



Polish CCS Demonstration Plant fully integrated into new unit 858 MW in Belchatow Power Plant (EBSA)



PGE Górnictwo i Energetyka Konwencjonalna S.A.
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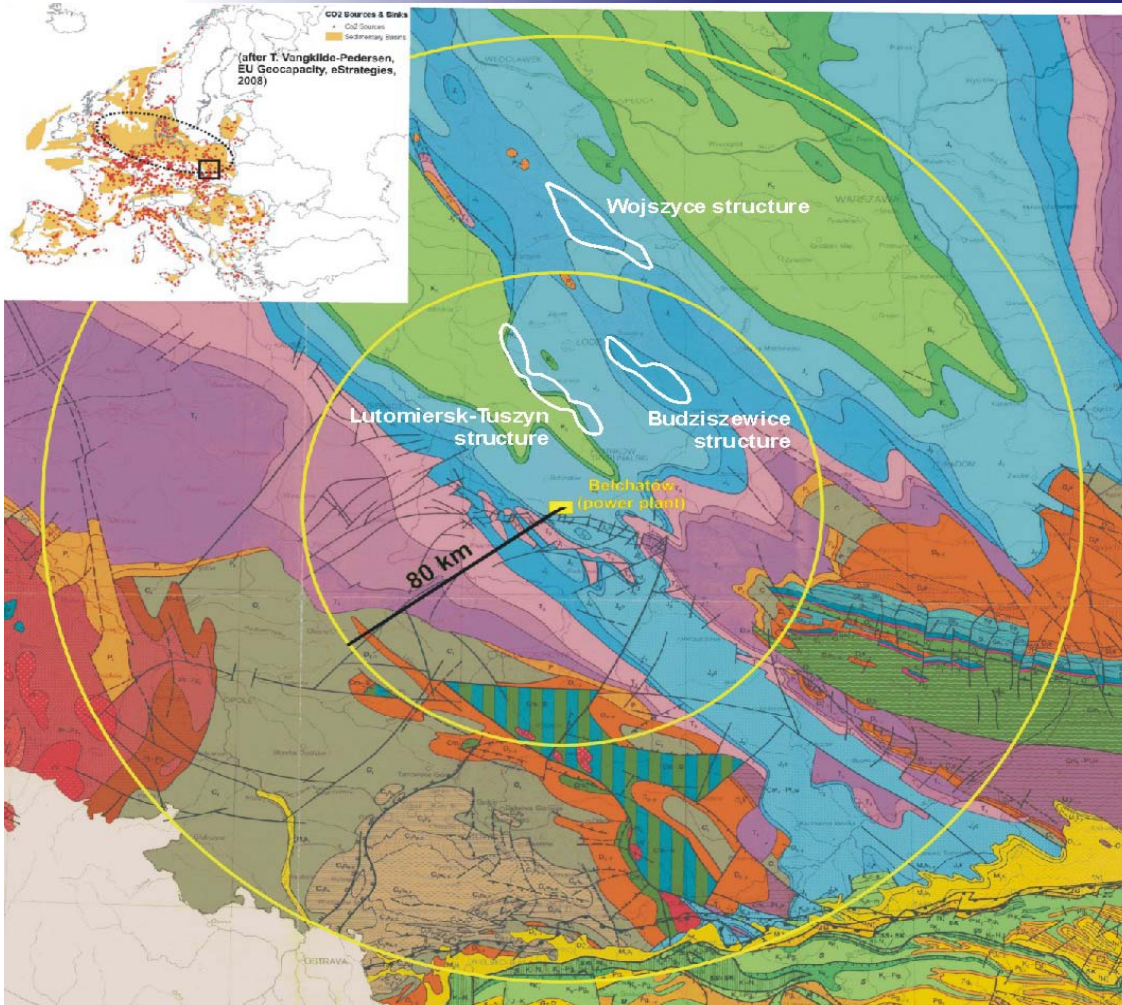


Technical specification of CCS Installation

- ❑ Post-combustion technology based on „advanced amine process”
- ❑ 1.8 million tonne of CO₂ captured and stored per annum, 235 tph
- ❑ Capture rate 90%
- ❑ Amount of flue gas corresponds to 260 MWe
- ❑ CCP heat consumption: 2.2 GJ/tonne CO₂ (30,1 MWe)
- ❑ Gross capacity of 858 MW Power Plant with CCP: ~827.9 MWe
- ❑ CCP energy consumption: ~40.0 MWe
- ❑ Anticipated new power plant efficiency without CCP: ~41.7%
- ❑ Anticipated new power plant efficiency with CCP (with vapour to amine regeneration, without CCP equipment demands): ~39.8 %
- ❑ Transport of compressed CO₂ in supercritical conditions using pipeline to storage site within 60-140 km
- ❑ Storage at deep saline aquifers
- ❑ Investment cost: 2.3 bln PLN (approx. 767 mln USD)



Three potential storage structures



- Budziszewice – Structure in distance of 60 km
- Lutomiersk-Tuszyn – located between 45 and 60 km in north of Belchatow Power Plant
- Wojczyce – maximize chance of finding suitable storage site for CO₂, an area further north about 115 km from Belchatow has been screened for potential structures seems most promising



Entire CCS Project Schedule

☐ Capture installation

- ☐ Building permit validation: 22 Feb 2010 - completed
- ☐ Completion of Capture Ready modifications: Jun 2010 - partially completed
- ☐ Mechanical completion: December 2013 - to be confirmed following selection of CCP contractor

☐ Transport

- ☐ Building permit: Aug 2013
- ☐ Construction completion: Nov 2014

☐ Storage

- ☐ Storage site selection - 1st half of 2011
- ☐ Permit application and storage site construction start up: Dec 2012
- ☐ Construction completion: Dec 2014
- ☐ Injection permit: Dec 2014

- ☐ **Optimization process completion and CCS final acceptance - Dec 2015 - We still believe it is possible to meet this deadline for entire CCS value chain completion.**



CCS – Partners of Belchatow Power Plant

Capture island

- Alstom Group – Partner in development of „advanced amine” technology
- Dow Chemical – Supplier of a selected solvent to capture CO₂ from industrial flue gas stream

Integration – „Capture ready”

- Alstom Group

Transport

- Gazoprojekt – Feasibility Study
- Contractor for engineering and construction – to be selected

Geology

- Polish Geological Institute (PIG) and Schlumberger – Support during first appraisal phase
- Additional subcontractors – PBG Ltd, Geofizyka Toruń, Sp z o.o., PRWiG



Critical tasks

- Completion of geological work (phase I) and storage site selection - I half of 2011
- Completion of capture component FEED study to move to contracting phase
- Setting forth procedures for further evaluation of CCS components
- Public awareness campaign



CCS Project benefits

- ❑ Development of CCS Project including full chain of components: capture, transport and safe geological CO₂ storage
- ❑ Storage site and transportation pipeline of CCS Installation set standard model for other large CO₂ Emitters in Poland
- ❑ Implementation of demonstration scale CCS Installation and advanced status facilities enables widespread commercialization for large scale fossil fuel power generation unit
- ❑ This clean coal technology will give necessary boost to similar projects within Poland and Europe
- ❑ Realization of CCS Project provides local employment in economic crisis and develops CCS skills and knowledge within Poland and Europe



CCS financial structure

☐ Grants:

- ☐ EEPR – **180 mln EUR** – Grant Agreement signed with EC, May 5th, 2010.

☐ Financial Sources Under Consideration

- ☐ NER 300
- ☐ Norwegian Financing Mechanism
- ☐ Polish-US Cooperation Funds
- ☐ European Investment Bank
- ☐ European Bank for Reconstruction and Development
- ☐ Domestic sources
- ☐ Other (Australian Funds)

☐ Own funds



CCS Project risks

- ❑ Technology is not mature yet, risk of scaling up from pilot to industrial level,
- ❑ Project is not commercially viable - Necessity of optimal project financial structure concept
- ❑ Legal risk – implementation of CO₂ storage Directive into Polish Law
- ❑ Power net efficiency reduction caused by CO₂ capture process
- ❑ Possibility of lack of public acceptance for CCS, and particularly concerning CO₂ transport and geological storage especially on Lutomiersk – Tuszyn area, additionally amplified by some local environmental NGO's



Current Project Status and Plans

- ❑ **Capture**
- ❑ modification to unit's flue gas system and main cooling water system (capture ready)– completed
- ❑ FEED phase – 90% advanced
- ❑ contracting structure of CCP – almost agreed
- ❑ design and construction of pipeline steam extraction – under ordering
- ❑ **Transport**
- ❑ feasibility study done and depicted three routes included in Lodz Voivodeship Zoning Master Plan
- ❑ turn key contractor would be selected after storage site selection
- ❑ preparatory permitting activities would start asap.
- ❑ **Storage**
- ❑ 2D seismic work, drilling tests, gravimetric and non-conventional research have been performed within area of two structures (2,000 km²)
- ❑ modelling and site selection in 2011 and further development of storage component afterwards through selected site characterisation and storage site localisation and necessary permitting



Another EEP Projects

- ❑ **Jaenschwalde**, Vattenfall, Germany, **oxyfuel + post combustion**, probably **onshore** (180 mln EUR)
- ❑ **Porto-Tolle**, Enel, Italy, **post combustion, offshore** (100mio EUR)
- ❑ **Rotterdam**, E.ON + Electrabel, Netherlands, **post combustion, offshore** – (180 mio EUR)
- ❑ **Compostilla**, Endessa. Spain, **oxyfuel**, probably **onshore** (180 mln EUR)
- ❑ **Hatfield**, Powerfuel Power, UK, **IGCC, offshore**, (180 mln EUR)



Thank you for your attention

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