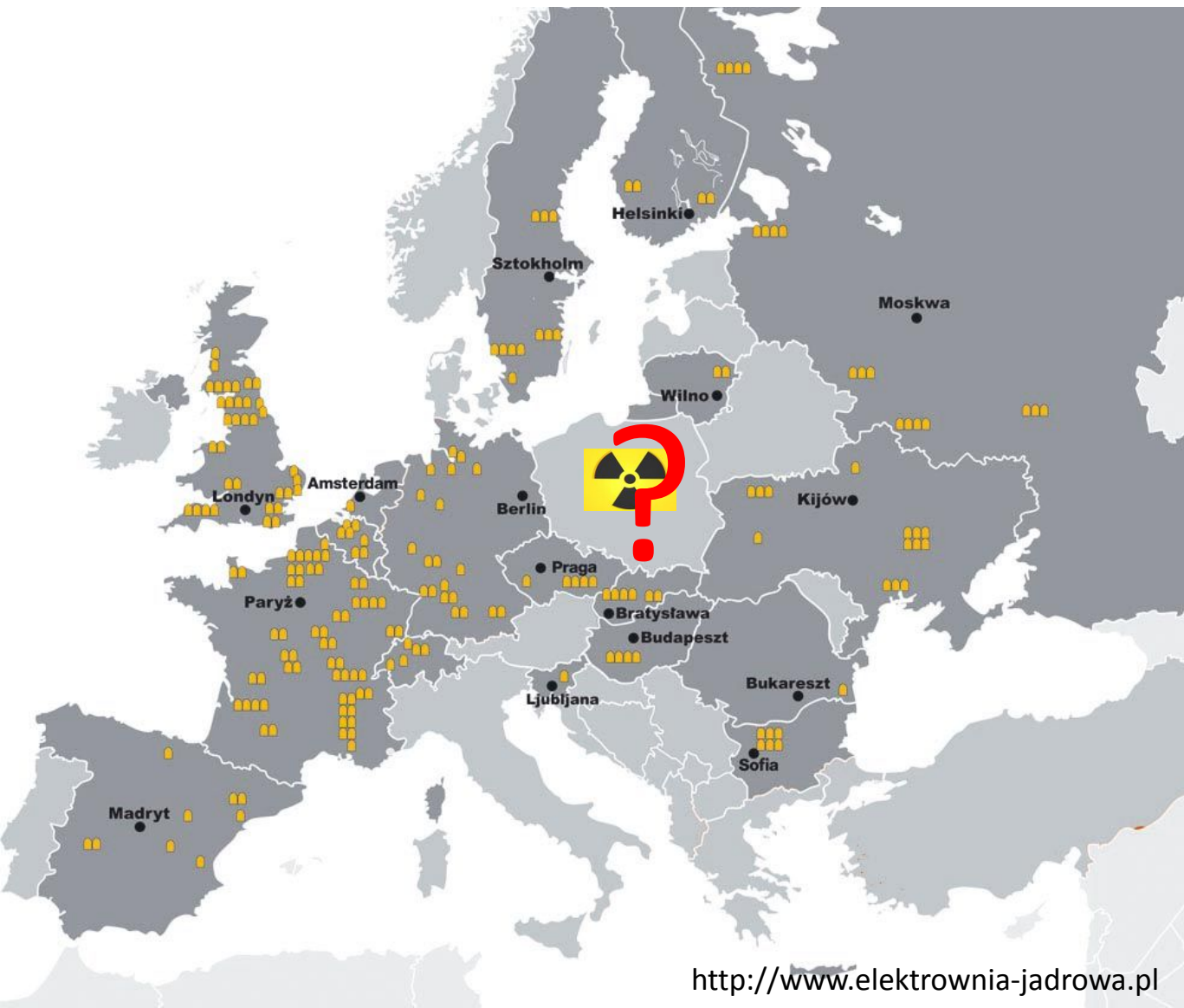
Problems with nuclear energy in Poland

- Internal (public participation, localisation, bad memories)
- External (Fukushima)



- Most of our neighbours use nuclear energy
- Advanced technologies
- Radioactive waste utilisation
- Uranium - import

Nuclear power plants around Poland



- In the distance of 310 km from our borders there is 10 working nuclear plants (25 reactors) with total power of 17 GWe.

Nuclear power plants around Poland



Wymienione elektrownie jądrowe obejmują:

14 reaktorów WWER-440 (każdy o mocy 440 MWe):

2 bloki elektrowni Równe (Ukraina),
4 bloki elektrowni Paks (Węgry),
2 bloki elektrowni Mochovce (Słowacja),
2 bloki elektrowni Bohunice (Słowacja),
4 bloki elektrowni Dukovany (Czechy),

6 reaktorów WWER-1000 (każdy o mocy 1000 MWe):

2 bloki elektrowni Równe (Ukraina),
2 bloki elektrowni Chmielnicki (Ukraina),
2 bloki elektrowni Temelin (Czechy),

4 reaktory BWR:

1 blok elektrowni Krümmel (RFN) o mocy 1316 MWe,
3 bloki elektrowni Oskarshamn (Szwecja) - o mocach 487, 623 i 1197 MWe,

1 reaktor RBMK:

1 blok elektrowni Ignalina (Litwa) 1300 MWe.

Nuclear energy in Poland – developing story

Nuclear power plant in Żarnowiec 1982–1990



26 April 1986



CZARNOBYL

СТІЙ!
ЗАБОРОНЕНА ЗОНА

Czarnobyl dziś.
Fotografie.
Waldemar Józwa

wernisaz: 30 maja
godz. 19.00
„Dudowne Lato”
ul. Karmelicka 43
Kraków

Nuclear energy in Poland – developing story



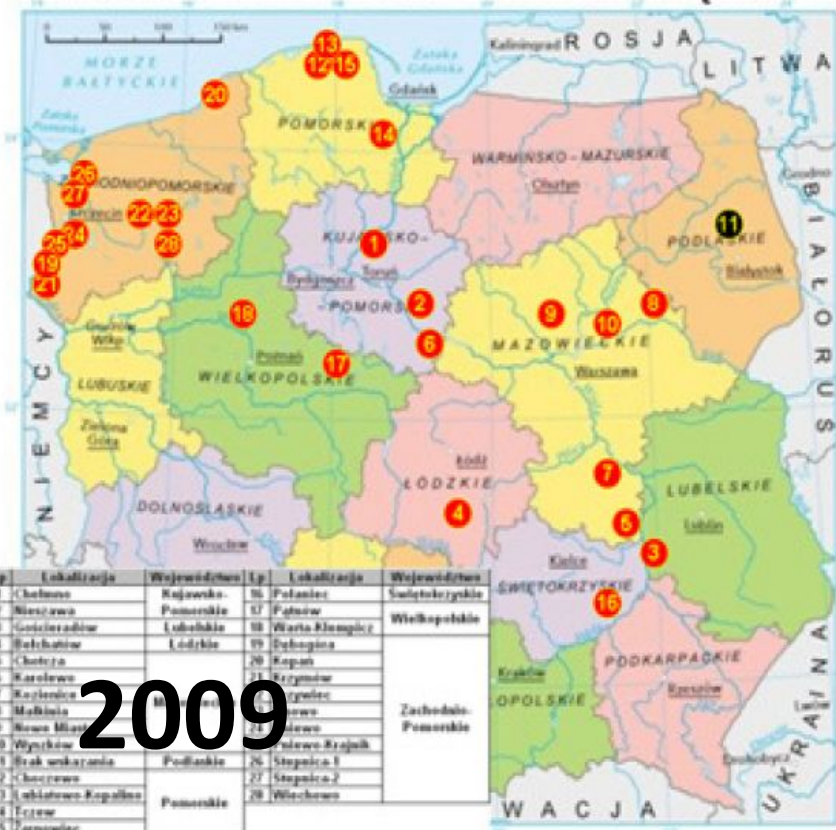
- In 1990:*
- we didn't need additional energy*
 - nuclear energy was more expensive than conventional energy (coal)*
 - public security*
 - public acceptance*

„EJŻ jest inwestycją zbędną dla polskiego systemu energetycznego w horyzoncie 10 do 20 lat, a potem wcale nie ma pewności, że energetyka jądrowa będzie potrzebna”

Nuclear energy in Poland – developing story

From 2010 – new Program of nuclear energy in Poland
 Till the end of 2013 – localisation and contract agreement

POTENCJALNE LOKALIZACJE ELEKTROWNI JĄDROWEJ



2009



Nuclear energy in Poland – developing story

Program of nuclear energy in Poland

01.01.2014 - 31.12.2015

technical design and documentation

01.01.2016 - 31.12.2020

construction of the first block, following by others

01.01.2021 - 31.12.2030

localisation and construction of other plants/blocks



POTENCJALI PRODUKCJI URANU ORAZ ENERGII JĄDROWEJ



Comparison of use of the resource and CO₂ emission for power plant 1000 MWe

Electric Power plant	Use of the resource	CO ₂ eq. emission
coal	2 000 000 – 6 000 000 t	960 t/GWh
gas	1 000 000 000-3 000 000 000 m ³	480 t/GWh
oil	1 500 000 t	730 t/GWh
biomass	6 000 km ² of land for plantation	
wind	100 km ² of land for wind farm	
sun	50 km ² of land for solar panels	
nuclear	35 t of uranium/ few km ² of land	

- Nuclear power plants in EU countries save 700 000 000 t CO₂ annually. This is similar to the total CO₂ emission from cars used in EU.

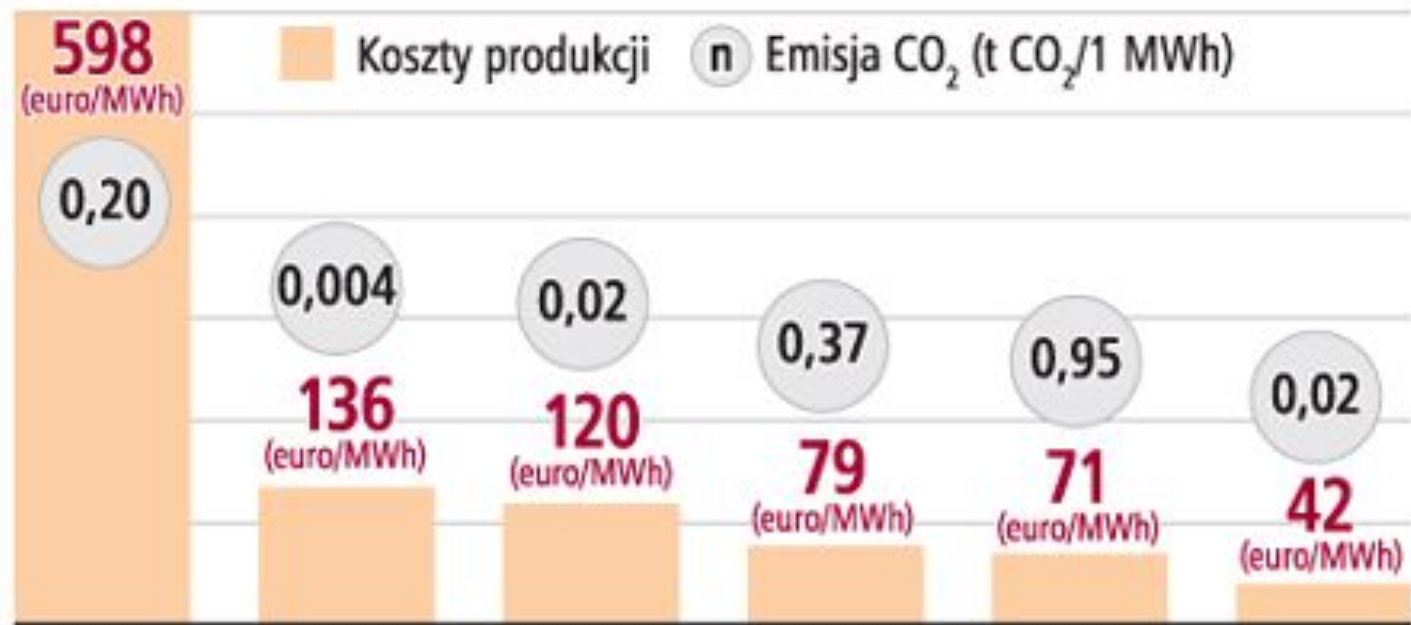
Nuclear energy in Poland – developing story



Per 1 person per life

Cost of energy (Euro/MWh) and CO₂ emission (t CO₂/MWh)

KOSZTY PRODUKCJI ENERGII W NOWOCZESNYCH ELEKTROWNIACH*



Energy from: sun water wind natural gas black coal nuclear

Zródło: CEZ, Oeko-Institute, Darmstadt

*z uwzględnieniem kosztów emisji CO₂

tR

11 March 2011



Nuclear energy in Poland – developing story

We are on the right way but ...



Nuclear power plant in Fukushima in 2009 (left) and year after tsunami (right)

Eg. Germany (26%*) decided to close all their power plants till 2022; Switzerland (40%*) till 2034; Belgium (50%*) 2025;

* % of energy from nuclear plants in total energy use

Fot. KYODO REUTERS

Nuclear energy in Poland – developing story

Nuclear energy in Poland – public acceptance

Budowa elektrowni jądrowych ma swoich zwolenników i przeciwników. Gdyby poproszono Pana(ią) o zajęcie jednoznacznego stanowiska w sprawie budowy takich elektrowni w naszym kraju, to czy był(a)by Pan(i) za czy też przeciw?



* Badanie Ambasady Brytyjskiej

** Badanie Ministerstwa Gospodarki

*** W latach 1987 – 2008 wariant odpowiedzi brzmiał: „nie potrafię zająć stanowiska w tej sprawie”

2012

„Fukushima effect” is decreasing- **51% / 45%**

but...

„NIMBY” syndrom

36% / 63%

Nuclear energy in Poland – developing story

- Gąski – case: one of 3 selected localities:
- REFERENDUM
 - over 90% of citizens said „**NO**” to nuclear plant in their village.



Nuclear energy in Poland – developing story

- **OPPOSITION**

- some of NGO (waste utilisation and damage risk)

but...

- over 30 000 protests from Germany!



Nuclear energy – why?

Social advantages:

- Ensure of permanent electricity supply
- Competitive prices of energy
- Diversification of energy sources
- Cleaner environment
- New working places
- New study directions
- Development of local enterprises
- Development of regions



Challenges for Polish energy sector

- Security and independency (diversification of energy sources). Increase of energy use...
- Climate change and global warming (CO₂ em. decreasing)
- 15% from RES till 2020
- Nuclear power implementation
- Increase efficiency of energy (production and transport)
- Reasonable use of energy!!! – education action
- Need of stable regulations
- Investments 1,5% PKB/year = 250 Euro/person/year

FUTURE OF ELECTRIC ENERGY PRODUCTION IN POLAND

year	2010 TWh	2010	2030 TWh	2030
Black coal	87,9	55,8%	71,2	35,8%
Brown coal	48,6	30,9%	42,3	21,0%
Natural gas	4,8	3,0%		6,6 %
Nuclear energy	0	0%	31,6	15,7%
RES:		7,3%		18,8%
Biomass and biogas	6,3	4,0%		.
Water	3,5	2,2%		
Wind	1,7	1,1%		
others	4,8	3,0%		1,5%

Źródło: Rocznik ARE "Statystyka elektroenergetyki polskiej"; Energetyka Ciepła i Zawodowa 12/2009, 1/2010

Źródło: Program Polskiej Energetyki Jądrowej (Ministerstwo Gospodarki - projekt 2010)

Climate change: Commission sets out Roadmap for building a competitive low-carbon Europe by 2050

08.03.2012

Towards a low carbon society:

„If the EU makes the transition to a low-carbon society by 2050 we will live and work in low-energy and low-emission buildings, with intelligent heating and cooling systems. We will drive electric and hybrid cars and live in cleaner cities with less air pollution and better public transport. The transition would give Europe's economy a boost thanks to increased investment in clean technologies and clean energy”.

Effective investing
in renewable
sources of energy

Time for clean energy



„Patrz! To Niskoemisyjny Człowiek!”

Rys. 1.10. Zamieszczony dzięki
uprzejmości Petera z PRIVATE EYE.
Więcej na: www.private-eye.co.uk

**„Europe could cut most
of its emissions and
reduce the use of key
resources like oil and
gas, raw materials,
land and water.”**



**SZKOŁA GŁÓWNA
GOSPODARSTWA
WIEJSKIEGO
W WARSZAWIE**