



INSTITUTE FOR CHEMICAL
PROCESSING OF COAL



Carbon Capture
Forum

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Overview of Polish carbon capture research

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Strategic Programme

Advanced Technologies of Energy Generation

Planned co-financing from
National Research and Development Center (Poland)
in 2010-2015 about PLN 300 000 000



Overall Target :

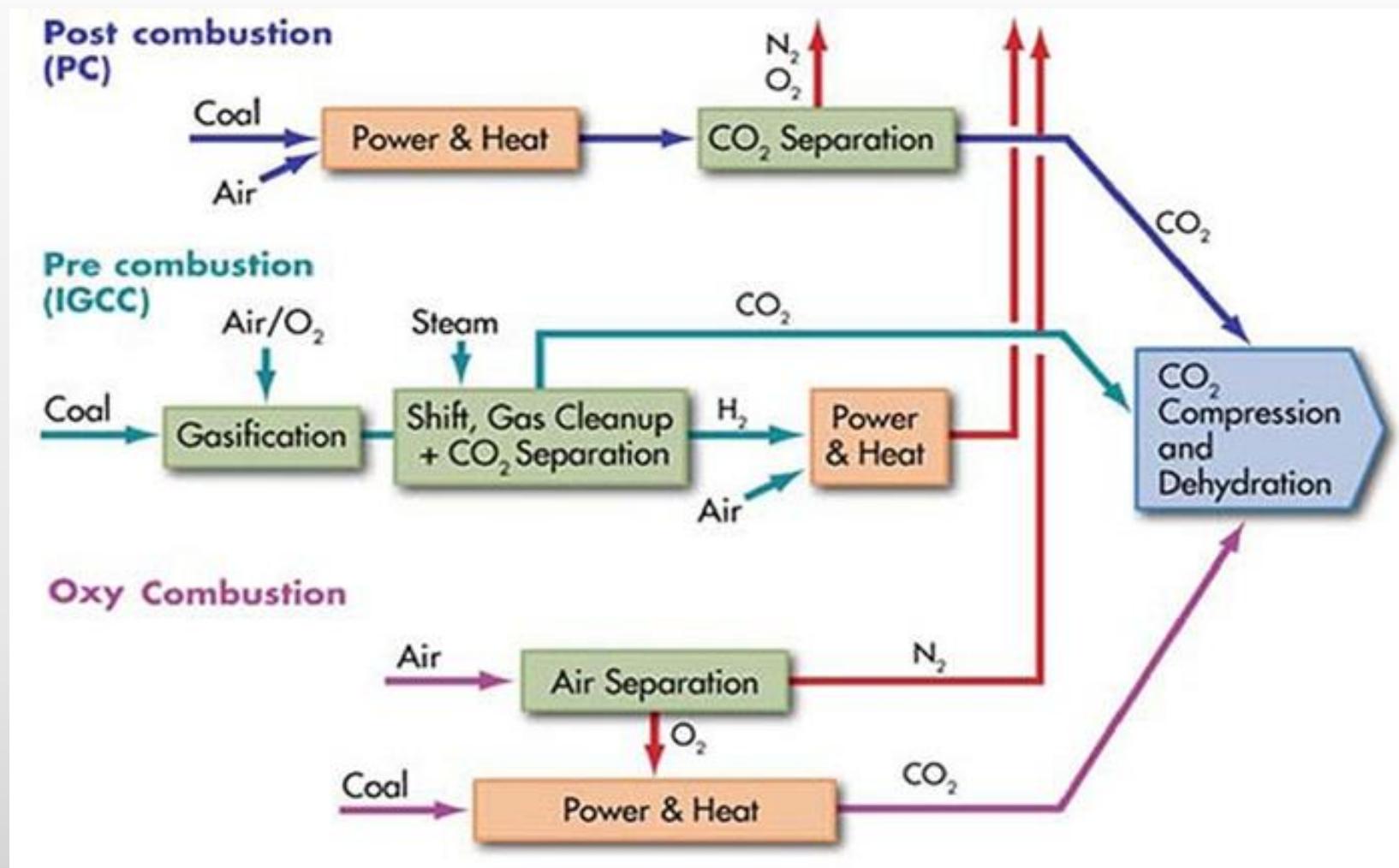
Development of the technologies which implementation will have an impact on achievement of the EU 3x20 goals:

These targets, set three key objectives for 2020:

- A 20% improvement in the EU's energy efficiency;
- Raising the share of EU energy consumption produced from renewable resources to 20%;
- A 20% reduction in EU greenhouse gas emissions from 1990 levels.



The main technology options for CO₂ capture from power plant



Pre combustion

Project No. 3:

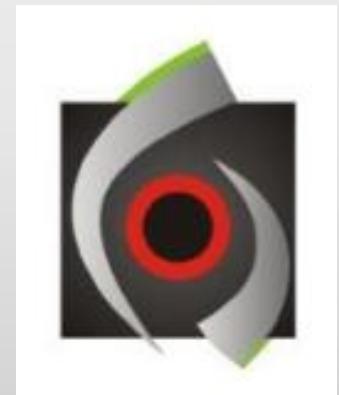
Development of coal gasification technology for highly efficient production of fuels and electricity

Contractors:

AGH University of Science and Technology (Leader),
Główny Instytut Górnictwa (GIG), Institute for Chemical Processing of Coal (IChPW), Silesian University of Technology, KGHM Polska Miedź S.A., Katowicki Holding Węglowy S.A., TAURON Polska Energia S.A., TAURON Wytwarzanie S.A., TAURON Wydobycie S.A., Grupa Azoty - ZAK S.A.

Co-financing PLN 80 000 000

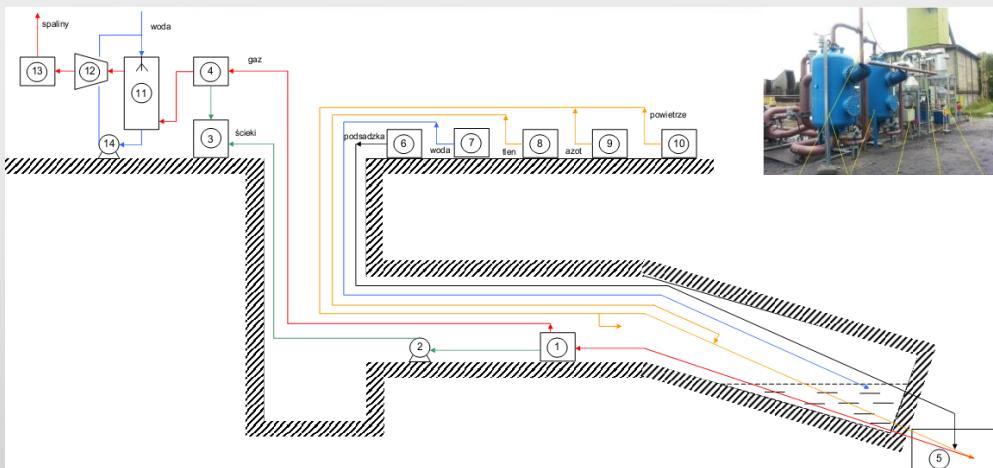
Budget PLN 80 000 000 + non-financial and voluntary contractors contribution



Project No. 3 – selected research



Pressurized CFB pilot gasifier
Institute for Chemical Processing of
Coal (IChPW)
Capacity: 100 kg coal per hour



Underground gasification pilot plant
Central Mining Institute
Capacity: 600 kg coal per hour

Oxy combustion

Project No. 2:

Development of a technology of oxy - fuel combustion for pulverized fuel and fluidized-bed furnaces integrated with CO₂ capture system

Contractors:

Częstochowa University of Technology (Leader),
Silesian University of Technology,
Wrocław University of Technology,
Institute for Chemical Processing of Coal (IChPW), TAURON-Wytwarzanie
S.A., Institute of Power Engineering, PGE S.A. /
Turów Powerstation, Foster Wheeler Energia
Polska Sp. z o.o.

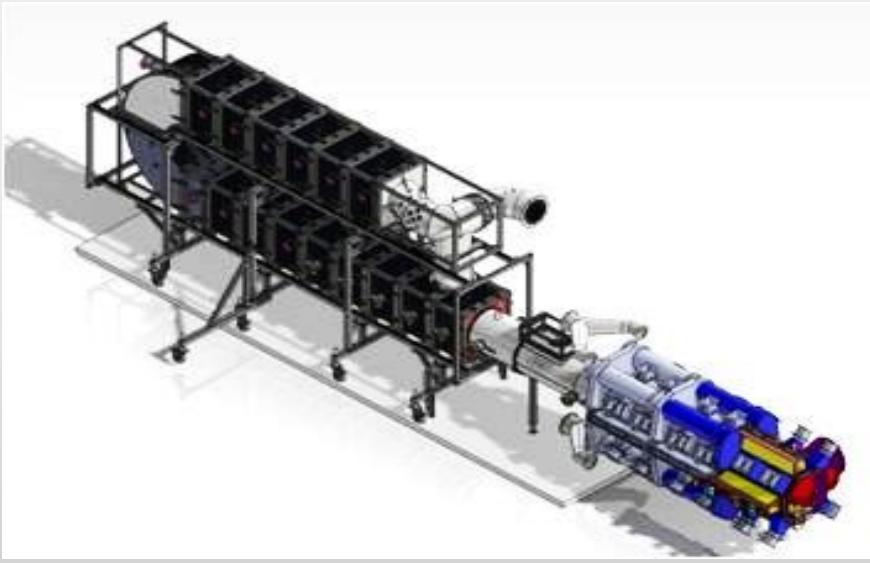
Co-financing PLN 80 000 000
Budget approx. PLN 87 400 000



Project No. 2 – Oxy combustion main research



Pressurized CFB oxy combustion pilot reactor (0,2 MW)
Institute for Chemical Processing of Coal (IChPW)
Capacity: 25 kg coal per hour



PC pilot boiler for oxy combustion research (0,5 MW)
Institute of Power Engineering

Project No. 2 – Oxy combustion selected research



VPSA CO₂ capture mobile pilot plant
Częstochowa
University of Technology / Tauron
Flue gas capacity: 100 m³/h



Air separation mobile pilot plant
Wrocław University of Technology

Post combustion and efficiency improvement

Project No. 1:

Development of technology for highly efficient “zero-emission” coal units integrated with CO₂ capture from exhaust gases.

Contractors:

Silesian University of Technology (Leader),

Wrocław University of Technology, Institute for Chemical Processing of Coal (IChPW),

Kraków University of Technology, Częstochowa University of Technology,

Łódź University of Technology, Warsaw University of

Technology, Institute of Flow Machinery of the Polish

Academy of Sciences, AGH University of Science and

Technology, RAFAKO S.A., TAURON-Wytwarzanie S.A.

Co-financing PLN 69 965 500

Budget approx. PLN 73 000 000



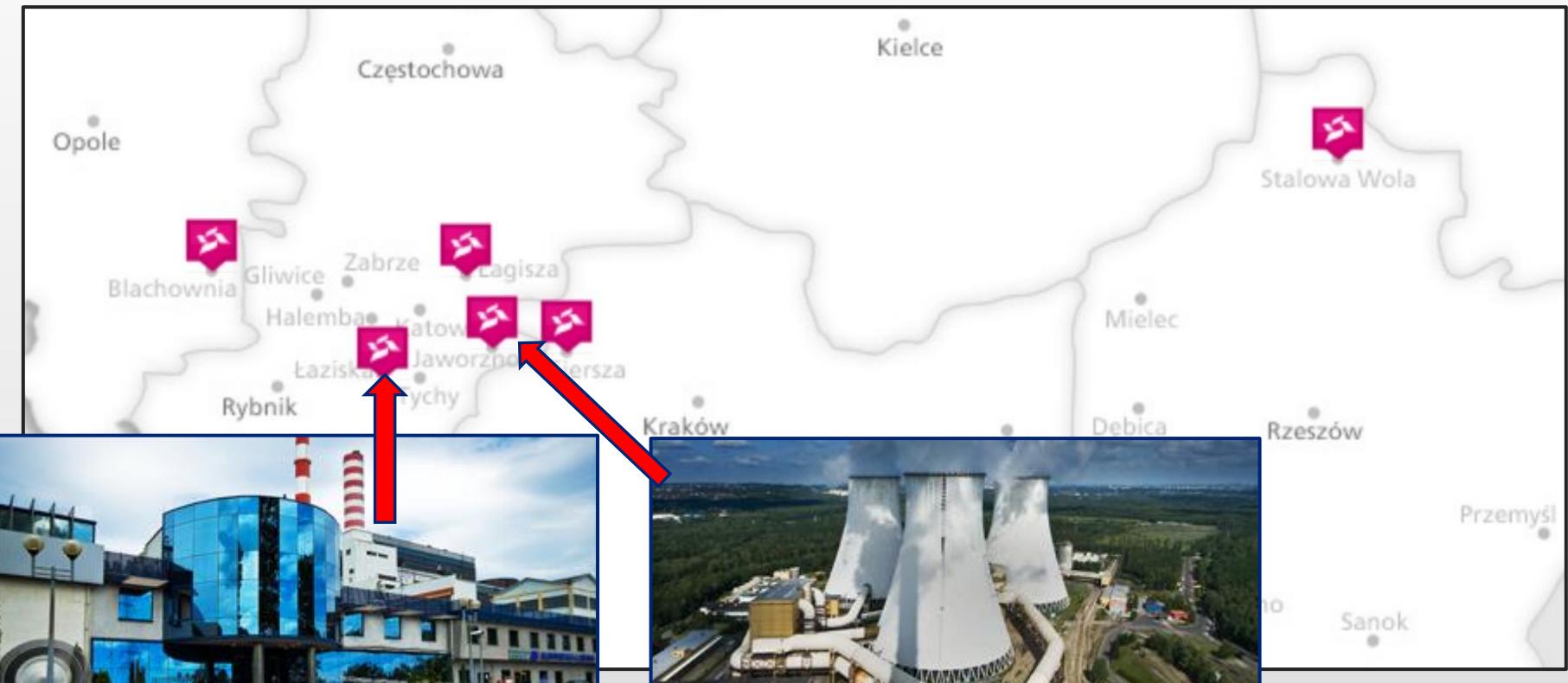
Project No. 1 – Post combustion research

Column diameter:	300 mm
Column height:	15,0 m
Number of devices:	40
Measurements:	180 points
Solvent: solution	30% MEA
Solvent stream:	up to 1600 dm ³ /h
Gas stream:	up to 200 m ³ _n /h
Tested gas:	

Flue gases from
coalfired boiler



Bussines partner - TAURON



Łaziska Power Plant

Electric power installed: 1155
MWe

Maximal thermal power: 196 MWt



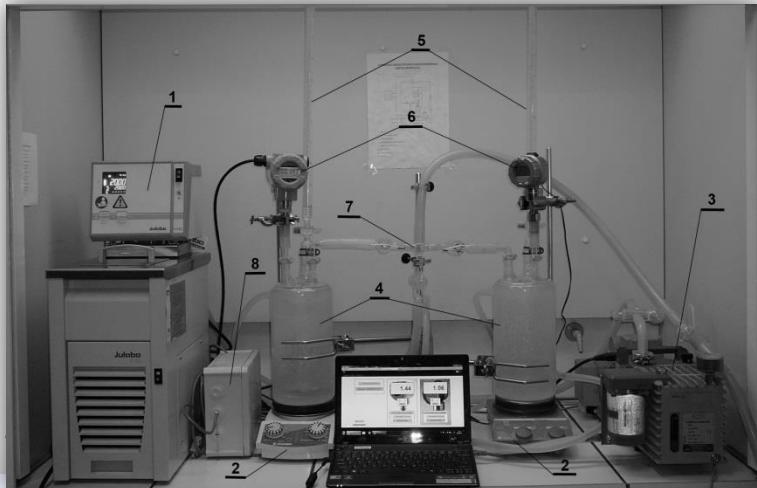
Jaworzno Power Plant

Electric power installed: 1535
MWe

Maximal thermal power: 371,6
MWt

IChPW CO₂ capture process scale-up strategy

Experimental apparatus of CO₂ absorption kinetics and equilibriums in amine blends



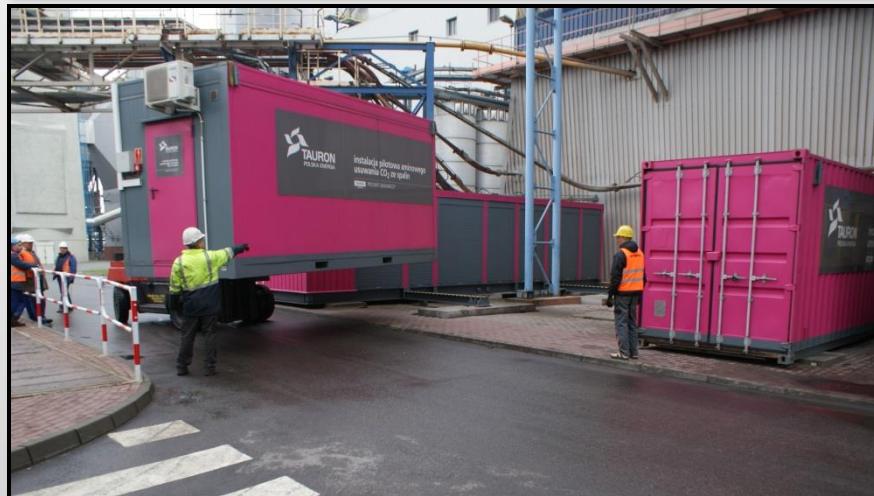
Lab stand for CO₂ capture process – 5 m³/h



PDU for CO₂ capture process – 100 m³/h
(IChPW Zabrze)



Pilot plant assembly at Jaworzno Power Plant – 15.04.2014



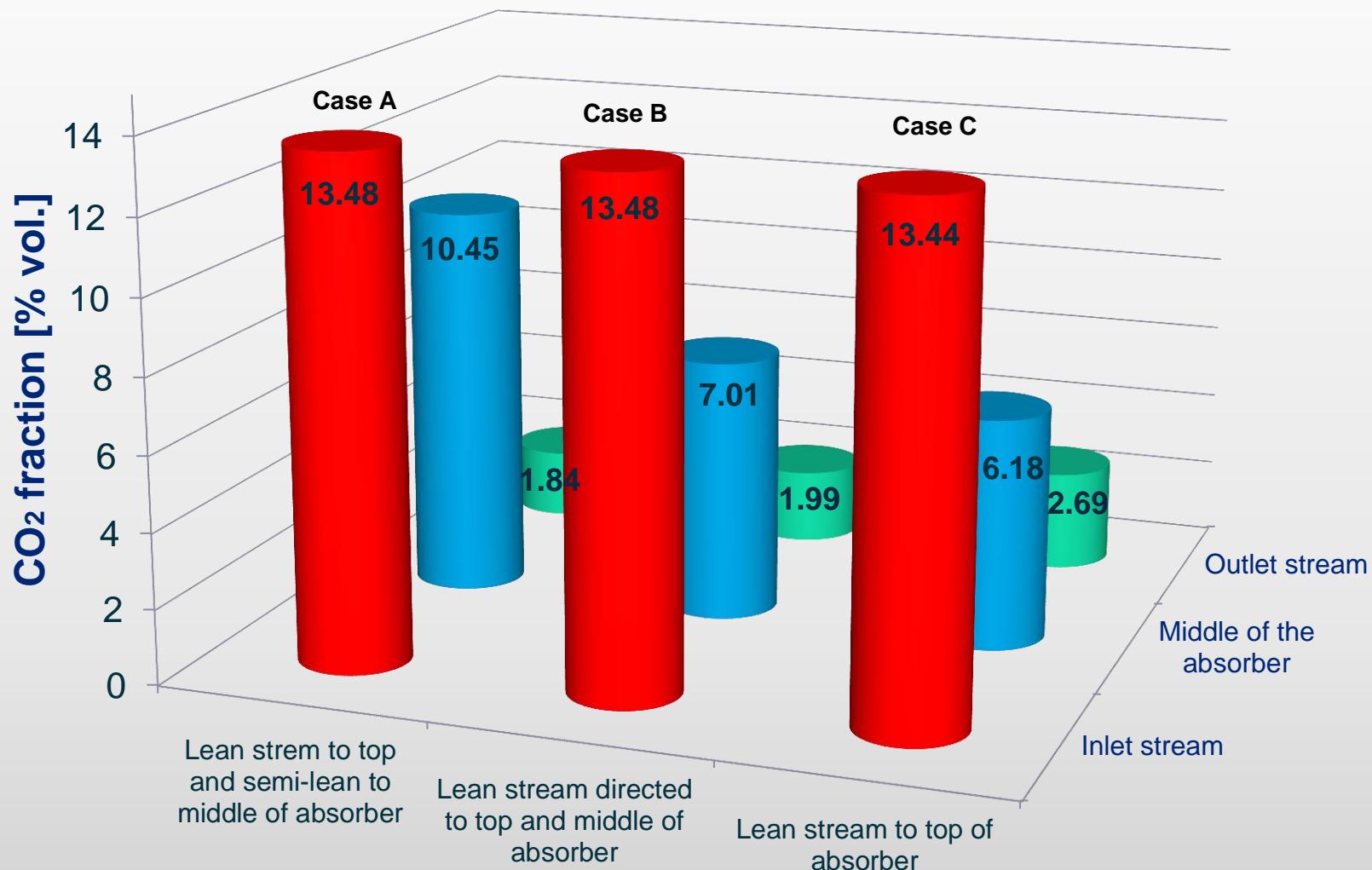
Pilot plant commissioning at Jaworzno – 5.05.2014



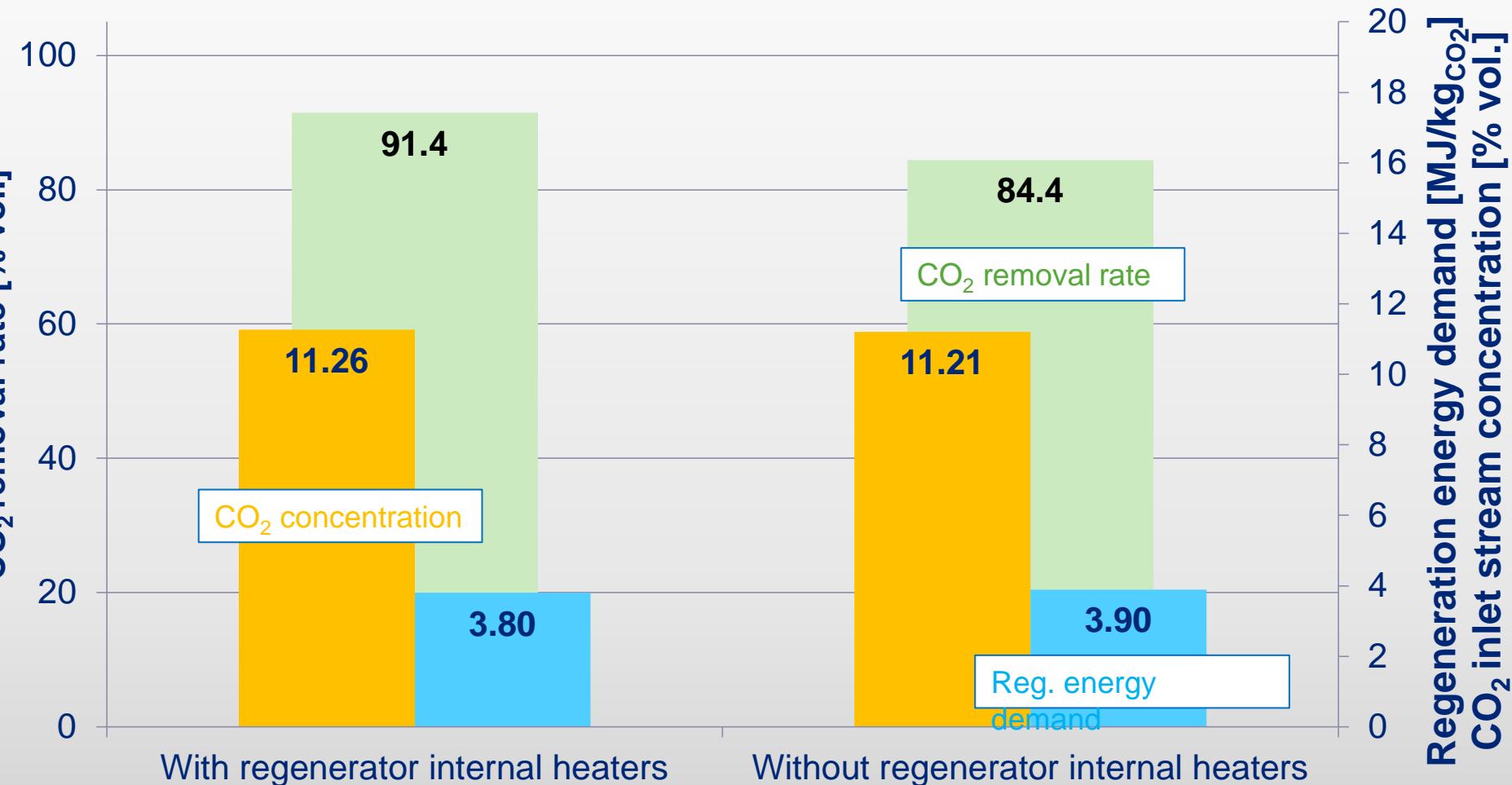
The Mobile Pilot Plant flow diagram



Split streams versus single stream amine configuration-streams CO₂ fraction

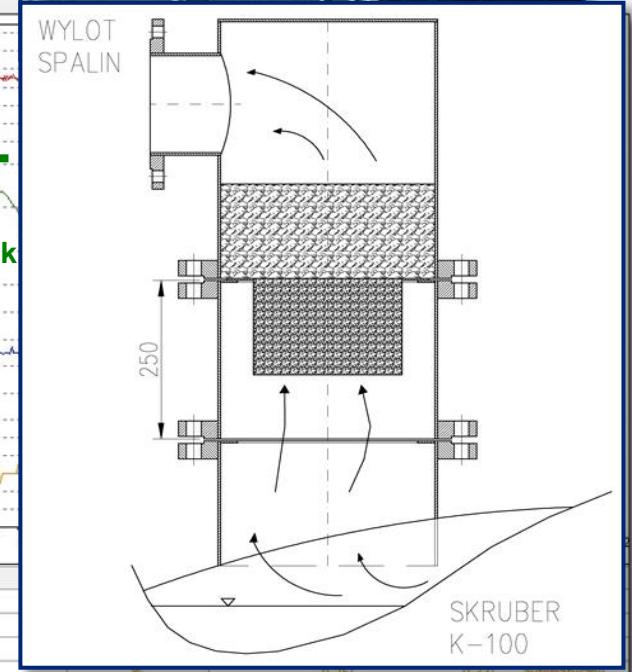
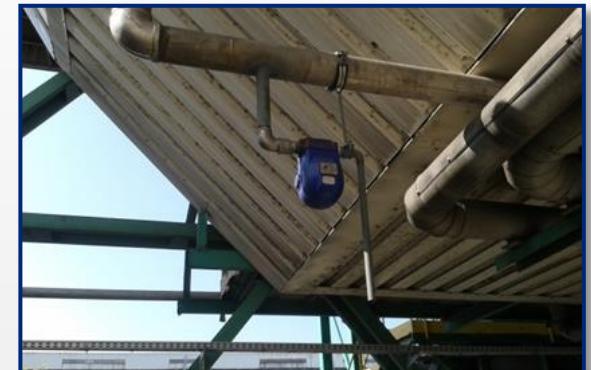
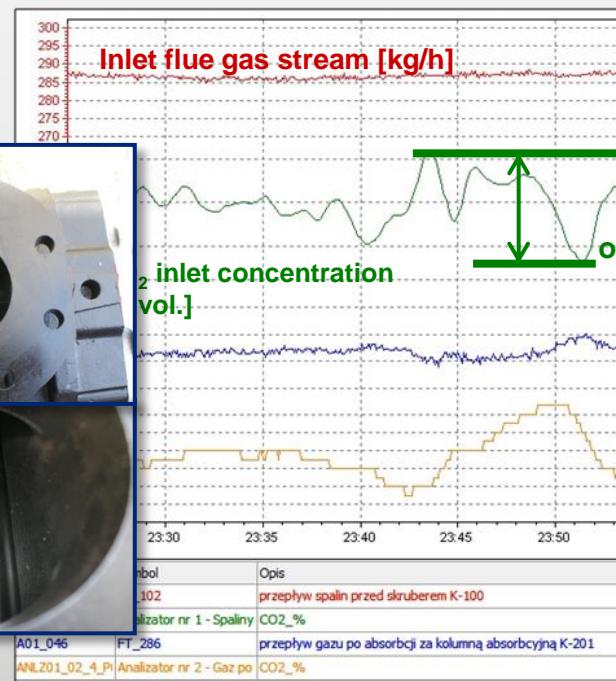


Effect of regenerator internal heating on removal efficiency and regeneration energy



Operational difficulties

- CO₂ concentration fluctuations in inlet flue gas stream
- Additional Venturi scrubber demister due to flue gases moisture
- Rapid corrosion in blower



Mobile Pilot Plant research summary at TAURON facilities

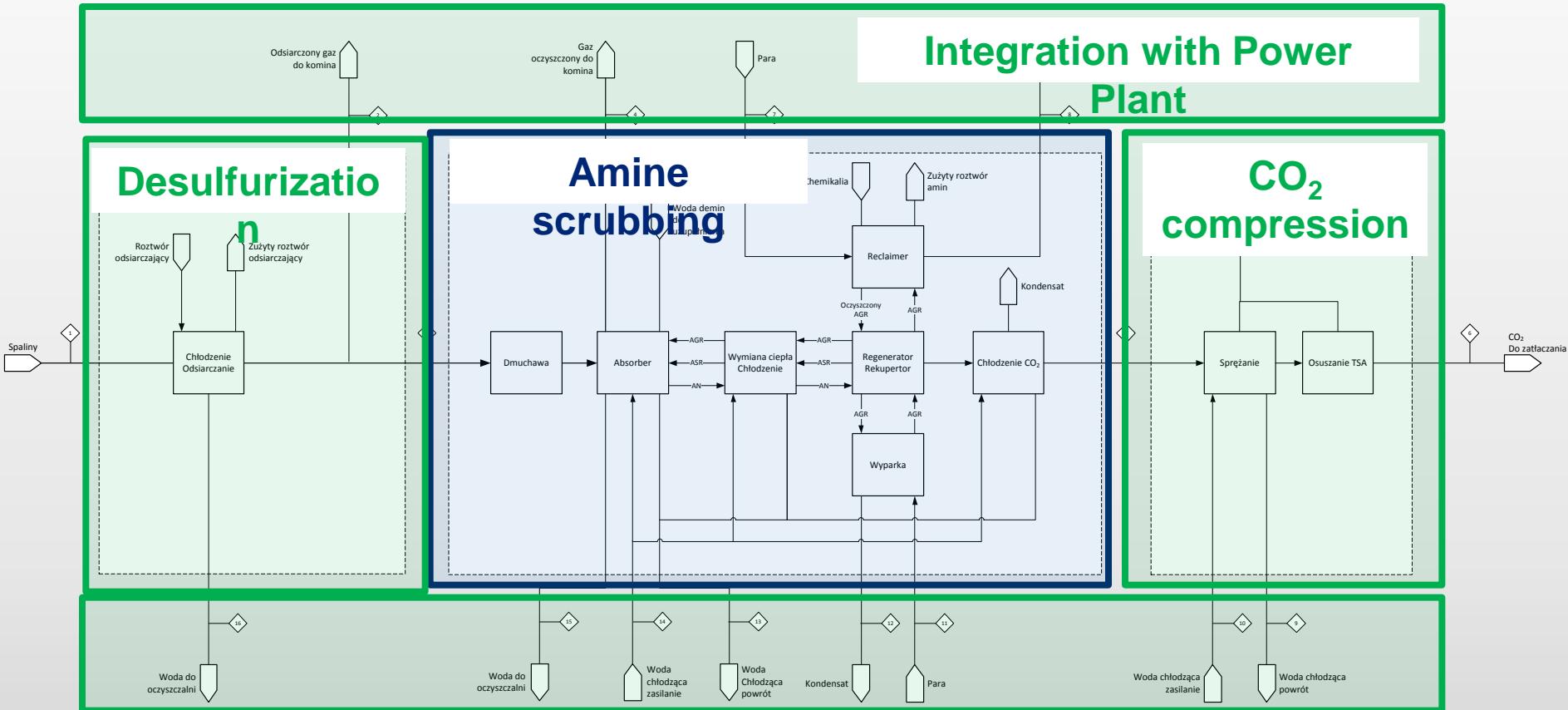
- The pilot plant campaigns successfully demonstrated reliable operation allowing the removal of over 55 000 kg of CO₂ from real flue gas.
- The energy requirement for MEA as solvent was found about 3,6 MJ/kgCO₂ with 90% CO₂ removal efficiency due to the application of technological modifications.
- The completed test campaigns can become a baseline for extended comparisons with world data
- Operational experience was gained during test campaigns which can be helpful in designing amine installations on a larger scale



Parameter	Value
Number of campaigns	23
Number of tests	300
Operation time	1400 h
CO₂ removed	approx. 55 000 kg



Block diagram of demo CCS PLANT

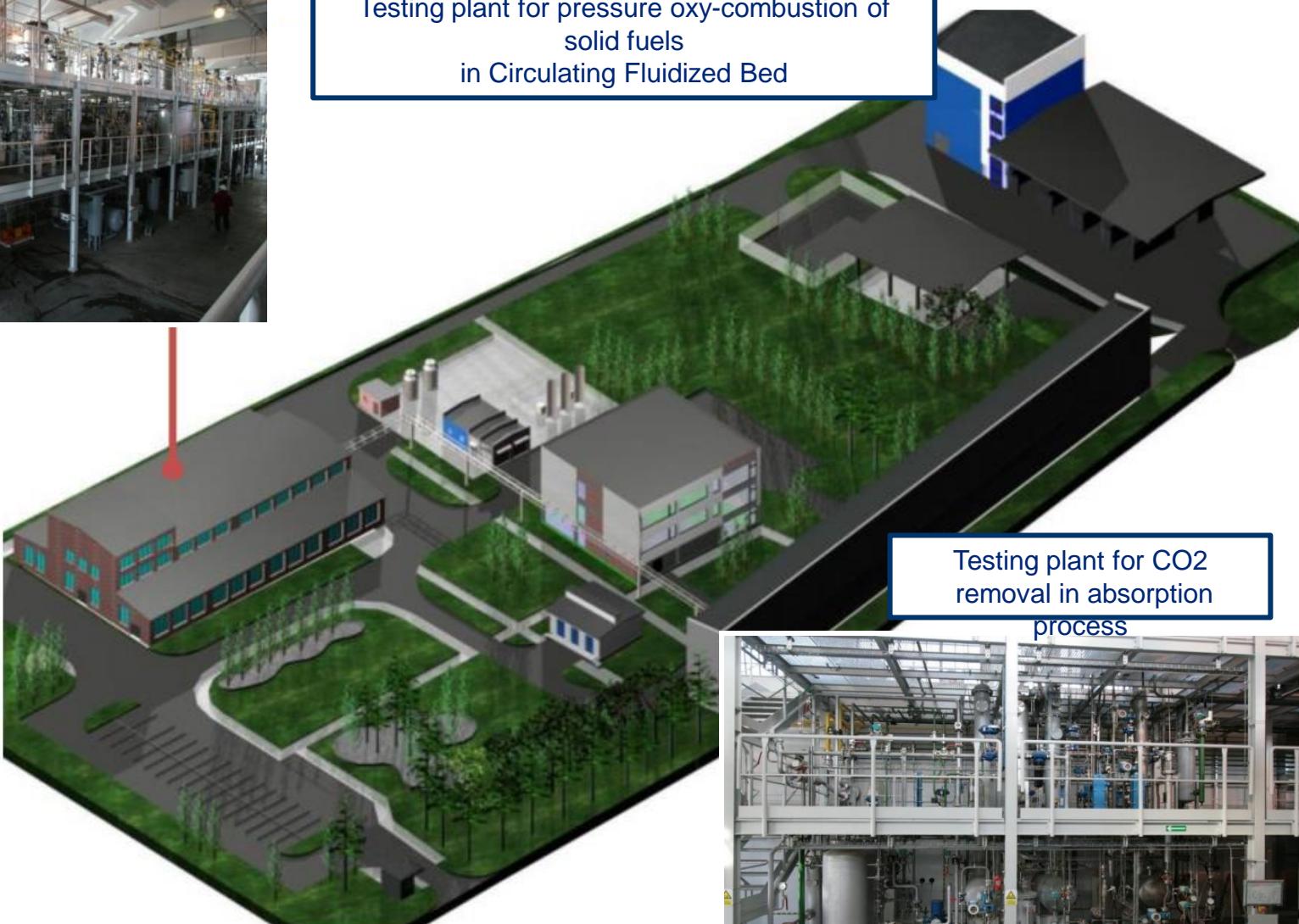


Demo Plant Capacity = 175 tonnes of CO₂/h

Clean Coal Technology Centre in Zabrze (Upper Silesia, Poland)



Testing plant for pressure oxy-combustion of
solid fuels
in Circulating Fluidized Bed



Acknowledgments

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"A journey of a thousand miles begins with a single step"

Thank you for
attention.

