Vattenfall`s Oxyfuel Pilot Plant
First Experiences from Commissioning and Operation

Euracoal
Brussels, 26.01.2009
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Decision process for the Oxyfuel Pilot Plant

2002
GAP Analysis
- Start of project
- Available components
- Known process steps
- Degree of development

2003
Technology Benchmark
- Evaluation of different steps of development
- Decision to develop Oxyfuel

2004
Feasibility Study
- Financial frame
- Comparing scales
- Possible sites
- Risks

2005
Decision for Oxyfuel Plant
- Building site: Lausitz area
- Scale: 30 MWth
- Complete process chain from ASU to CO₂-processing
Location of the Oxyfuel Pilot Plant

power plant “Schwarze Pumpe”

building site
Time schedule of the project

- **Planning**
  - 2005-2006

- **Approval process**
  - 2006

- **Construction phase**
  - 2007

- **Commissioning**
  - 2008

- **Operation**
  - 2009-2011
The Oxyfuel Pilot Plant

- **Thermal capacity:** 30 MW\textsubscript{th}
- **Coal demand:** 5.2 t/h
- **Oxygen demand:** 10 t/h
- **CO\textsubscript{2} (liq.) production:** 9 t/h
- **Capture rate:** 90%

**Components:**
- Boiler
- Electrostatic precipitator
- Flue gas desulphurization
- Flue gas condenser
- Air separation unit
- Social and switchgear building
- CO\textsubscript{2}-plant

Webcam: www.Vattenfall.de/CCS
Milestones during project realisation

- July `05 project start
- 23.11.06 notice of approval
- March `08 end of construction
- 05.06.08 first fire (ignition burner)
- 26.06.08 first coal fire (main burner)
- 20.08.08 first Oxyfuel operation
- 03.09.08 first separation of CO₂
- 09.09.08 official inauguration
Challenges

• Implementation of approx. 15 new technical concepts and specifications.

• Miscellaneous innovations where necessary to fulfill the new requirements of the Oxyfuel process in comparison to conventional power plants, e.g.:
  
  – Provision of Oxygen
  – Operation on both air and oxygen
  – Flue gas recirculation
  – FGD: external oxidation and high sulfur removal
  – Flue gas condensation and high aerosol precipitation
  – CO$_2$ processing and liquefaction under pressure
Transport concept for pilot phase

- Transport with trailers
- 7 to 9 vehicles per day
- distance: aprox. 350 km
- Storage in depleted gas field
Status of the Oxyfuel Pilot Plant

- Commissioning of all components and systems finished (Aug. 2008).
- Security and function test by technical authority (TÜV) finished (Sept. 2008).
- Optimization and verification of warranted characteristics finished.
- Functionality of the Oxyfuel process is verified in pilot scale.
- Until beginning of January 2009
  - 430 hours of Oxyfuel operation
  - separation and liquefaction of > 100 t CO₂
Outlook on test program

- Variation of coal quality (moisture, sulphur content, particle size).
- Tests of special measurement technique for flue gas composition and CO₂ monitoring.
- Material tests for demo plants and 700°C technology under Oxyfuel atmosphere.
- Testing of different burners.
- DeNOₓ tests at the boiler and for the vent gas stream from the CO₂ plant.
- Test of an integrated dry lignite ignition burner.
- Tests with bituminous coal.
Vision of the next generation power unit

Concept 1
Oxyfuel boiler

Concept 2
Post combustion capture

Amine scrubbing
Air separation unit

Oxyfuel boiler with integrated coal drying
Lessons learned: Schwarze Pumpe to Jänschwalde

• The integration of chemical plant parts (ASU, CO2P) needs more attention regarding technical regulations, nomenclature and standards.

• New operating concepts for bigger Oxyfuel units have to be developed, considering different behavior of the whole plant in start up and shut down.

• Oxyfuel power plants will have a demand of high skilled employees for operation, engineering and maintenance of the new components (ASU, CO2P).

• For engineering and erection the time schedule of “conventional” power plants fits for Oxyfuel power plants too, but there will be more time needed for commissioning.
Summary

- Oxyfuel works in pilot scale, emission limits are kept.
- Successful integration of plant parts from chemical engineering (ASU, CO2P).
- Gained experiences from approval process and implementation of secondary clauses for CCS power plants.
- \( \text{CO}_2 \) monitoring over the whole technology chain (capture – transport – storage) developed for the first time world wide.
- World wide first application for participation in the emission trading market for a CCS plant.
- First steps towards full scale CCS plants is successfully done.
Thank you for your attention!