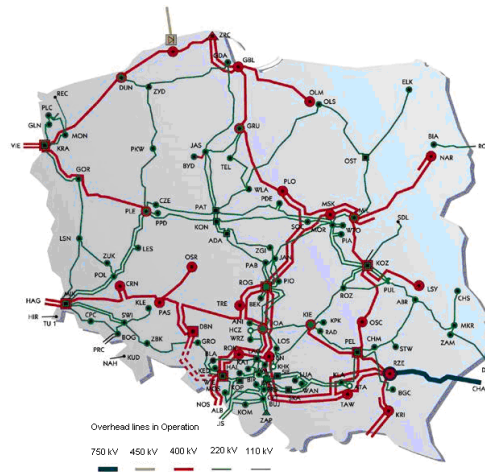


THE ELECTRICITY MARKET IN POLAND



Andrzej Szajner

**Bałtycka Agencja Poszanowania Energii
S.A.**

www.bape.com.pl

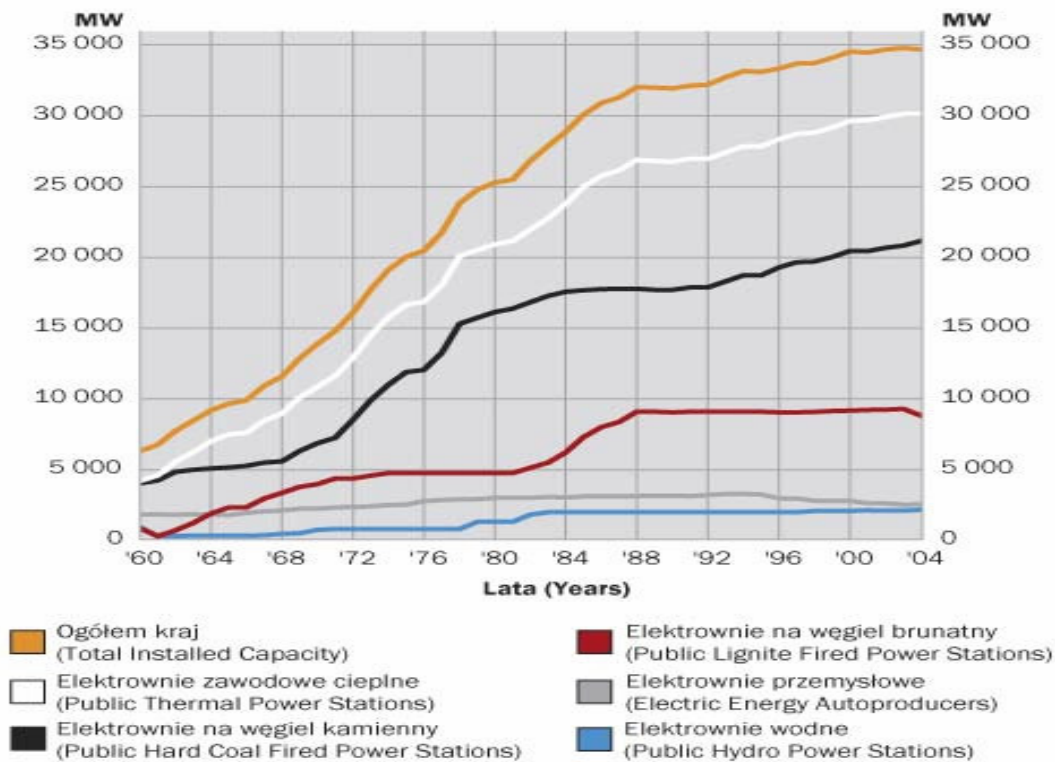
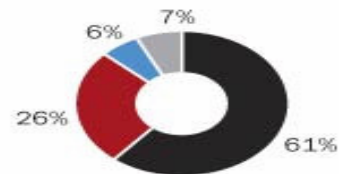


The electricity market in Poland

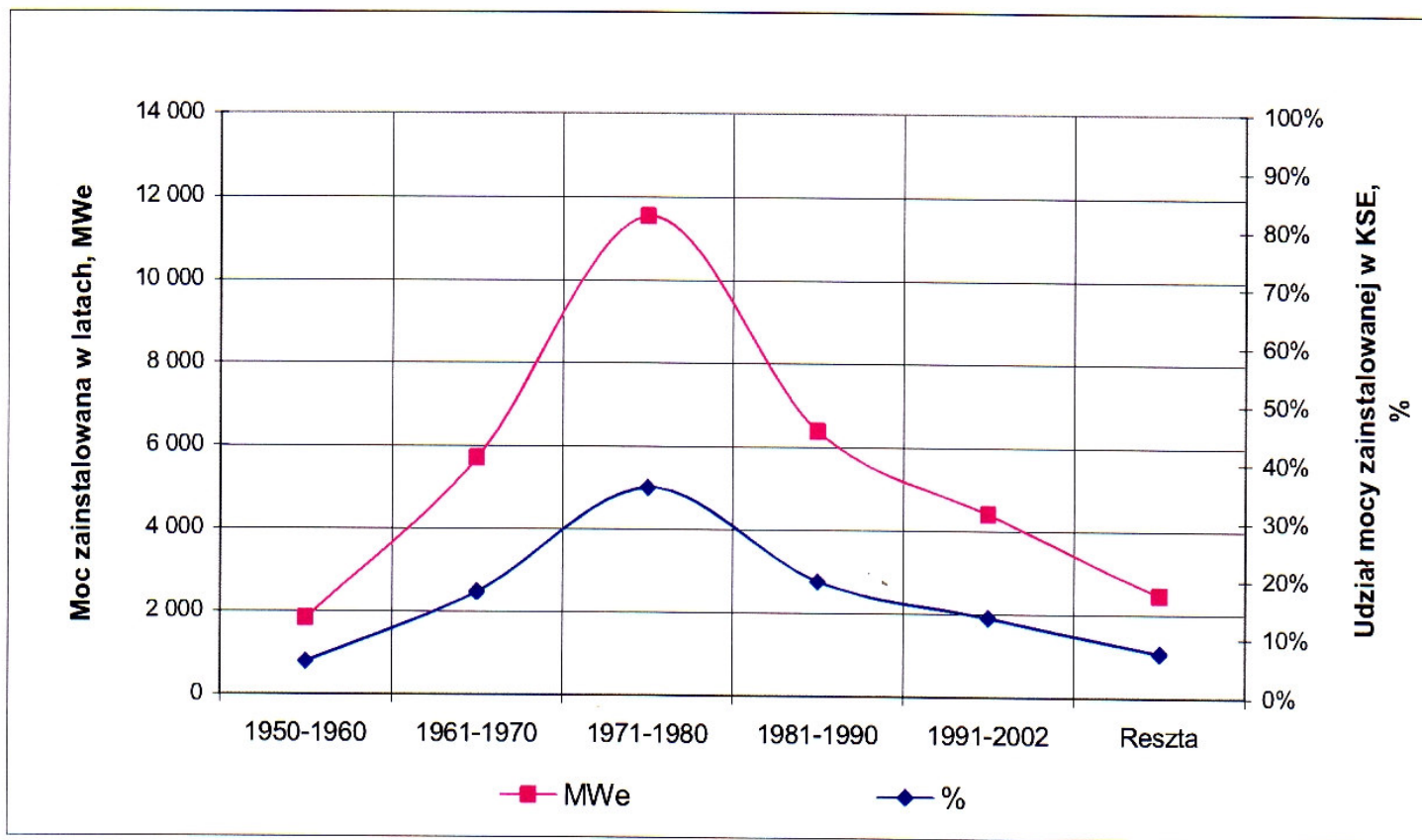
- Generation
- Transmission and distribution
- Organisation of the sector
- Green energy
- CHP electricity
- Problems and future

Installed capacity - history

Procentowy udział mocy zainstalowanej
na dzień 31.12.2004 r.
(100%=34 715 MW)
(% Shares in Capacities 31.12.2004)
(100%=34 715 MW)

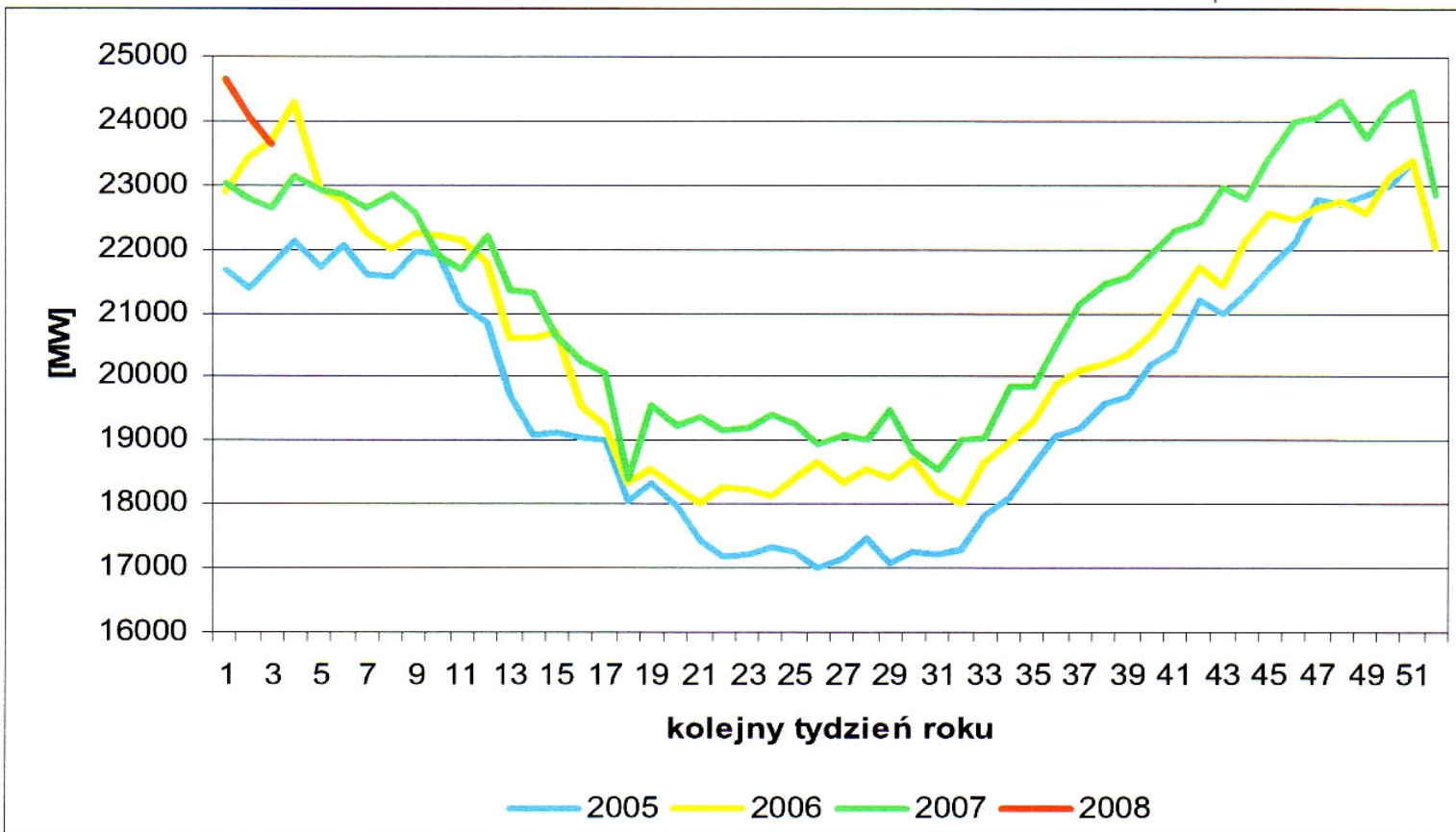


Ageing capacity



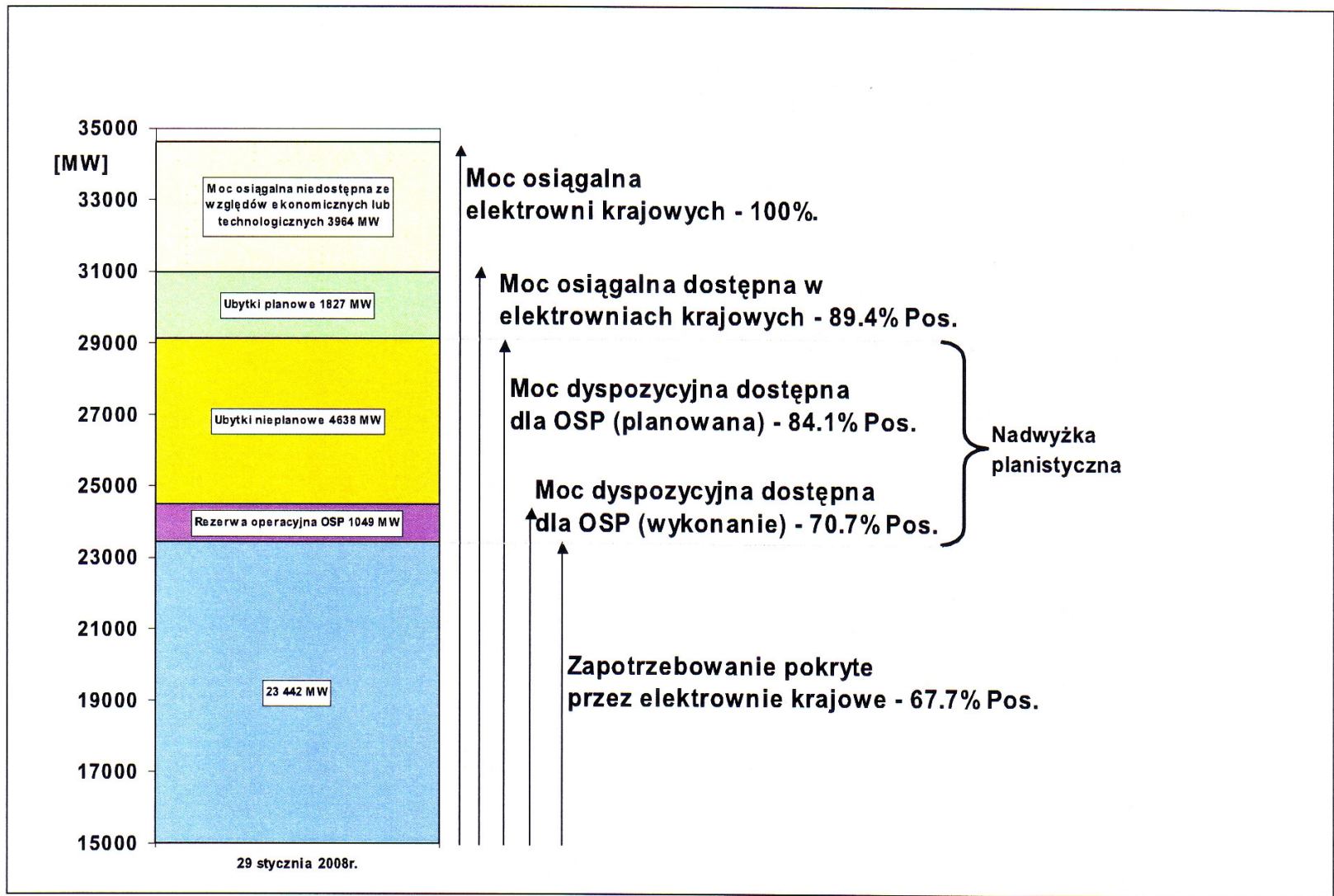
Rys. 1. Wiek mocy w Krajowym Systemie Energetycznym.

Peak demand 2005-2008



Weekly demand (average of daily peaks during week-days)

Demand coverage

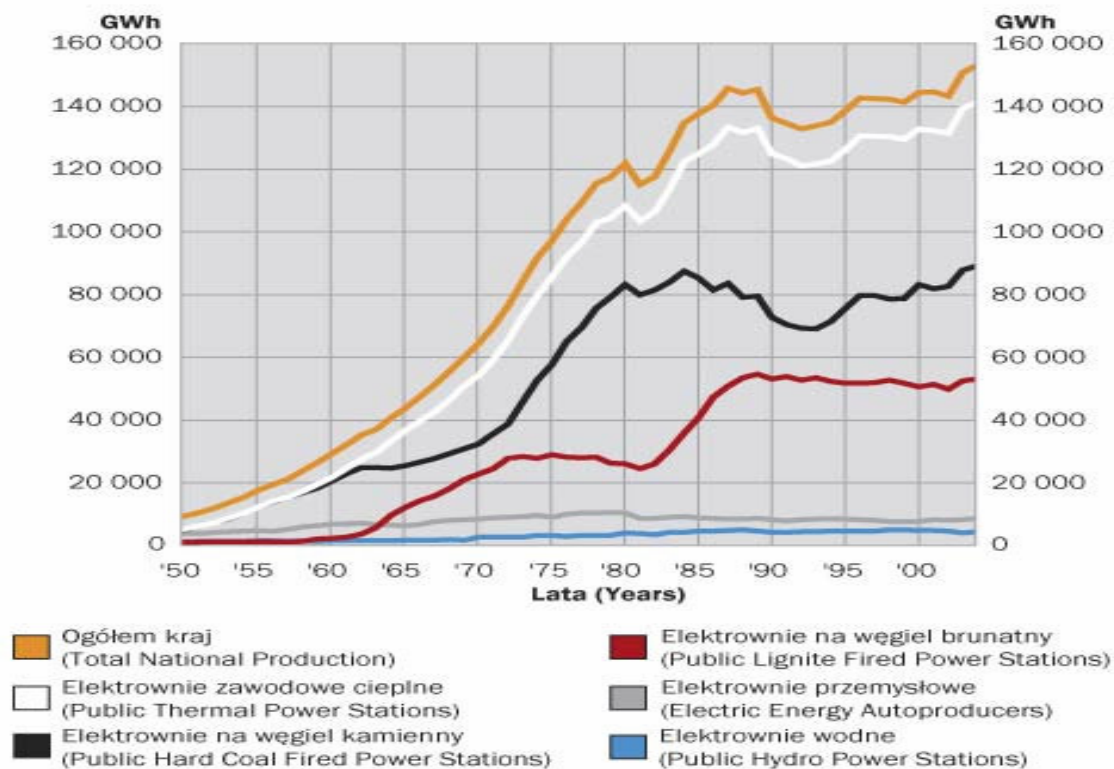
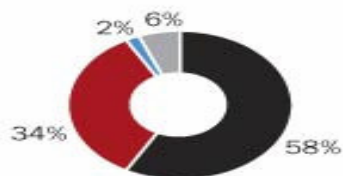


Rys. 6. Bilans mocy w KSE w szczycie dnia 29 stycznia 2008.

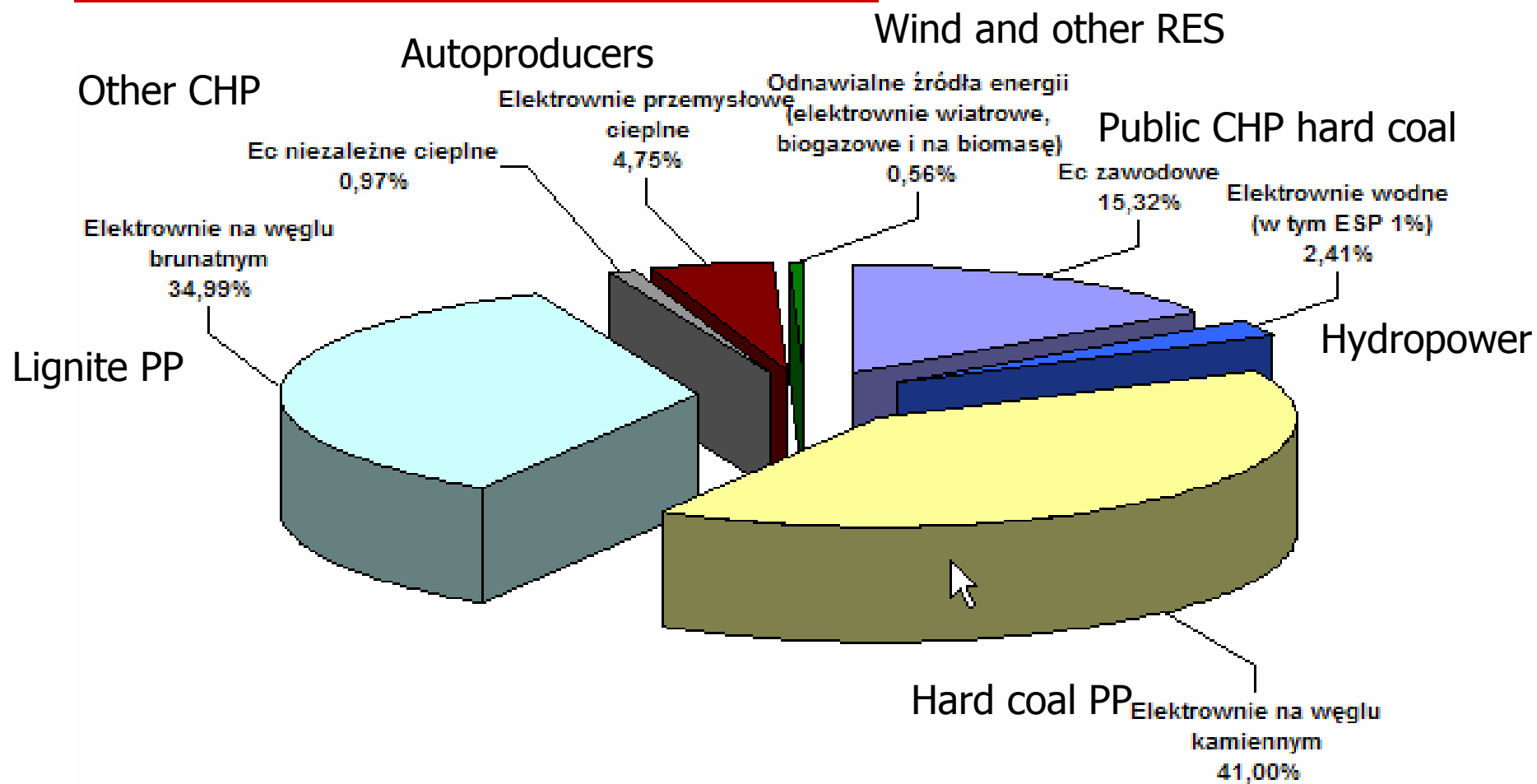


Production mix - history

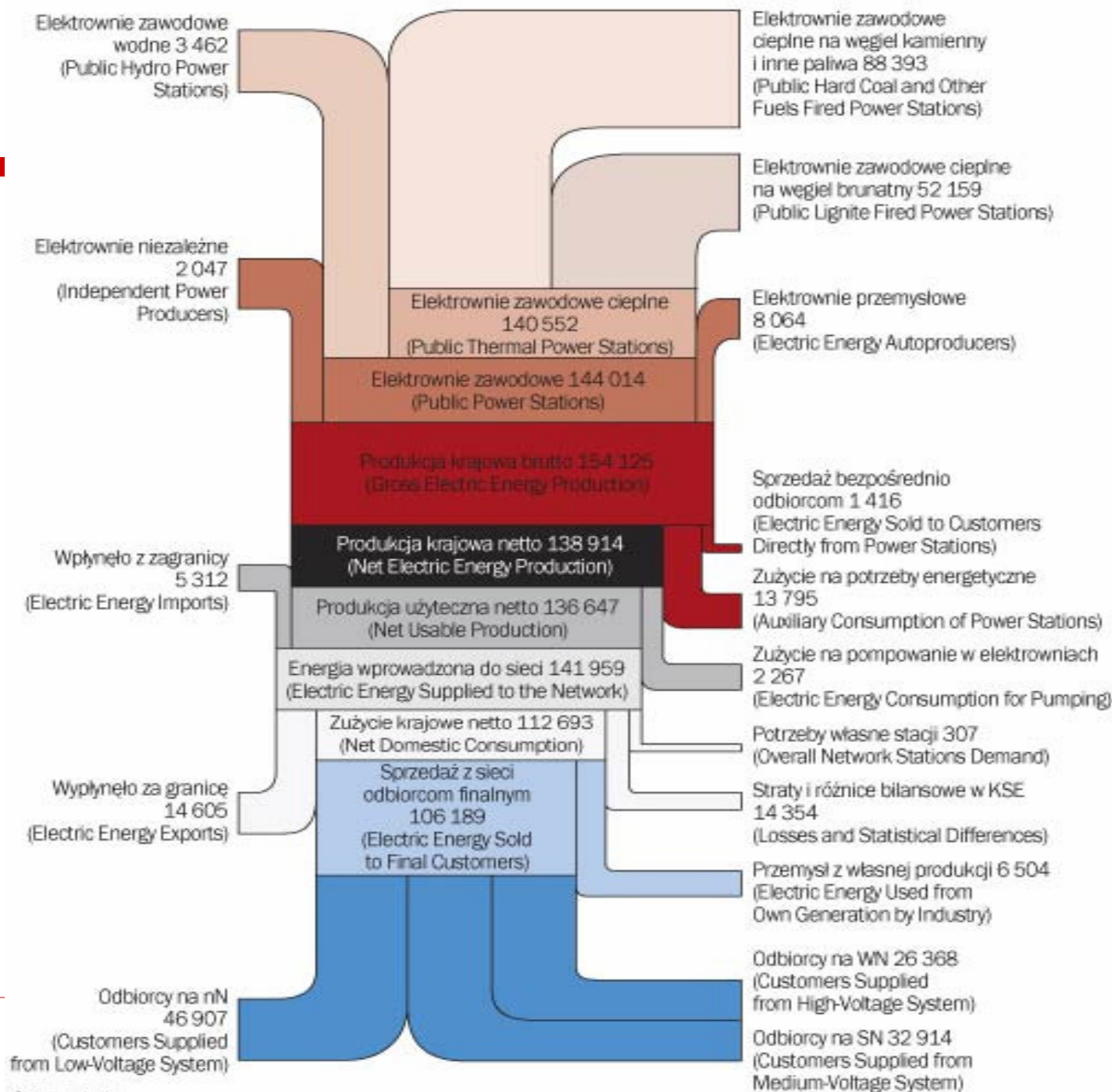
Procentowy udział w produkcji energii elektrycznej w 2004 r.
(% Shares in Production in 2004)



Production (2005)



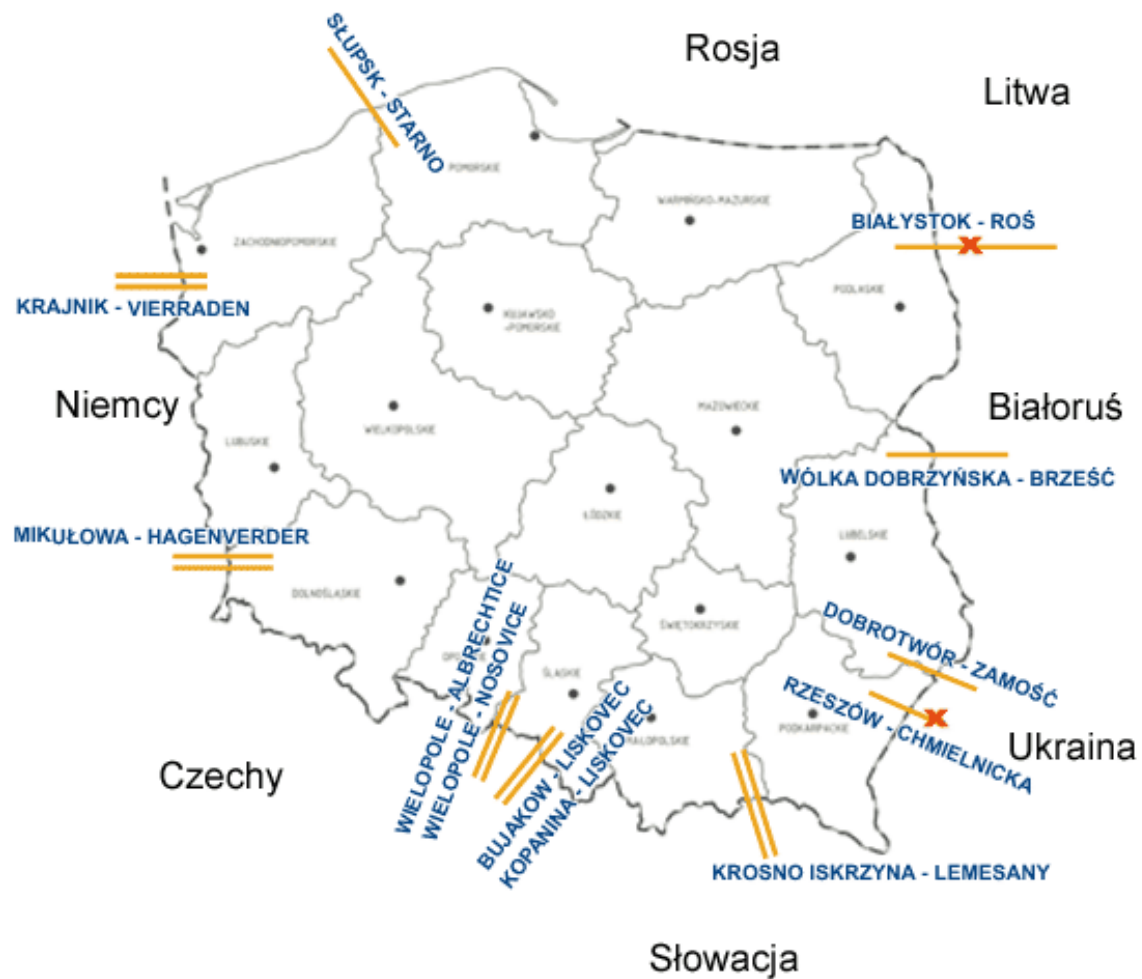
Flow diagram



Źródło: ARE SA



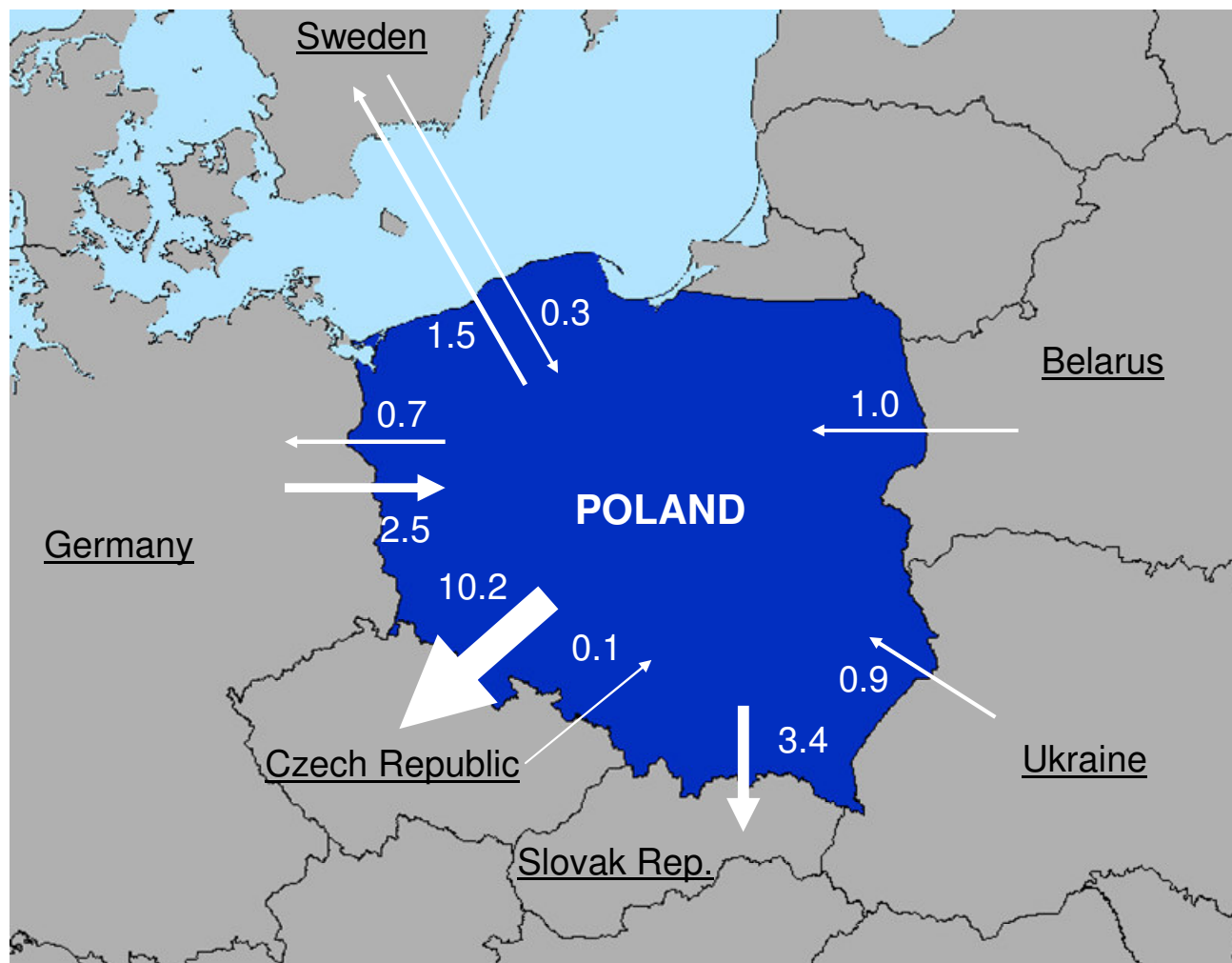
Trans-border power connections



| Line | Voltage | Maximum load | Lines | Remarks |
|----------------------------|-------------|-----------------|-------|--|
| Krajnik - Vierraden | 400 kV | 778 A, 296 MW | 2 | |
| Mikułowa - Hagenverder | 400 kV | 2000 A, 1385 MW | 2 | |
| Wielopole - Albrechtice | 400 kV | 2000 A, 1385 MW | 1 | |
| Wielopole - Nošovice | 400 kV | 2000 A, 1385 MW | 1 | |
| Bujaków - Liskovec | 220 kV | 1050 A, 400 MW | 1 | |
| Kopanina - Liskovec | 220 kV | 1050 A, 400 MW | 1 | |
| Słupsk - Stärno | 450 kV (DC) | | 1 | |
| Białystok - Roś | 220 kV | 608 A, 231 MW | 1 | Off-service since 30.06.2004 |
| Wólka Dobrzyńska - Brześć | 110 kV | 120 MW | 1 | Private line, connected to LUBZEL |
| Dobrotwór - Zamość | 220 kV | 660 A, 251 MW | 1 | Line in radial configuration |
| Rzeszów - Chmielnicka | 750 kV | 1500 A, 1300 MW | 1 | Element of only line 750 kV. Off-service since 1993. |
| Krosno Iskrzynia - Lemšany | 400 kV | 1200 A, 831 MW | 2 | |



Physical electricity exchanges in 2006, in TWh

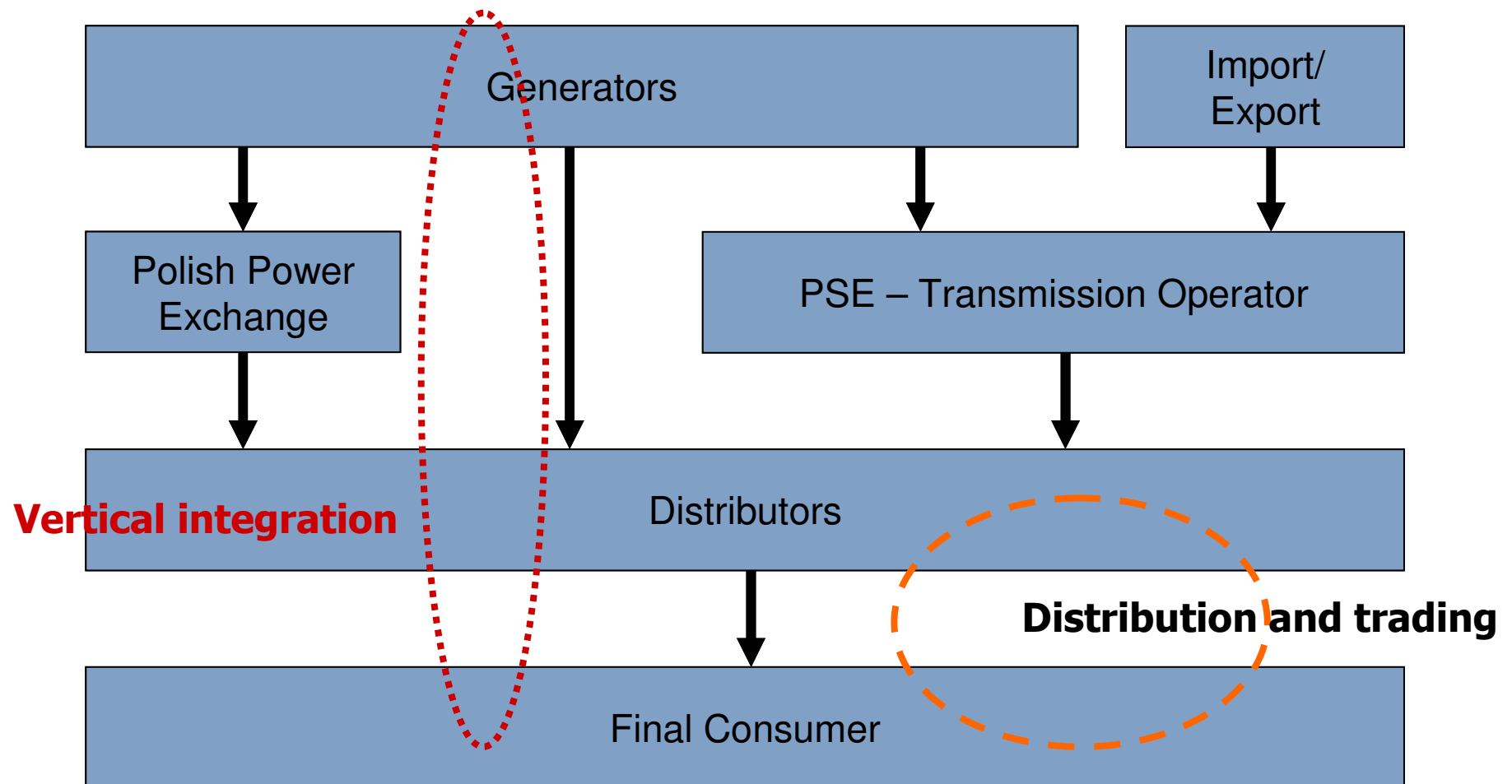


Problems with cross-border transfer

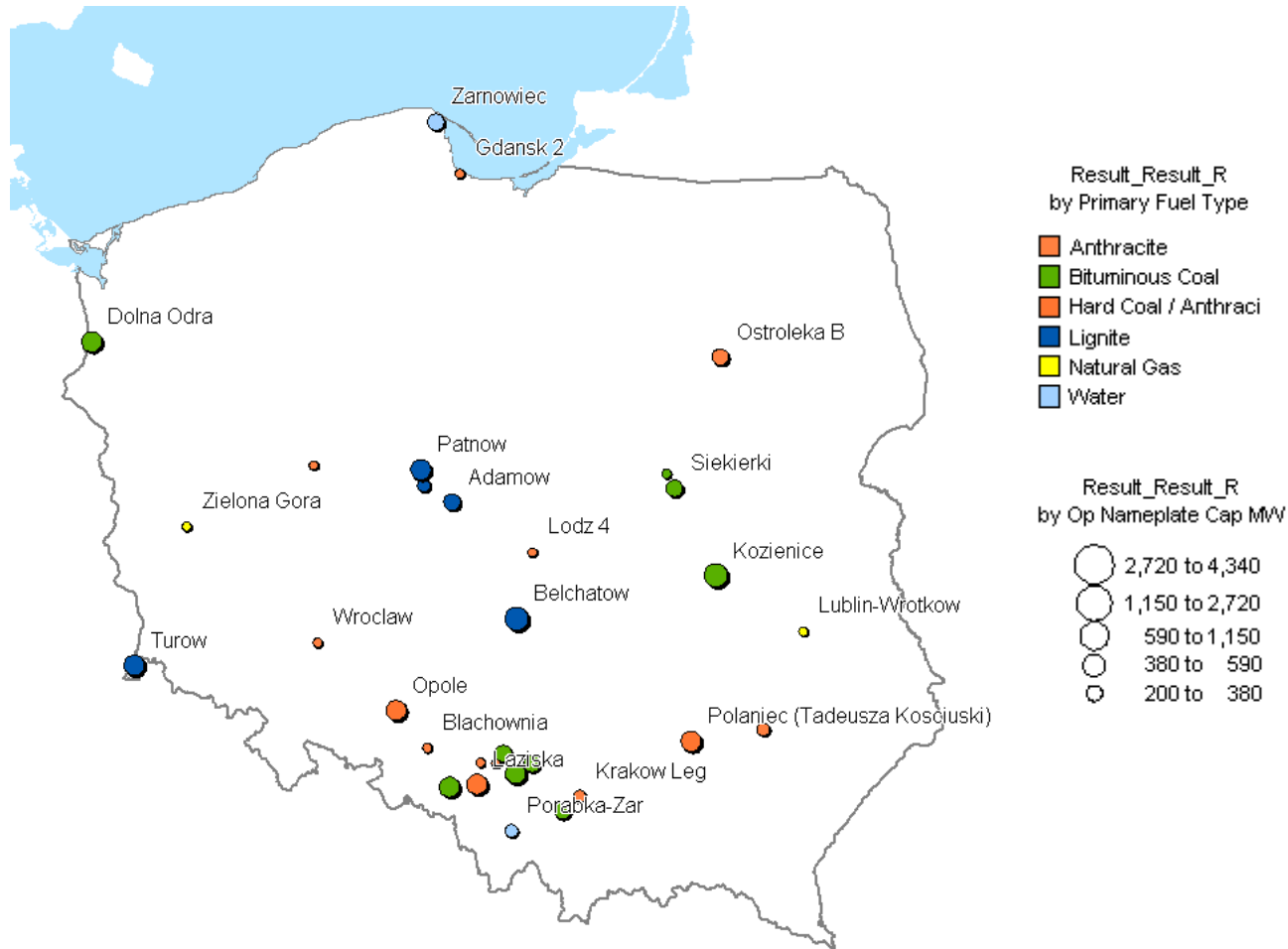
- ❑ Insufficient network capacity, especially in the southern and western part of the Polish transmission grid (congestions!)
- ❑ Transmission networks of Poland and Lithuania are not connected; two power systems belong to two different synchronously connected areas - Russian power system (the UPS/IPS system), Poland is a member of the UCTE system
- ❑ The Baltic Ring is identified as critical for creating a common power market in the region



Structure of Polish electricity sector (as of 2008)



Polish power plants over 200MW Capacity (2005)



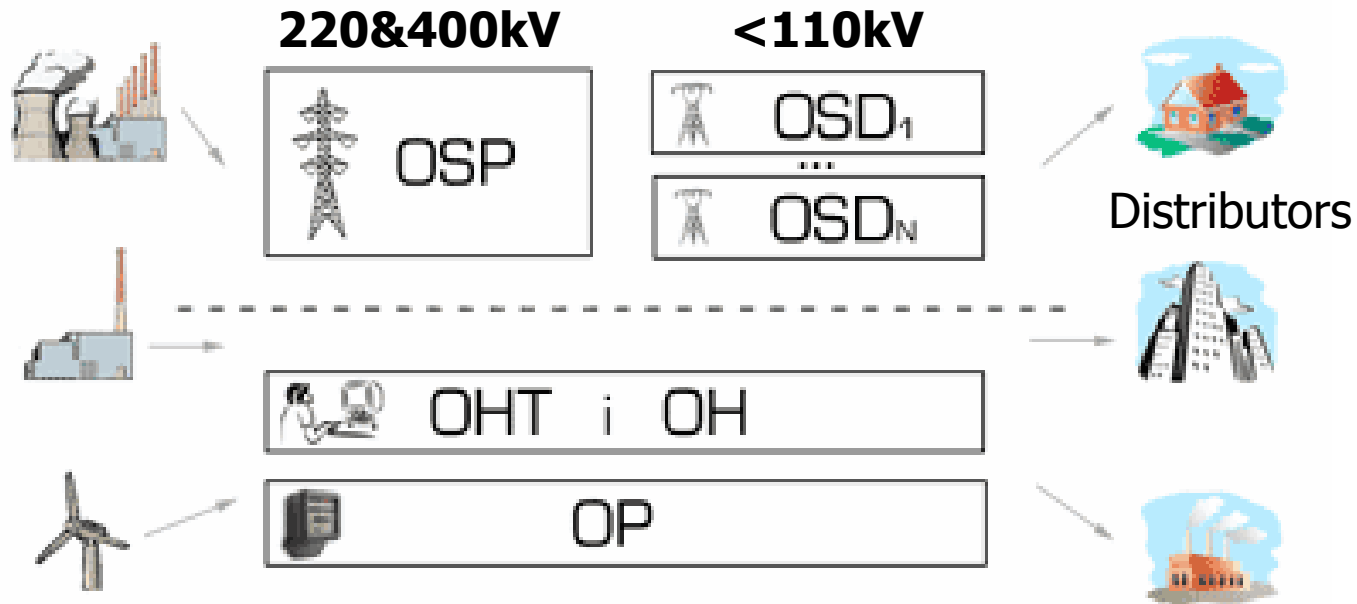
System operators responsibility

- ❑ OSP (Transmission operator) responsible for transmission network operation and development 220 i 400 kV.
- ❑ OSD (Transmission operators) responsible for distribution network operation and development 110 kV.
- ❑ OH – Trade operators; OHT – Technical and trade operators - responsible for acquisition of information on energy production and prognosis of consumption by end users.
- ❑ OP – Metering operators (in future) responsible for collection of data from energy meters of end-users and transfer to OSD.

Electricity market operators

Transmission and distribution

PRZESYŁ I DYSTRYBUCJA ENERGII



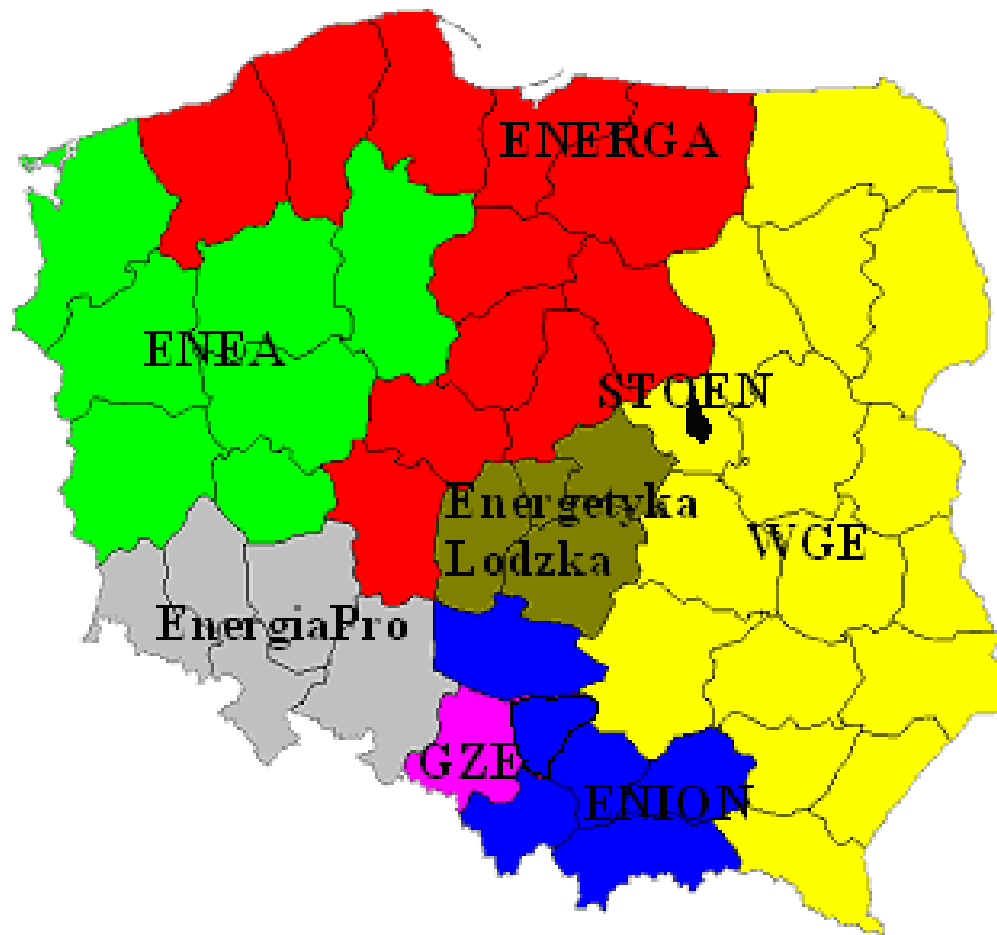
HANDEL ENERGIA
Electricity trade

OH – Trade operators; OHT – Technical and trade operators
OP – Metering operators

Operators of distribution systems (OSD)

1. Tauron Polska Energia S.A.
 - EnergiaPro Koncern Energetyczny S.A., Wrocław
 - ENION S.A., Kraków
2. Polska Grupa Energetyczna S.A.
 - ŁZE Dystrybucja sp. z o.o.
 - ZEŁ-T Dystrybucja Sp. z o.o.
 - LUBZEL DYSTRYBUCJA Sp. z o.o.
 - RZE Dystrybucja Sp. z o.o.
 - ZEORK Dystrybucja Sp. z o.o.
 - ZKE Dystrybucja Sp. z o.o.
 - ZEB Dystrybucja Sp. z o.o.
 - ZEW-T- Dystrybucja Sp. z o.o.
3. ENEA S.A., Poznań
4. Koncern Energetyczny ENERGA S.A., Gdańsk
5. Vattenfall Distribution Poland S.A., Gliwice
6. RWE Stoen Operator Sp. z o.o., Warszawa

Polish distribution sector



Vertically integrated companies



Suppliers of retail market

| Supplier of the retail market | Share |
|-------------------------------|-------|
| PGE | 32% |
| Tauron Polska Energia | 25% |
| KE ENERGIA | 17% |
| Enea | 14% |
| Vattenfall | 7% |
| RWE STOEN | 4% |

Source: URE



Vertically integrated companies

| Company | Generation | Distribution | Trading | |
|---|------------|--------------|---------|--------|
| | GW | share | gross | retail |
| Polska Grupa Energetyczna PGE | 8 | 32% | Yes | Yes |
| Tauron Polska Energia/PKE | 5 | 25% | | Yes |
| ENEA S.A., Poznan | 3 | 14% | | Yes |
| Koncern ENERGA, Gdańsk | 0,6 | 17% | | Yes |
| Vattenfall Distribution Poland, Gliwice | | 7% | | Yes |
| RWE Stoen Operator, Warszawa | | 4% | | Yes |

- Vertically integrated energy companies have surplus of own energy. They plan to retrofit their generating capacity and to build new, modern sources. Their advantage is that they have own distribution networks.
- **No room for IPP!**
- Concerning RES sources there is an obligation to purchase energy by a distribution company.



Future of vertical integration

- According to the opinion of URE, consolidation of energy sector introduced by the previous government has worsened conditions of competitiveness on the energy market. “Share of two biggest groups, PGE and Tauron is so significant that these groups could execute their dominant position and impose price conditions”, according to the document.
- URE is cooperating with the Office of Competition and Consumer Protection (UOKiK) on problems of consolidation of energy sector. In the opinion of URE it would be better for the market conditions if further merges were stopped (including purchasing PAK power plant by Enea and ENERGA distributor by PGE).

Trading of electricity

- ❑ **Contract market;** energy is traded under bilateral contracts, entered into directly by counter-parties ('Over the Counter', or OTC);
- ❑ **Exchange market;** energy is traded under the contracts concluded at the Polish Energy Exchange (till now <10%);
- ❑ **Balancing market;** the Transmission System Operator balances the differences between transactions made in the contract segment and exchange segment against the actual electricity demand.

Long-Term Power Purchase Agreements (KDT) – dissolved since 1.04.2008

- ❑ Till today Long-Term Power Purchase Agreements cover 50% of electricity generation (about 55 TWh out of 110 TWh sold to end-users)
- ❑ KDTs are terminated by voluntary "termination agreements"
- ❑ Electricity generating units have a right to cover "deserted costs", i.e. costs incurred on investments (~PLN 12.5 billion)
- ❑ Clients will no longer be charged with an equalizing element of the transmission tariff
- ❑ Deserted costs and charges paid by end-users are controlled by URE

Polish Power Exchange

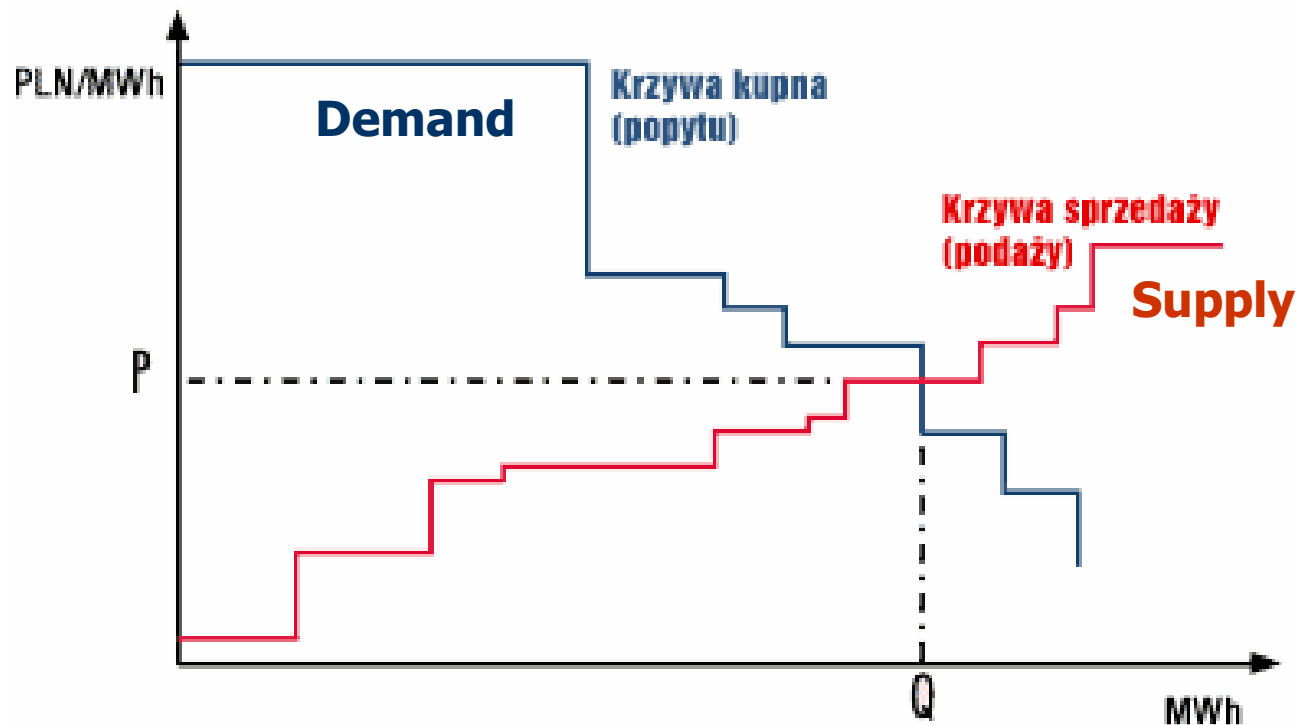
- Day-Ahead Market (DAM)
 - Green Certificate Market GCM
 - CHP Certificate Market
 - Certificates of Origin underlying rights, representing a confirmation that the electric energy was generated in high efficiency cogeneration, referred to in Art. 91 par.1 subpar. 1 of the Act of 10th April 1997 - Power Law. - **capacity < 1 MWe and gas CHP**
 - subpar. 2 - **other CHP plants**
 - CO2 Emission Allowance Market
- www.polpx.pl

Polish Power Exchange DAM

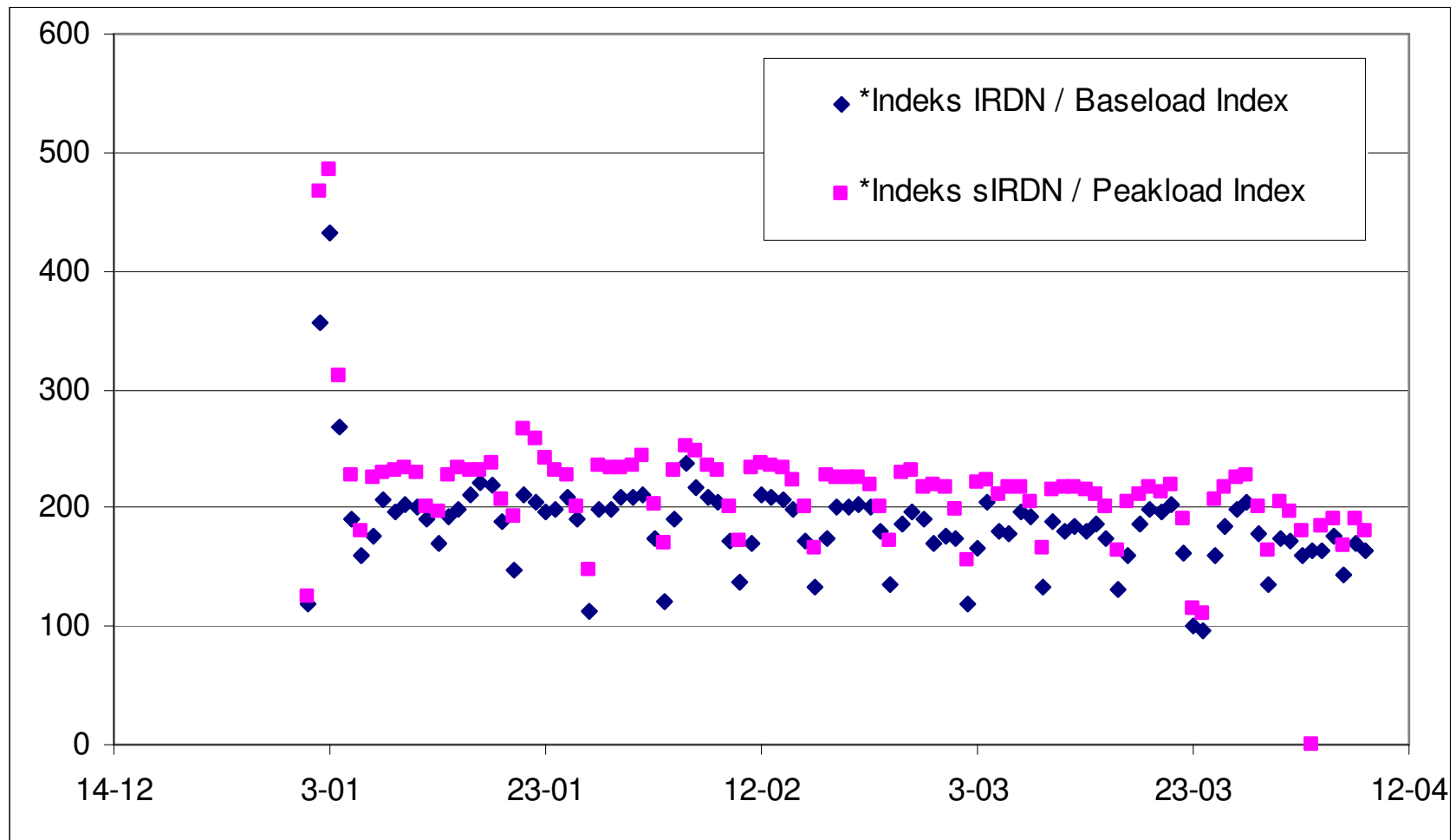
- Day-Ahead Market (DAM)
- Two sessions
- Hourly bidding
- The exchange transaction prices are fixed as equilibrium prices between electricity sale and purchase orders placed independently by the market players

The DAM comprises 24 hourly markets (accounting periods), in which DAM participants may buy and sell electricity

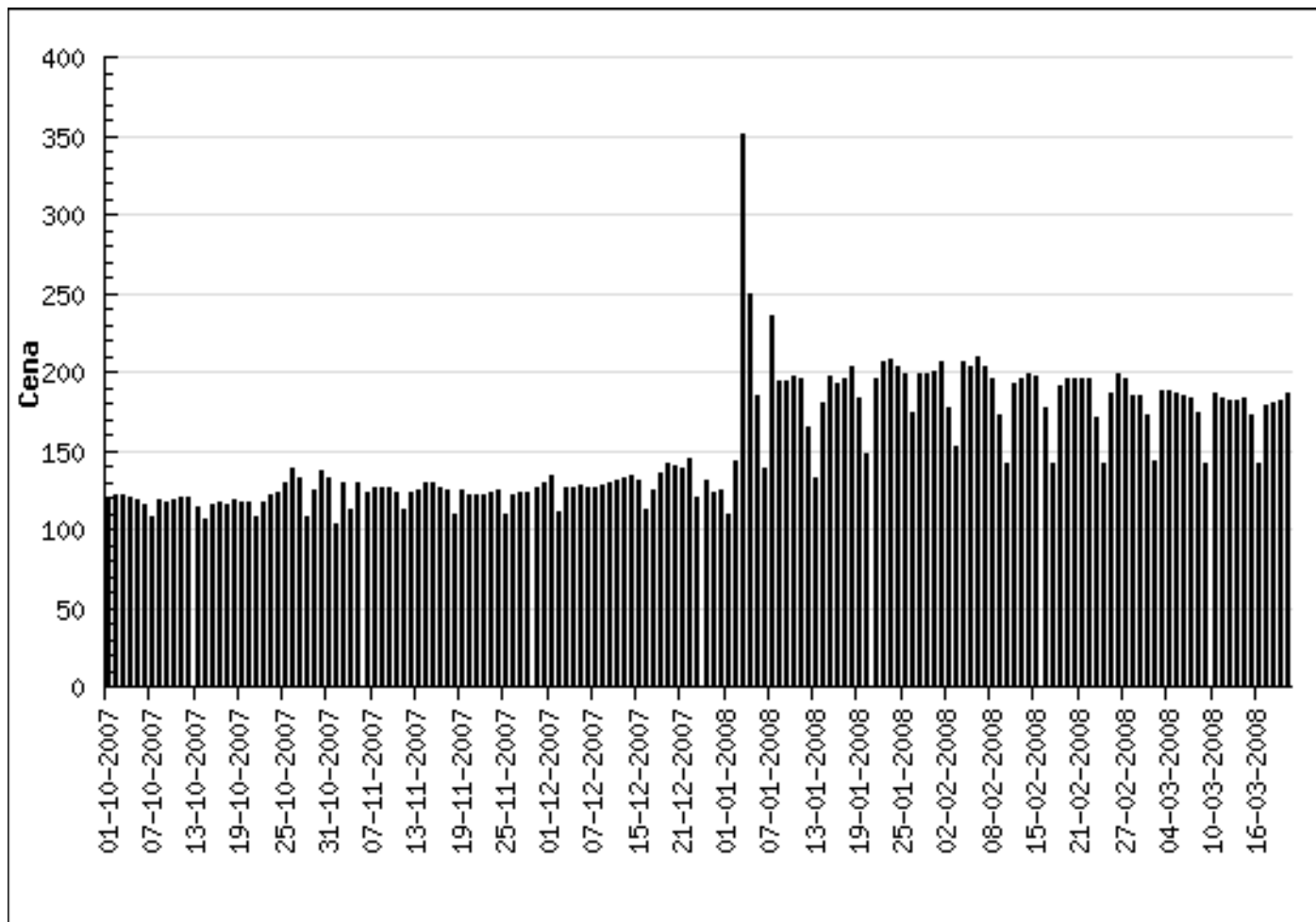
Wyznaczenie ceny równowagi i wielkości obrotu dla każdej godziny



Electricity price PLN/MWh (2008)



Polish Power Index ("PPI")



Support to green electricity

Minimum levels of „green electricity“ in electricity sold to final customers

- ❑ 3.1% – in 2005;
- ❑ 3.6% – in 2006;
- ❑ 5.1% – in 2007;
- ❑ 7.0% – in 2008;
- ❑ 8.7% – in 2009;
- ❑ 10.4% – in 2010;

Substitute fee – 242,4PLN/MWh (2007)

Green Certificate Market

Green Certificate Market - Market Results
Trading Session 127 **Date 04/04/2008**

| Contract name | Quotation system | Single price [PLN/MWh] | Min. price [PLN/MWh] | Max. price [PLN/MWh] | Volume [MWh] | Number of transactions | GCM Index [OZEX] |
|---------------|------------------|------------------------|----------------------|----------------------|--------------|------------------------|------------------|
| PMOZE | Continuous | | 239.06 | 239.15 | 4415 | | 239.21 |
| | Fixing | 239.35 | | | 2000 | | |
| | OTC Transactions | | | | 0 | 0 | |

Red certificates

- The cogeneration obligation for suppliers:
 - 13.7% in 2005;
 - 15.0% in 2006;
 - 15.2% in 2007;
 - 15.6% in 2008;
 - 15.8% in 2009; and
 - 16.0% in 2010.

- Substitute fees for cogeneration for 2006 and 2007

| Year | Ozg | Ozk |
|---------------|--|--|
| 2006 and 2007 | 117.00 PLN/MWh (94.74% of electricity price) | 17.96 PLN/MWh (15% of electricity price) |

CHP Certificate Market

CHP Certificate Market - Market Results - PMGM Trading Session 16 Date 04/04/2008

| Contract name | Quotation system | Fixed price [PLN/MWh] | Low price [PLN/MWh] | High price [PLN/MWh] | Trading volume [MWh] | Number of transactions | KGMX Index |
|---------------|------------------|-----------------------|---------------------|----------------------|----------------------|------------------------|------------|
| PMGM-2008 | Continuous | | 115,00 | 115,00 | 140 | | 115,00 |
| | Fixing | - | | | 0 | | |
| | OTC | | - | - | 0 | 0 | |

CHP Certificate Market - Market Results - PMEC* Trading Session 16 Date 04/04/2008

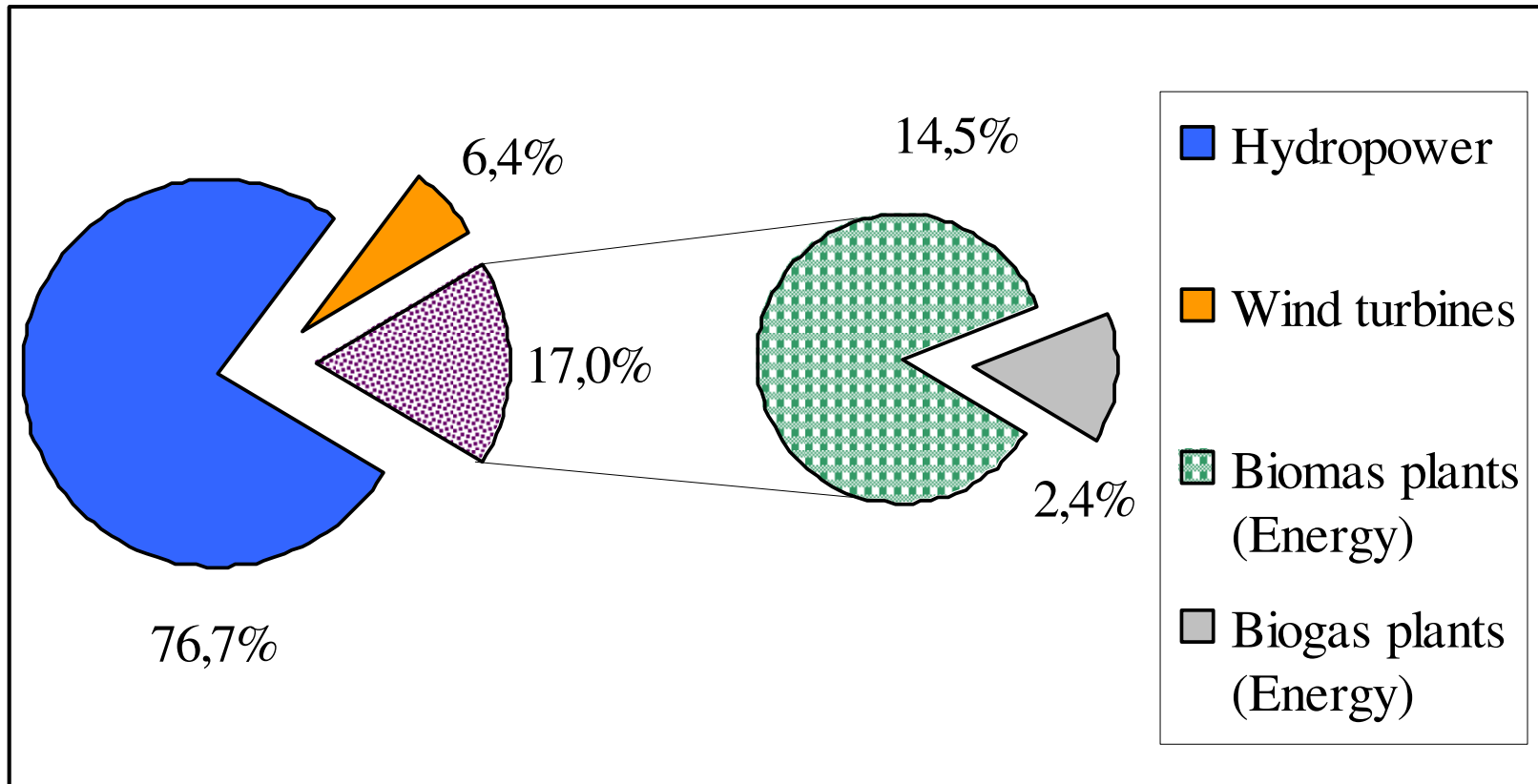
| Contract name | Quotation system | Fixed price [PLN/MWh] | Low price [PLN/MWh] | High price [PLN/MWh] | Trading volume [MWh] | Number of transactions | KECX Index |
|---------------|------------------|-----------------------|---------------------|----------------------|----------------------|------------------------|------------|
| PMEC-2008 | Continuous | | 17,44 | 17,44 | 983 | | 17,44 |
| | Fixing | - | | | 0 | | |
| | OTC | | 15,00 | 17,00 | 2 812 | 2 | |

CO2 Emission Allowance Market

CO2 Emission Allowance Market - Market Results
 Trading Session 154 Date 03-04-2008

| Contract name | Quotation system | Fixed price | Best bid | Best offer | Low price | High price | Trading volume | Last CO2 Index CO2PL |
|---------------|------------------|-------------|----------|------------|-----------|------------|----------------|--------------------------------|
| | | [PLN/tCO2] | | | | | [tCO2] | [PLN/tCO2] |
| 02-2007 | Continuous | | | | - | - | - | 0,55 |
| | Fixing | - | - | - | | | - | |
| | OTC | | | | - | - | - | |

Installed capacity in RES (2005)



Installed capacity in RES

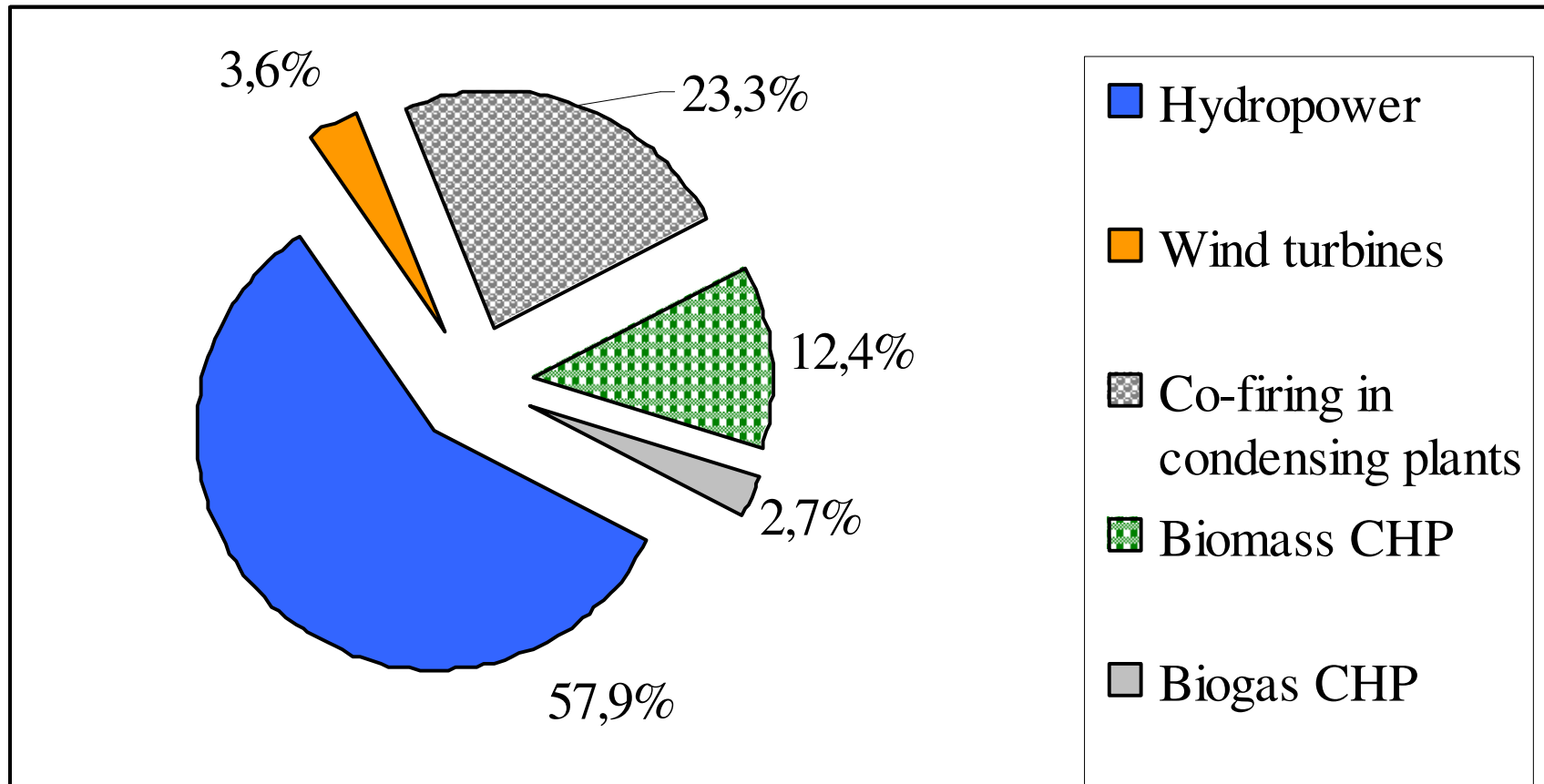
| | 2005 | 2006 |
|---------------------|-------------------------------|--------------|
| RES type | MW | MW |
| Biomass | 189,8 | 252,8 |
| Biogas | 31,9 | 36,8 |
| Wind | 83,3 | 176 |
| Hydro | 921,7 | 929,4 |
| Co-firing with coal | In plants of 1700 MW capacity | |
| Total | 1 227 | 1 395 |

Source:

Z. Kamiński, Dept. of Energy, Ministry of Economy; Pol-Eco Fairs, Poznań, 11.2007.



Green energy (2005)



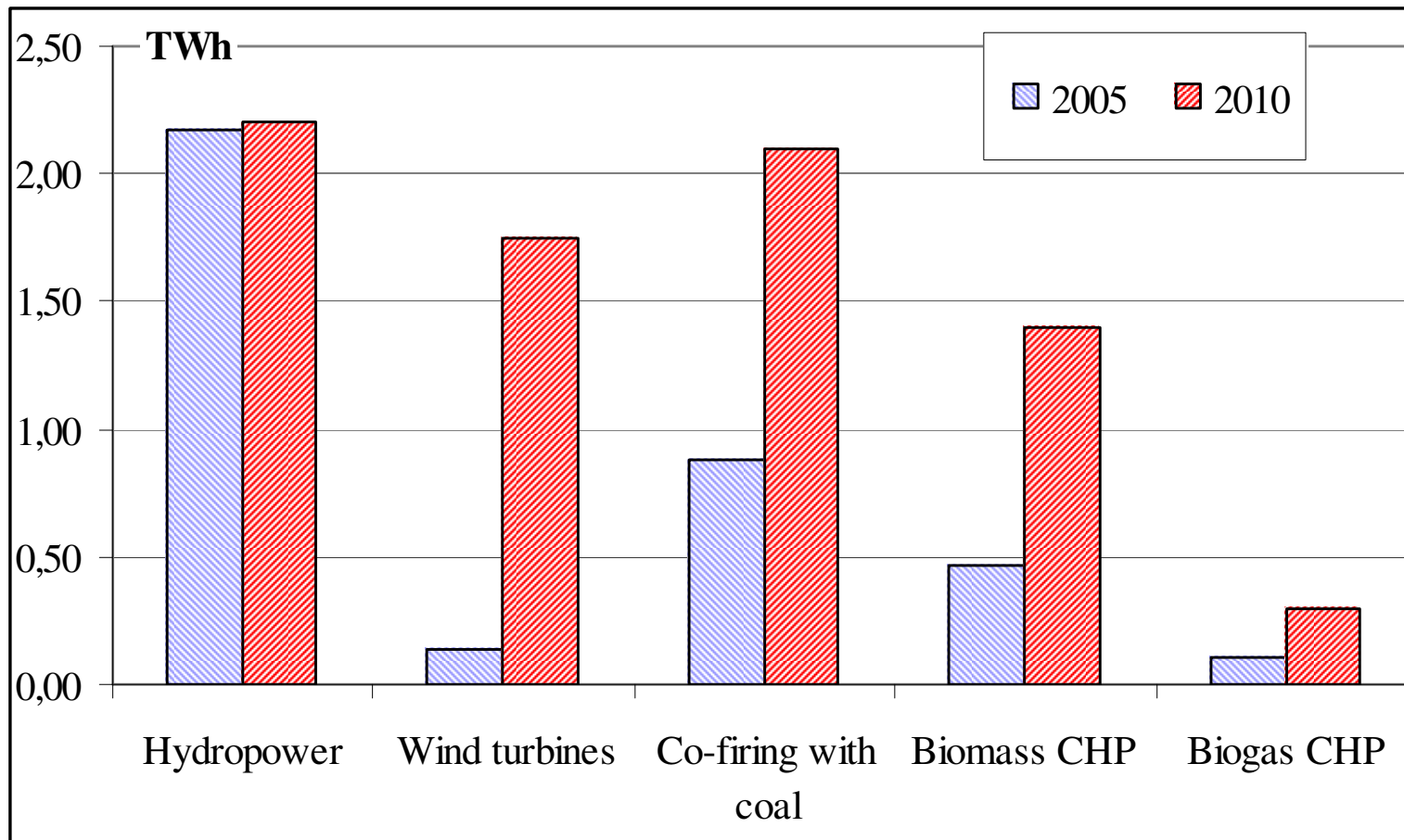
Green energy (2005)

| RES type | MWh | MWh |
|------------------------------|------------------|------------------|
| Biomass | 467 976 | 503 846 |
| Biogas | 104 465 | 116 692 |
| Wind | 135 292 | 256 345 |
| Hydro | 2 175 559 | 2 028 984 |
| Co-firing with coal | 877 009 | 1 314 337 |
| Total | 3 760 301 | 4 220 204 |
| | TWh | TWh |
| Total production | 145 | 149 |
| Share of green energy | 2,6% | 2,8% |

Predictions of Polish Economic Chamber of Renewable Energy (PIGEO)

| | | 2005 | Predictions for 2010 | |
|---|---------------------|-------------|----------------------|---------------|
| | RES | TWh | TWh | Share |
| 1 | Hydropower | 2,18 | 2,20 | 28,4% |
| 2 | Wind turbines | 0,14 | 1,75 | 22,6% |
| 3 | Co-firing with coal | 0,88 | 2,10 | 27,1% |
| 4 | Biomass CHP | 0,47 | 1,40 | 18,1% |
| 5 | Biogas CHP | 0,10 | 0,30 | 3,9% |
| | Total | 3,76 | 7,75 | 100,0% |

Predictions of Polish Economic Chamber of Renewable Energy (PIGEO)



Limits applied to biomass-fuelled generation

non-forestry crops in biomass

- 2008: 5%;
- 2009: 10%;
- 2010: 20%; **25%**
- 2011: 30%;
- 2012: 40%;
- 2013: 50%;
- 2014: 60%; **100%**.

Limits on co-firing!!

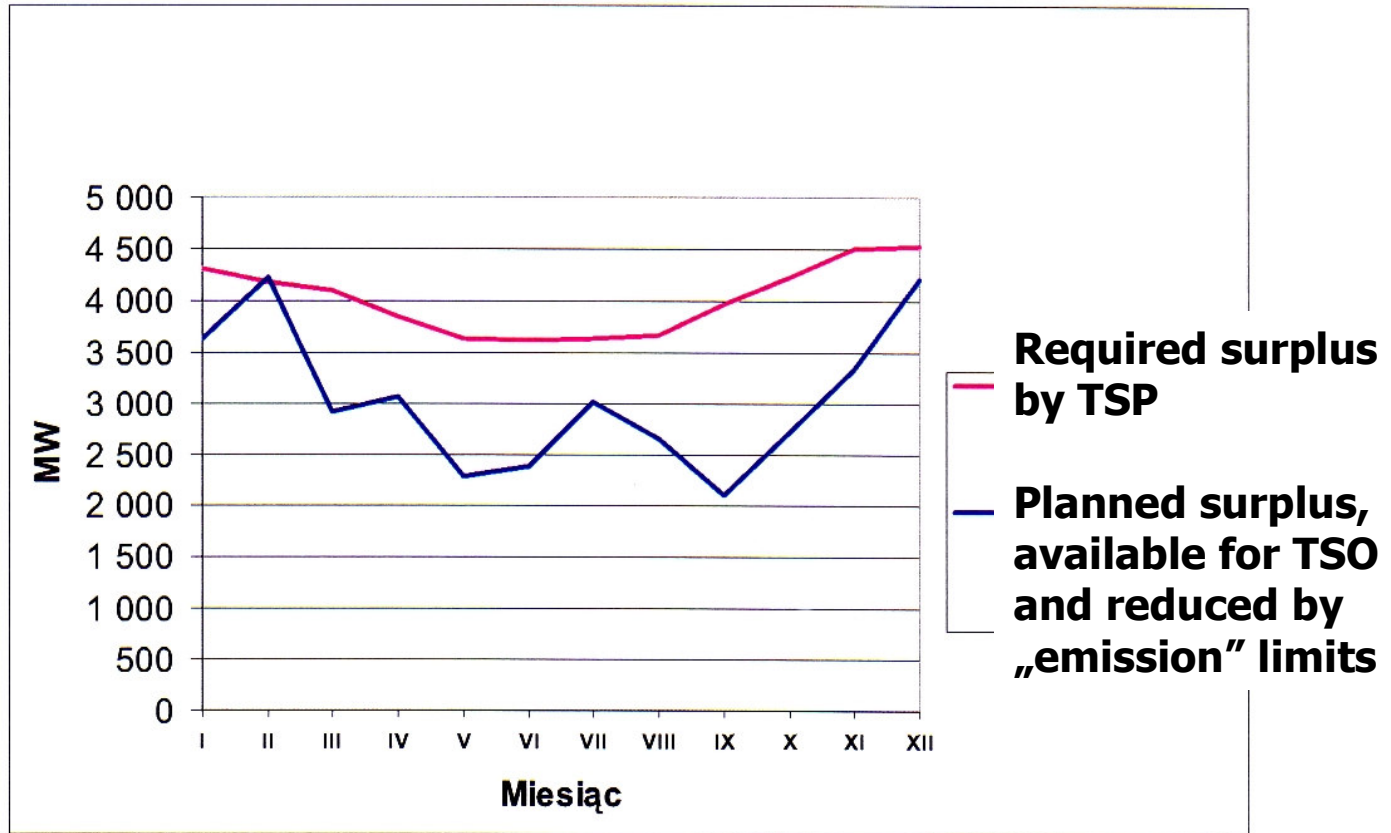


Problems and future

- ❑ Old generating capacity; current retrofits but breakdowns occur; required replacement 300-1000 MW/a
- ❑ Concentration of generation in the South, problems with transmission;
- ❑ Growing summer load in big towns; period of maintenance works at PP, problems with compensation of reactive power
- ❑ TSO – problems with reserve capacity

Power surplus for OSP/TSO

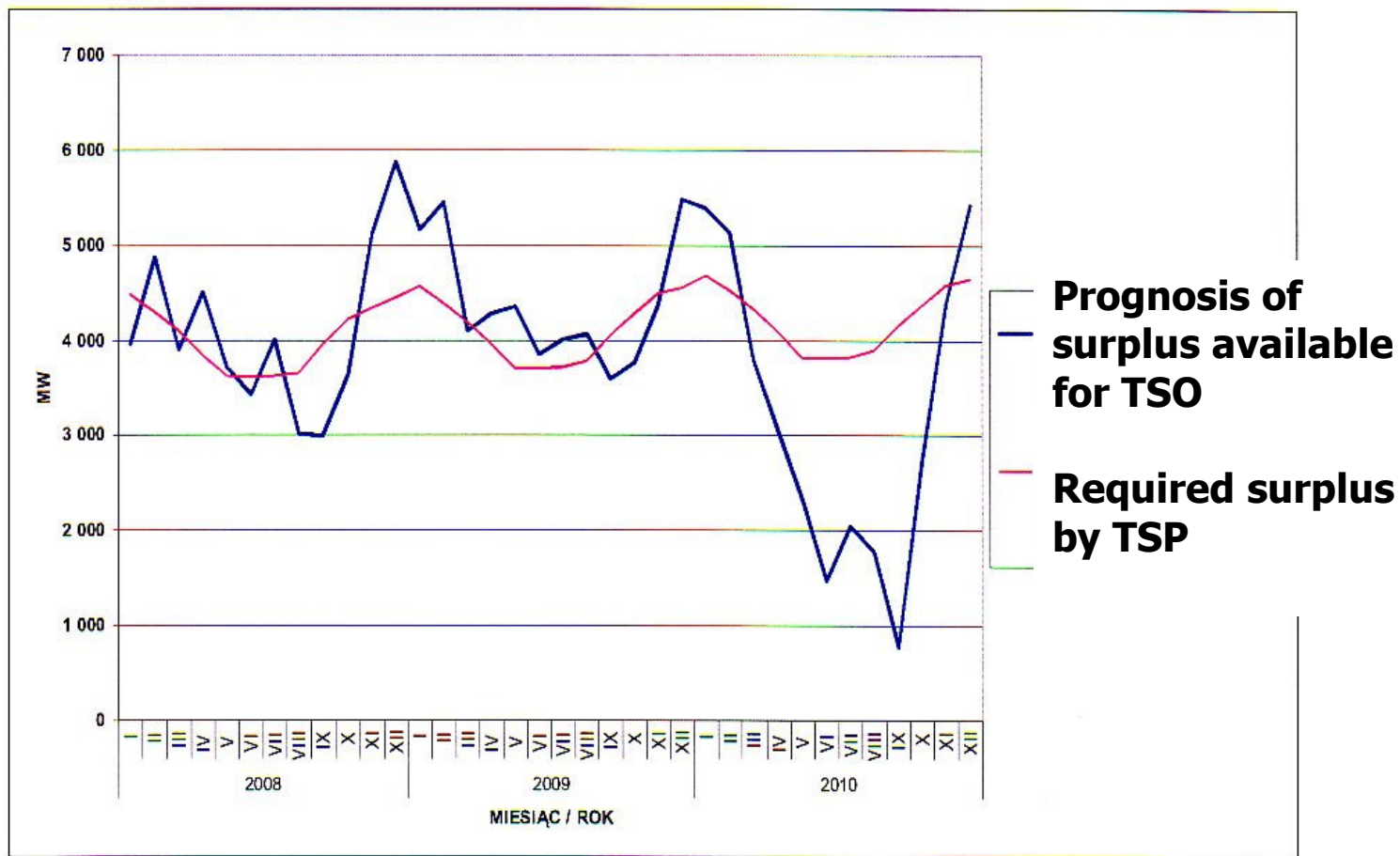
PSE-Operator - acting as a Transmission System Operator (TSO) in Poland



Planned supply surplus available for TSO in 2008



Power shortage till 2010



Planned supply surplus available for TSO in 2008-2010



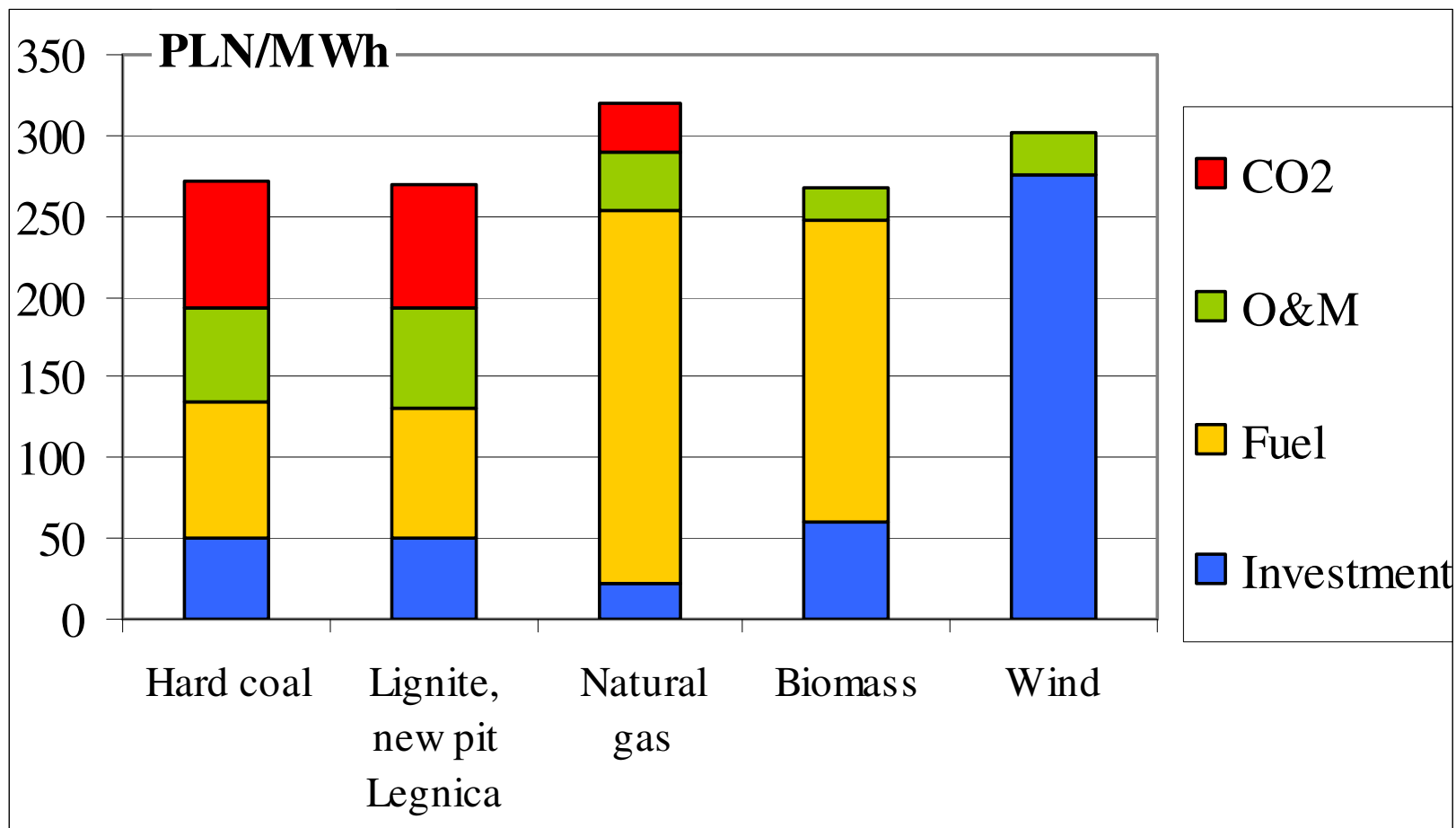
Problems and future (cont.)

- ❑ Necessary investments in transmission and distribution (lines, compensation); increase of tariffs!
- ❑ High excise duty; transfer from generators to retailers
- ❑ High price of energy not fully reflected in electricity tariffs (regulated for households)
- ❑ CO2 allowances allocation too low, expected necessity of buying; Polish National Allocation Plan (NAP) still under discussion

Problems and future (cont.)

- In longer perspective – power sector excluded from carbon burden sharing agreement – CO2 allowances from the market;
- new power plants:
 - clean coal technologies
 - CO2 sequestration
 - reduction of SO2 and NOx
- Bigger share of RES

Electricity costs for new power plants



Study by MSP - Ministry of the Treasury, press release Jan. 2008

