

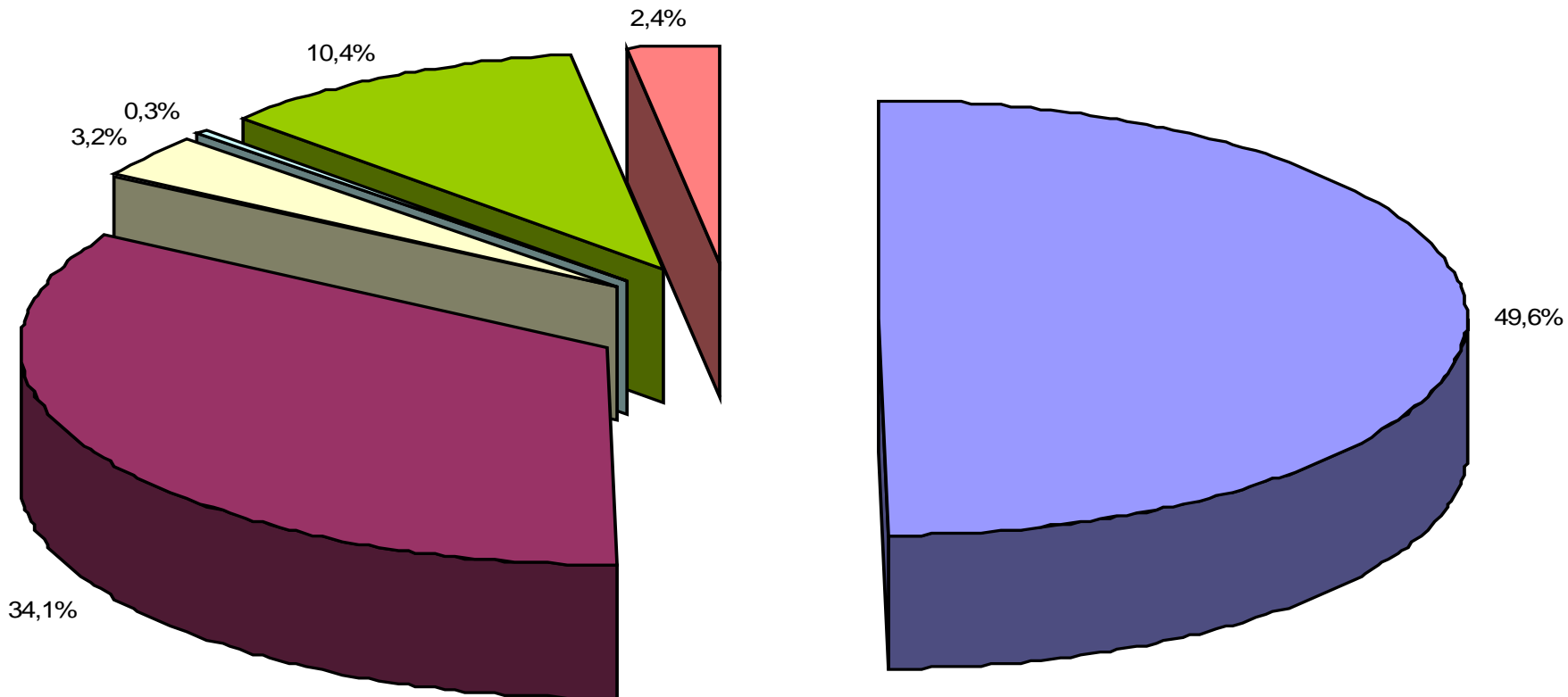


# **CCS – status of R&D and demonstration activities in Poland**

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## Poland's energy mix 2013 (electricity only)

■ coal ■ lignite ■ gas ■ hydro ■ wind and other renewables ■ other



## **Clean Coal Technologies – Polish priority among energy technologies**

- New, environmentally friendly, highly efficient power units,
- Development of coal gasification (both on land and underground),
- Development of CCS – pilot plants: in future also commercial installations,
- Development of CO<sub>2</sub> utilization technologies.

## **CCS Project Activities in Poland**

The current *Energy Policy of Poland till 2030* includes CCS as a part of the government's energy strategy.

The new “Geological and Mining Law” transposed the EU CCS Directive into the national Polish Law in 2013.

The Ministry of Environment launched in 2008 the first research program concerning geological formations and structures for the safe sequestration of CO<sub>2</sub> which was successfully finished in 2012.

Also in 2008 the Polish Government formally submitted to the European Commission information on possible two CCS demonstration projects to be developed: 1) at Bełchatow Power Plant and 2) in Kędzierzyn (polygeneration project). However both projects were abandoned due to financial problems.



## **CCS R&D in Poland (1)**

- As a contribution to the EU efforts aimed at development of CCS, Poland established a R&D program entitled *New technologies for energy generation* launched in 2009 which is to be carried on till 2015. Three of four main tasks in this program concern research on new and efficient Clean Coal Technologies including options of CCS. The program is funded by the national budget (by the National Centre for Research and Development) as well as by key Polish energy companies.
- Very interesting results were obtained in the field of high pressure coal oxy combustion technology and fluidized bed coal gasification using CO<sub>2</sub> as the feedstock. Both technologies were tested in pilot scale in the Institute for Chemical Processing of Coal (ICHPW), Zabrze. In particular the use of CO<sub>2</sub> in the gasification process allows to improve the efficiency of production and the simultaneous reduction of relative CO<sub>2</sub> emission per unit of product produced (e.g. energy, fuels, chemicals).



## **CCS R&D in Poland** (2)

Especially useful proved to be the research on the separation of CO<sub>2</sub> from the flue gas. Development and implementation of this technology seems to be, in the nearest term, the most probable way to drastically reduce CO<sub>2</sub> emissions from new and existing coal fired power plants.

Two pilot CO<sub>2</sub> capture plants were built: basing on CO<sub>2</sub> adsorption process –VPSA (Vacuum-Pressure Swing Adsorption) technology and on CO<sub>2</sub> chemical absorption concept – Pilot Amine-Based CO<sub>2</sub> Capture Plant. The installations are now used in on-site tests in Lagisza and Jaworzno coal power plants. Determining the impact of basic operational parameters on the efficiency of the process and the possibility of obtaining the technical and operational know-how (real-time process data) will allow for the optimization of the systems for CO<sub>2</sub> removal from flue gases, and development of process principles for constructing such systems at a larger scale.

## **CCS R&D in Poland (3)**

- These first in Poland on-site pilot tests of CO<sub>2</sub> capture from coal-fired power plants flue gases were carried out in 2013 by The Institute for Chemical Processing of Coal (ICHPW) in cooperation with the second largest power company TAURON.
- The Pilot Amine-Based CO<sub>2</sub> Capture Plant is able to capture 1 t CO<sub>2</sub> per day from real flue gases that contain different types of pollutants such as SO<sub>x</sub>, NO<sub>x</sub> and particles. The Pilot Plant consists of flue gas pre-treatment unit (with deep desulfurization) and CO<sub>2</sub> capture unit – consisting of absorber and desorber columns. The Pilot Plant operates 24 h per day, 5 days per week.
- The conducted operation allows for extended evaluation of chosen solvents (MEA -monoethanolamine), and the capture process efficiency. Over 500 h, 81 tests and more than 20 t of separated CO<sub>2</sub> were achieved during the operation in 2013. The unique design of the Pilot Plant allowed for the evaluation of various process modifications such as split stream and heat recuperation.
- In future a pilot CO<sub>2</sub> injection project in that area is considered.





## **CCS R&D in Poland - CO<sub>2</sub> geological storage and utilization**

- In the years 2008-2012/2013 the project of the Ministry for Environment „Assessment of formations and structures for safe CO<sub>2</sub> geological storage including monitoring plans” was carried out (led by the State Geological Institute PGI-NRI; with budget of approx. 8 M€). It allowed for a regional assessment of various CO<sub>2</sub> storage options. The program covered case studies, injection simulations, laboratory experiments, studies necessary to obtain a research permit for test injections, etc.. The program was supposed to support the planned Belchatow demo project, and its main outcome is information that can be utilized by a competent authority for future exploration permit decisions and by stakeholders applying for a permission to build new „CCS ready” power blocks.
- A number of research projects on CO<sub>2</sub> utilization, funded by the Ministry of Environment and the National Centre of Research and Development, were carried out recently; e.g., on Enhanced Oil Recovery with the use of CO<sub>2</sub> injection (injection simulations, economic evaluations), on physico-chemical phenomena in gas bearing shales during CO<sub>2</sub> injection (injection simulations, laboratory experiments).
- Studies on CO<sub>2</sub> test injection at a site close to the TAURON power plants (Southern Poland region) were also conducted.

## **CCS R&D in Poland – laboratory infrastructure (1)**

Poland has currently modern laboratories for Clean Coal Technologies (CCTs) and a technological centre - The Clean Coal Technology Centre. The Centre is a joint investment project of The Central Mining Institute (*[Główny Instytut Górnictwa](#)* – *GIG*), Katowice and The Institute for Chemical Processing of Coal (*[Instytut Chemicznej Przeróbki Węgla](#)* – IChPW), Zabrze.

The CCT Centre comprises three parts:

1) Technological unit on the premises of IChPW in Zabrze.

Technological installations in various scales, including the PDU scale (Process Development Unit), were built to enable conducting tests in the area of gasification processes and pressurized oxy-combustion of solid fuels, to remove CO<sub>2</sub> in absorption reactor, to convert fuels in a reactor with chemical looping combustion as well as to pulverize, sieve and prepare coal blends.

## **CCS R&D in Poland – laboratory infrastructure (2)**

2) Laboratories in GIG, Katowice. The laboratories support interdisciplinary research. The analytic potential - for analyses on properties of solids, liquids and gases (in particular fuels), process engineering analyses, supporting the works from the energy, geo-engineering and environmental engineering sectors - is developed,

3) Technological unit on the premises of the “Barbara” Experimental Mine in Mikołów- where the Underground Testing Infrastructure for analyzing coal gasification were built.

The CCTs Centre is a „large project” co-financed by EU funds. The value of the project was around 41 million Euro.



## 12 The mobile CO<sub>2</sub> capture pilot plant – tests in Lagisza Power Plant (TAURON company)

- Column diameter: 300 mm
- Absorber height: 14,0 m
- Desorber height: 15,0 m



MINISTRY  
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## Clean Coal Technologies Centre



- 3 specialized, modern laboratories in Katowice + laboratory in Zabrze and the experimental mine in Mikolow

- Opened in May 2013

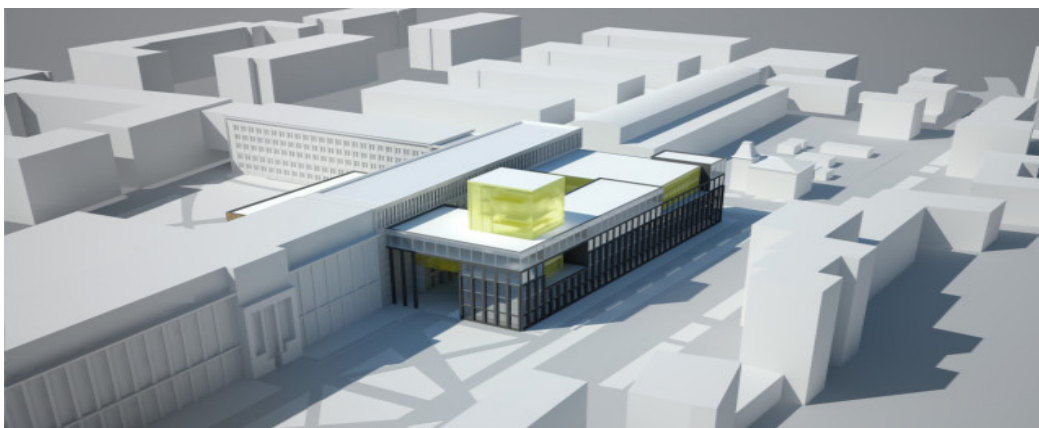
**Building in Katowice**



## A new Energy Centre at AGH University of Science & Technology in Cracow



- Investment costs 190M PLN
- 15 th m<sup>2</sup> of floor space
- 38 specialized, modern laboratories
- First part of the Centre will be opened in Nov 2014





**Thank you for attention!**

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