Emission reduction by an order of magnitude -
Results from the post-combustion capture pilot plant
at Niederaussem

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CO₂ Capture Pilot Plant
Niederaussem
In a nutshell

- Flue gas from lignite fired power plant: 1,550 m³/hr
- CO₂ product: 7.2 t_CO₂/day; capture rate 90%
- Absorber / regenerator packing type and height corresponds to full scale
- Instrumentation: 275 measuring points
- MOC tested at several different locations
- Commissioning and start-up 2009, availability of 97%
- Budget of RWE for phases I/II: 15 Mio. €
- 40% funding by German Federal Ministry of Economics and Technology (0327793 A-F)
- Phase III being planned
CO₂ Capture Pilot Plant Niederaussem Targets

- Performance test of solvents without plant limitations
- Materials of construction under real-life conditions
- Fine tuning of simulation model
- Emissions control concepts
- Long time behavior
- Operations experience

**Test runs**
- MEA > 5,000 hrs
- OASE® blue > 23,000 hrs / 16,000 hrs in plant / in operation
- Plant availability > 97%

→ all targets achieved at given dimensions
Test runs history

OASE® blue

[Graph showing CO₂ captured and net time operational over time]

- CO₂ captured
- Solvent circulation
- Net time operational
CO₂ Capture Pilot Plant
Niederaussem
Set-up For Coal Fired Power Plant

Flue gas cooling, SO₂-prescrubbing

CO₂-capture

Solvent regeneration

Acid

Booster fan

Prescrubber

Flue gas (downstream of FGD)

Drain

NaOH solution tank

NaOH (optional)

Make-up water

Desorber

Filter

Reboiler

Steam generator

Make-up water

Solvent tank

Solvent

Condenser

Drain

CO₂

OASE®
GAS TREATING EXCELLENCE

RWE
Measures for emission reduction

Water wash

- Amine emission in equilibrium to water phase
- Equilibrium = f(p, T, x_amine)
- Limited effect on aerosols
- No waste stream generated

Acid wash

- Amines chemically bound to acid
- Range of reasonable pH values
- Limited effect on aerosols
- Waste stream generated
Measures for emission reduction II

Upstream treatment

- prevents aerosol enhancers
- keeps amine system cleaner

“Dry“ bed
- patented -

- no additional liquid stream
- no waste stream generated
- very little pressure drop
Effect of water wash temperature on emissions

OASE blue run

- effects of water wash not in accordance with equilibrium thermodynamics
- aerosols and their abatement explain findings

**Amine traces downstream water wash**

- Low water wash temperature promotes higher amine emissions
- Elevated water wash temperature helps reduce amine emissions
- High water wash temperature influences condensation and promotes lower amine emissions
Emission reduction by upstream measure
OASE blue run

Amine traces downstream water wash

flue gas pre-treatment can reduce amine emissions in case there is potential for aerosols
“dry“ bed is a simple measure to reduce emissions by an order of magnitude
- CAPEX ↓, acid wash column mostly can be avoided
- OPEX ↓, no additional liquid cycle and no waste stream
Emission reduction using a “dry” bed MEA run

MEA traces in water wash

- full height
- reduced height + "dry" bed

MEA concentration [% weight]

- MEA traces in water wash
- runs at high flue gas temperature w/o addition of demin water

Time [days]
Discussion

- different methods to reduce emissions to the atmosphere are available
- individually combined measures will provide best fit to local requirements
- application of water wash unit needs careful temperature control in case aerosols are being built
- upstream measure can greatly help reduce emissions based on aerosol formation
- “dry“ bed is a viable option to reduce costs and additional waste water

Research cooperation of an operator, an engineering company and a technology provider is a perfect set-up for successful process development.
Outlook for phase III

- understanding of aerosols and particles formation and abatement
- innovative non-thermal solvent reclaiming
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