INSTITUTE OF POWER ENGINEERING

(IEn)

INSTITUTE OF POWER ENGINEERING ACTIVITIES IN THE FIELD OF CO_2 EMISSIONS REDUCTION IN THE POLISH ENERGY SECTOR

Hanna Bartoszewicz-Burczy, PhD.
Energy Economic Section
Institute of Power Engineering (IEn), Warsaw, Poland

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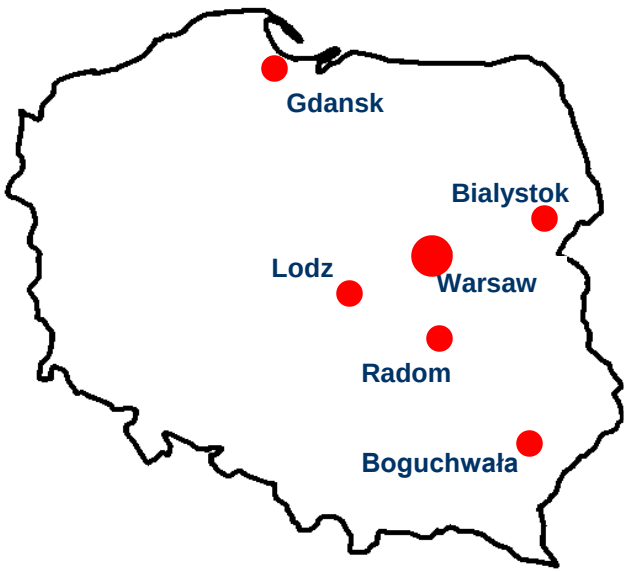
Institute of Power Engineering (IEn) was established in 1953 and currently employs above 500 skilled workers

The IEn comprises of

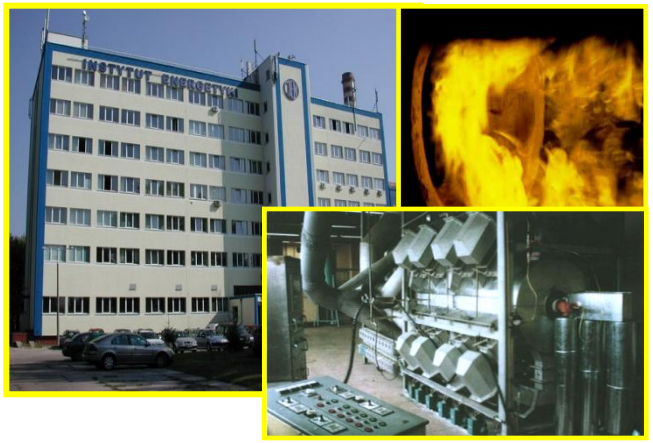
- Central Unit in Warsaw

and six branches in different parts of Poland:

- Ceramic Branch "CEREL" in Boguchwała
- Gdańsk Branch in Gdańsk
- Transformers Branch in Łódź
- Thermal Technology Branch "ITC" in Łódź
- Heating & Sanitary Technology Branch in Radom
- Prototype Production Branch in Białystok



Main activities of the IEn



Research and demonstration of

new energy technologies including:

- energy generation from biomass
- clean coal technologies
- hydrogen and SOFC
- CO2 capture
- wind energy
- distributed energy generation
- smart grids
- advanced ceramic materials (nanotechnology)

Development of apparatus, machines and equipments for electrical power stations and overhead transmissions lines

Energy strategies, plans and programs for the development of energy sector

Energy policy, economic and social issues related to energy technologies

Protection of environment against harmful effects of energy sector

IEn – the main important partners in Poland

POZNAN
Poznan University of Technology

WROCLAW
- Wroclaw University of Technology
- Wroclaw Research Centre EIT+

ZABRZE
Institute of Thermal Processing of Coal

GLIWICE
Silesian University of Technology

KATOWICE
Central Institute of Mining

GDANSK
- Institute of Fluid Flow Machinery
- Gdansk University of Technology

WARSAW
- Warsaw University of Technology
- Institute of Nuclear Problems
- Institute of Fuels and Renewable Energy
- Institute of Fundamental Technological Research

RADOM
Institute for Sustainable Technologies

CRACOW
- AGH – University of Sciences and Technology
- Institute of Oil and Gas

IEn – the main important partners in Europe

SWEDEN
KTH, Stockholm
Chalmers UT, Göteborg

NORWAY
SINTEF, Trondhei

UK
Cambridge University
Cardiff University

GERMANY
Forschungszentrum Jülich GmbH
IVD, Stuttgart

THE NETHEERLANDS
ECN, Petten
Delft University of Technology

FRANCE
ADEME, Paris

ITALY
ISTEC, Bagnacavall
University of L'Aquila
APRE, Roma

SPAIN
CSIC, Madrid
Deloitte, Madrid
Union Fenosa
Universidad de Zaragoza

PORTUGAL
Instituto Superior Technico

ESTONIA
Tallinn Technical University

LITHUANIA
Lithuanian Energy Institute, Kaunas

LATVIA
Institute of Physical Energetics

CZECH REPUBLIC
EGU Brno
Nuclear Physics Institute, Rez

SLOVAKIA
Slovak University of Technology, Bratislava

HUNGARY
Budapest University of Technology and Economics

ROMANIA
Institute of Power Studies and Design, Bucharest

BULGARIA
Energoproject Jsc, Sofia

UKRAINE
Galician Academy, Ivano-Frankovsk
Zrzeszenie gromad „Energooszczędni miasta", Lwów

FINLANDIA
VTT

IEn participation in UE projects

FP5

BioFlam, PowerFlam2, CENERG

FP6

BIO-PRO, BIOFUCEL, BIOASH, FET-EEU, ENFUGEN, Roads2HyCOM, EIFN, INESCE

FP7

UNIQUE, EFFECTS, HYDROSOFC, DEMOYS, OCTAVIO, NET PROTECTION, RELCOM –oxi combastion,

RFCS

FLOX COAL, BOFCom, SMARTBURN, FLOX COAL II

Central Europe:

4BIOMASS

Strategic projects: financed by The National Centre for Research and Development

Development of oxygen combustion technology with CO2 capture.

Coal – strategically energy source to Poland

- Poland has relatively large resources of hard coal and brown coal, modest reserves of natural gas, insignificant of crude oil and small hydro potential.
- A coal structure of primary energy consumption has changed significantly during the last decades of 20th century.
- Share of solid fuels dropped with the simultaneous gradual increase in hydrocarbon fuels share.
- The other components of the energy balance: RES were reached 7,5 % of primary energy consumption.
- Despite the advantageous changes in the primary energy consumption structure coal is still main Polish energy source - cheap and produced domestically.
- Coal is main fuel for electricity production.

Structure of primary energy consumption

- **Changes in the primary energy consumption structure in the years 1980-2008**

[Mtoe]

Specification	1980	1990	2000	2008
Hard coal	89,4	61,8	44,8	42,6
Brown coal	6,6	13,3	12,1	12,6
Crude oil	18,4	15,3	19,8	25,2
Natural gas	8,8	8,9	10,0	12,5
RES	1,3	1,3	3,1	6,5
Total consumption	124,5	100,6	89,8	99,0

Crude oil includes net imports of liquid fuels

Main activities to minimise the environmental impacts, especially CO_2 emission

- Since 1990 burning of higher quality coal, steam coal processing and enrichment in the mines to reduce the contents of sulphur and ash and to increase the caloric values of coal.
- Modernisation of burning equipment in power and CHP plants.
- Various modernisations of industrial power and heat plants.
- Modernisation of old inefficient municipal heat plants.
- Modernisation or replacement of electrofilters.

Results of the environmental protection activity

Specification		1988	1990	2000	2008
CO_2 (million t)	- country total	477	381	320	323
	- public electricity	160	150	-	150
SO_2 (1000 t)	- country total	4180	3210	1511	1145
	- public electricity	1990	1540	805	668
NOx (1000 t)	- country total	1550	1280	838	875
	- public electricity	420	386	237	226
Flue dust (1000 t)	- country total	3400	1950	464	430
	- public electricity	770	560	64	24

The main objectives of the energy policy in the field of reduction CO_2

- Reduction to the levels technically feasible without compromising the energy security.
- Development of the low emission technologies of energy production
- Development of co-generation and dispersed sources.
- Diversification of electricity generation technologies trough the introduction of nuclear technology.
- Create the national system of greenhouse gas emissions management.

Forecast of CO_2 emission to the year 2030

The forecast of CO_2 emission according to the „Energy Policy of Poland to the year 2030”

[million ton]

Specification	2010	2015	2020	2025	2030
Country total	299,1	295,7	280,3	294,7	303,9
Energy industry	170,3	167,7	148,7	154,1	157,2
Public electricity	131,7	130,1	110,6	114,2	115,7
Heat plants	13,7	13,7	12,9	13,9	14,8

- Energy Policy does not forecast a wider use CCS (beyond the demonstration projects.)

Economic impact of CO_2 capture to Polish energy sector

- Implementation EU strategic goals in relation to the CO_2 emission reduction will be very difficult and will constitute a great challenge for our national economy.
- Social Council of the National Programme for Reduction of Emissions estimated capital expenditures in energy sector on 90-100 billion Euro by 2030.
- McKinsey&Company estimated investments costs of reducing CO_2 emission in 2011- 2030 for 92 billion Euro, and decline of GDP by 0,6% in 2011-2015 years.
- World Bank: „Transition to a low-emissions economy in Poland" estimated decline of GDP by ca.1% during 2011-2030 years.

IEn's research directions

- Public awareness and acceptance of CO_2 capture and storage - if CCS is to play significant role in mitigating effects of climate change it must have public support.
- Zero CO_2 : approach for large scale development of zero emission coal power plants.
- Risks and ethical challenges associated with CCS weighted against the significant potential benefits.
- Impact of CCS on electricity costs in comparison with other options to reduce GHG emissions (efficiency, renewable, nuclear, etc.)
- Avoided externalities in health sector due to CCS technology development.
- Success depends on knowledge sharing and close cooperation between Member States.

Conclusions

- European Union greenhouse gases emissions reductions commitments are very ambitions for next decades (A Roadmap for moving to a competitive low carbon economy in 2050).
- According to Polish coal dependency and energy structure achieved this objectives would required wide research and support on:
  - the growth of energy efficiency,
  - development of renewables,
  - methods for reducing CO_2,
  - minimize the effects of reductions coal consumption,
  - evaluation huge investment both in the energy sector development, replacement of old equipment as well as multilateral activities to meet the requirements of CO_2 reduction.

Thank you for your attention

Institute of Power Engineering (IEn)
Mory 8, 01-330 Warsaw, Poland

Tel.: (+48 22) 3451 158

Website: http://www.ien.com.pl

Hanna Bartoszewicz-Burczy, PhD.
Energy Economic Section
Institute of Power Engineering (IEn)
Warsaw, Poland
Hanna.burczy@ien.com.pl